

# **S-COM 7K**

## **Microprocessor Repeater Controller**

**Version 2.03B**

**(July 20 1998, updated 25 November 2000)**

**S-COM Industries**

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USA

# Limited Warranty

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

## Coverage

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The following are *not* covered by the warranty:

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- Damage resulting from failure to follow instructions contained in the owner's manual.
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- Damage resulting from repair or attempted repair by anyone other than S-COM Industries.
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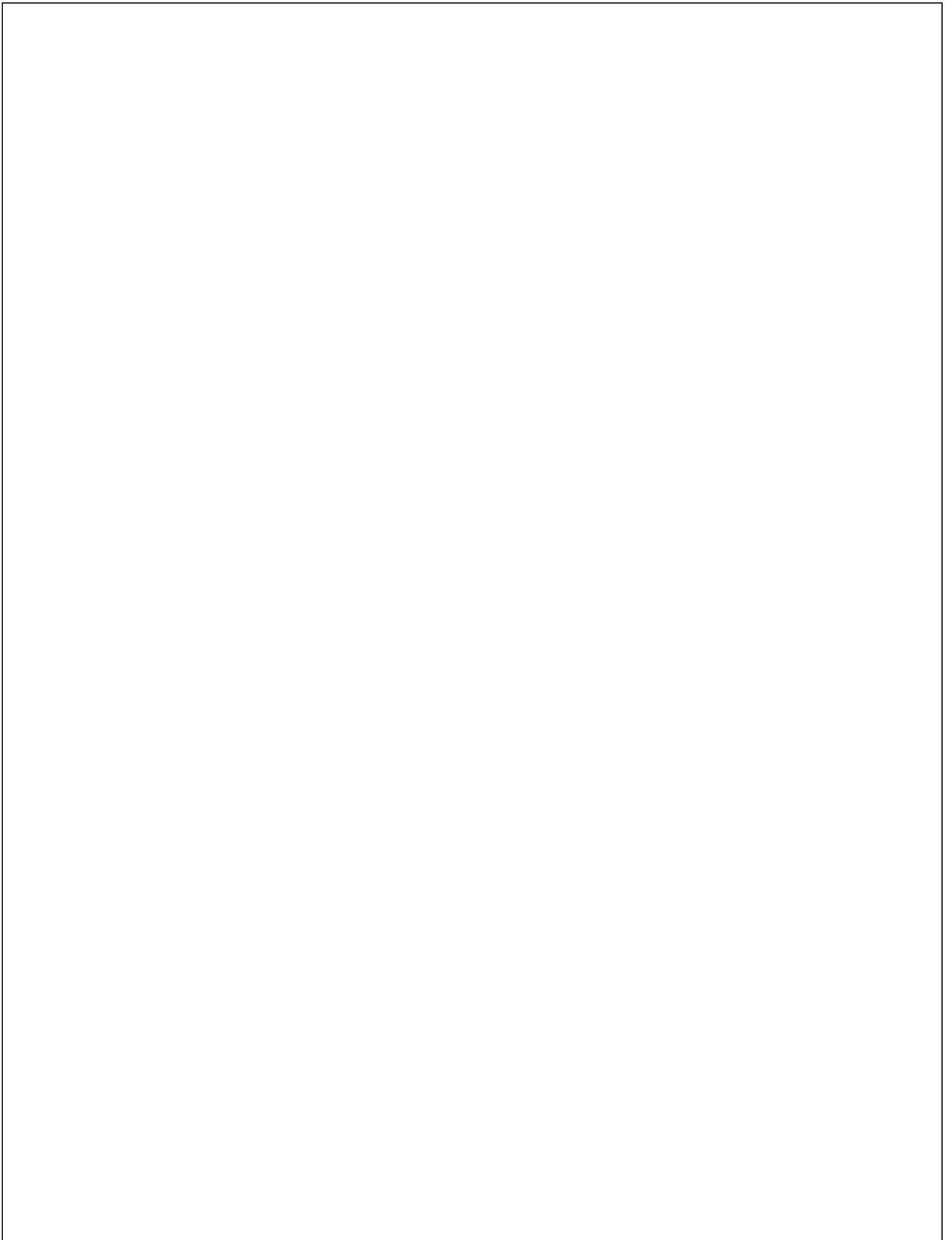
## How You Can Get Warranty Service

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## *Chapter 1*

# Product Description

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The S-COM 7K is a high-quality, compact, microprocessor-based repeater controller intended for use in amateur radio and commercial installations. Incorporating advanced hardware and software designs, the 7K provides most-often-needed control functions and powerful new features not found in any comparably priced controller.

- The 7K is fully remotely programmable via DTMF commands over the telephone or receiver ports—eliminating the inconvenience of returning EPROMs, microcontroller ICs, and boards to the factory for reprogramming.
- No jumpers or diodes are needed for programming.
- Data is retained in non-volatile memory, ensuring that no information is lost during power outages, making extra trips to the repeater site unnecessary.

## Standard Hardware Features

### Configuration

The standard 7K controller package consists of a main board mounted in a mainframe cabinet, a set of mating connectors, and a manual. No options are required to perform the most-often-needed repeater control functions.

### Cabinet

The standard cabinet provides mounting for the main board and for optional boards, and can be installed in a standard 19" wide equipment rack. The cabinet is constructed of three parts: An iridite-plated chassis box, an iridite-plated chassis cover, and a black front panel. The complete assembly is only 1-3/4" high and 7" deep, allowing installation in any rack (including slim Motorola racks).

### Main Board

The *7K Main Board* measures 6" deep by 9-3/4" wide, and can operate as a stand-alone controller. The digital portion of the board contains the microprocessor, memory, logic input/output, and real-time clock circuits. The analog portion contains the DTMF encoder/decoder, audio crosspoint switch, tone synthesis, and audio interface circuits. Three connectors (two DB25S and one 2.5-mm power jack) are mounted on the main board. These connectors protrude through cutouts in the rear of the cabinet, making the interior of the cabinet free of wiring.

## Optional Hardware Features

### Telephone Interface Module

The *Telephone Interface Module* (TIM) is constructed on a 3" by 6" PC board, and adds autopatch, reverse patch, and phone line control capabilities to the 7K. The module is registered with the FCC under Part 68 Rules, eliminating the need for a separate telephone coupler. Transient protection and RFI filtering are provided. All solid-state design eliminates mechanical relays. Built-in electronic hybrid allows both half-duplex and full-duplex autopatch calls. Supports both regenerated DTMF dialing and 10/20 PPS rotary dialing.

### Speech Synthesis Module

The *Speech Synthesis Module* (SSM) is constructed on a 3" by 6" PC board, and adds convenient, high-quality speech message capabilities to the 7K. The SSM has its own microprocessor for controlling the speech synthesizer, supplied with a large vocabulary. A third-order lowpass filter smooths analog output of the synthesizer IC.

## Digital Audio Delay Module

The *Digital Audio Delay Module* (DADM) is constructed on a 2.1" by 2.7" PC board, and removes squelch noise bursts and DTMF tone bursts from repeated audio. As many as two DADMs may be installed in the cover of the 7K cabinet, one each for receiver #1 and receiver #2. The DADM delays the audio from 12 to 197 milliseconds, adjustable via a dip switch.

## Standard Software Features

### CW Identifier

The software *CW Identifier* stores remotely-programmable multiple call signs with ID tail messages. Time between identifications is also programmable. CW is internally mixed with repeat audio. The ID-er is *polite*, and attempts to identify during breaks between transmissions.

### CW Messages and Paging Formats

Most of the *CW Messages* are remotely programmable. CW pitch and speed are programmable, and can be changed within a message. The character set includes alphanumerics, punctuation, and a large library of "Beeps." CW level is set with a potentiometer.

The 7K supports the following paging formats: Single-tone (group call), two-tone sequential, 5/6-tone, and DTMF. Pages may be stacked for convenient call-up of ARES members, weather spotters, DX club members, on-the-air meetings, etc.

### Timers

All timers in the 7K are derived from the microprocessor's crystal-controlled clock circuit for improved accuracy over other methods. Most timers are remotely programmable, including: *Courtesy Delay*, *Dropout Delay*, *Transmitter Timeout*, and *Autopatch Timeout*.

### Repeater Characteristics

The character of a repeater can be varied with choices of *Courtesy Messages*, *Dropout Messages*, *Timeout Messages*, and their associated timers. The repeater can be placed into one of several access modes, or disabled. Repeater characteristics can be changed by either a command or a transition on one of the logic inputs.

## **Clock and Calendar**

Time and date information may be obtained by inserting one or more *Run-Time Variables* into any programmable message. CW readout is available from the main board. Male and female voice readout is available if the optional SSM board is installed.

A 100-setpoint *Scheduler* executes commands at programmable times and dates.

## **Logic Inputs and Outputs**

Logic inputs are used to detect a change of state in monitored devices at the repeater site. Logic outputs can be manipulated by command to pulse or latch a controlled device at the site.

## **Command Language**

Commands are given to the 7K with an easy-to-use DTMF language. Security is enhanced with a *Password* (PW) system, as well as programmable restrictions on DTMF decode operation. A library of *Macros* may be defined for repeater users. Macros may be created, deleted, renamed, and modified at any time by authorized programmers.

---

## Chapter 2

# Getting Started

---

In this section, we will assume that you have either completed the installation of the controller into the repeater, or you are simulating a repeater with switches for COR signals, LEDs for PTT loads, and so on. To perform the installation of your new controller, see the *Installation* appendix on page C-1.

If desired, the controller can be programmed on your workbench, then moved to the repeater site for installation.

---

**Note:** *Be sure* to transport the controller in anti-static packing material. Large electrostatic discharges can damage components and destroy the data stored in memory.

---

## Power ON Initialization

### Initialize Controller

Each time power is applied to the controller, it will check to see if the *Initialize Push-Button* is being pressed. (The initialize push-button is located in the right rear corner of the main board.) At that moment, the controller will decide whether to retrieve default information stored in the EPROM and write it into the non-volatile RAM (push-button DOWN), or retain the previously-stored information (push-button UP)

---

**Note:** If the initialize push-button is pressed at any other time, it will have no effect. Likewise, since a specific sequence is needed to initialize your controller, accidental contact with the push-button *will not* destroy your programming efforts.

---

Controllers are initialized as part of the testing procedure at the factory. However, we recommend that you do another initialization before attempting to program the controller.

There may be other occasions when you will need to initialize the controller. Some examples follow:

- The programming password was never written down, and was forgotten by the programmer.
- A general erasing of all programming is desired, since the controller is being transferred to a new repeater and will receive all new programming.
- You are installing a new software upgrade EPROM.
- It has been necessary to replace the battery, RAM IC, RAM controller IC, or some other part in the non-volatile RAM circuit.
- In this last case, you must perform the initialization sequence twice to ensure proper operation of the RAM controller IC.

To initialize the controller, follow these four steps:

- Remove power from the controller. This can be done by pulling out the 2.5 mm DC power plug.
- Press and hold down the initialize push-button.
- While holding down the push-button, restore power to the controller. This can be done by inserting the 2.5 mm DC power plug.
- Continue holding down the push-button for several seconds after the power has been restored.

### **Cold Start**

An initialization is sometimes called a cold start. When a cold start occurs, the controller will send ? *RES C* (reset, cold) in CW.

### **Warm Start**

Applying power without doing an initialization is sometimes called a warm start. When a warm start occurs, the controller will send ? *RES* (reset) in CW.

### **Default Condition**

After an initialization, the controller's programming is in the *Default Condition*. Default conditions are necessary if you want the controller to be able to operate the repeater before you've had a chance to program it. An initialization can therefore be thought of as a quick *pre-programming* of the controller. Most commands have default conditions. They remain in effect until you change them through programming. The default conditions are described with the commands in this manual.

---

**Note:** There is a push-ON jumper in the main board which is used to disconnect the battery from the RAM IC. This jumper is removed during some repair operations, and during current drain tests. Removing this jumper will not initialize the controller. Removing and replacing the jumper will require an initialization sequence before proper operation will resume

---

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## Chapter 3

# Programming Fundamentals

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**Note:** Throughout this manual, numerous *Programming Tables* are used to facilitate programming the controller. Most of these tables are reprinted in Appendix A (on page A-1). Additionally, all commands used in this book appear in the *Command Quick Reference* on page A-25.

---

You program the controller by entering strings of DTMF digits. These strings of digits are referred to as *Commands*. A standard DTMF keyboard with 12 digits may be used for nearly all commands. A few advanced features are available to programmers with 16- button keyboards. The extra 4 lettered keys may be used in passwords or macro names to increase the security of the system. (See the *Special Keys* section on page 3-4.) The controller may be programmed over any of the receiver inputs and the telephone line, if enabled. The controller responds to valid commands by sending *Acknowledgment Messages (Acknowledgments)*. These responses may be disabled if desired using the *Enable/Disable Command Response Messages* command on page 11-2.

## Valid Digit and Time Detection

As shipped from the factory, the DTMF decoder requires about 40mS to detect a valid digit. The microprocessor scans the decoder once every 10mS to see if a digit has been detected. Thus, it can take about 50mS to store a valid digit. Allowing a 50mS pause between digits, the controller is able to store about 10 digits per second. Since these are best-case times, use longer durations and pauses if you wish to reliably program the controller with automatic DTMF sending equipment.

In the following section of the manual, we will discuss the basic structure of control commands.

## Control Command Structure

All control commands follow the format as shown in Figure 1.

(Add Figure Here!)

**Figure 1**

**A control command always begins with a *Security Password***—generally referred to as “*Password*,” and using the symbol “(PW)” in this manual.

- The default security password is 99.
- The password increases the security of the system.
- It can be changed at any time.
- The password can be 2, 4, or 6 digits long, and may consist of any combination of the numbers 0–9, and the letters A, B, C and D.
- Star (\*) and pound (#) are not allowed in passwords.
- The controller supports several passwords, used in programming the system and in accessing the Autopatch.

---

**Note: Choose a security password immediately!** If you begin creating macros using the default password and later wish to change it, all your commands will have to be re- entered using the new password.

---

**Following the security password is a *Root Number***, and sometimes, a *Post-Root Number*. (Some of the tables in this manual use the term “*Code*” to mean root number or post-root number.)

- The root number tells the controller which function the user wishes to program.
- Root numbers are either 2 or 4 digits long, and consist only of the numbers 0–9. (Technically, when a root number is 4 digits long, a post-root number comprises the second 2 digits. Generally, we use the term root number to mean both the root and post- root number.)
- Each control command has a unique root number.
- The root number is fixed by the controller's internal software, and cannot be changed.

**Following the root number is one or more *Data Digits*.**

- Data digits may be thought of as “variables.”
- Some commands are quite simple, and do not need any data digits. Other commands require a string of data digits.
- A particular command may have more than one *type* of data digit (x, y, or z).
- Do not confuse the types of variables with the number of data digits. The number of symbols (x, y, or z) indicate the number of digits expected by the controller. For example, “xx yyy zzzz” means enter two digits of data digit x, 3 digits of data digit y, and 4 digits of z.

**Following the Data Digits (if any) is a *Terminator*.**

- The terminator can be either the star character (\*) or a carrier drop (if enabled).
- The star character will always work as a terminator; in fact, it is necessary when programming the controller via the telephone, since there is no carrier to drop.
- The terminator tells the controller that the command has ended.
- It is necessary, since control commands vary in length.
- The terminator is similar to a “carriage return” on a computer keyboard, or the “equals” key on a calculator.

### **Example Control Command**

Here's an example of a control command:

```
99 63 00 0 *
```

---

**Note:** We've put spaces between some digits to help explain this example. However, you *do not* need any pauses between the digits when you are programming the controller.

---

- The security password in this example is 99, the default password. The password tells the controller that you are a legitimate programmer.
- The root number is 63. This root number tells the controller that you wish to control a software switch.
- The 00 specifies the switch, in this case it is the Transmitter 1 Enable/Disable switch.
- The data digit is 0. In this particular command, the 0 tells the controller to disable transmitter 1.
- The terminator is “\*,” which tells the controller that you have reached the end of this particular command. The controller always waits for the terminator before it processes a command.

If we make no mistakes in entering this command, the controller will respond with a message, and turn OFF Transmitter 1. If a mistake is made in the command, such as a data digit of 2, the controller will send an *Error Message*, and Transmitter 1 will not change. If you enter a control command with an incorrect password or a non-existent root number, the controller will not respond to the command.

## Command Response Messages

### Acknowledgment

Most Control Commands respond in some way to tell you that they were accepted by the controller, or that you made a mistake in entering the command. The usual *Acknowledgment Message* is *OK* (sent in CW). If another response is more appropriate, a different acknowledgment will be sent instead of the OK.

### Errors

When a mistake is made entering a command, an error message (error) is sent in CW. There are two commonly-used error messages:

- **? err 1** means you have made an error in the number of keystrokes entered for a particular command. If the command requires 5 keystrokes, for example, and you entered 6, the response will be an error 1.
- **? err 2** means you have made an error in the data presented for a particular command. If a timer, for example, has a range of 0 to 5.0 seconds, and you entered 6.0 seconds, the response will be an error 2.

*Command Response Messages* can be turned ON and OFF using the *Enable/Disable Command Response Messages* command on page 11-2.

## Special Keys

There are two keys on your 12-button or 16-button DTMF keyboard which have special meanings to the controller. They are the star (\*) and pound (#) keys. (Technically, the # is called an *octothorpe*, but we'll just call it a *Pound*.) These two characters are not allowed to be part of a password or macro name, and they won't be found in root numbers or data digits.

### Star (\*) and Carrier Drop as Terminators

As mentioned earlier, the *Star* (\*) digit serves as a terminator, indicating to the controller that you have finished entering a command.

- The (\*) will always work as a terminator.
- The (\*) method cannot be turned OFF, and will terminate any command.
- You can also allow a carrier drop to work as a terminator if you wish.
- The carrier drop method can be turned ON and OFF.

Why do we have the two methods?

- It's easier to terminate a command by simply releasing the PTT (push-to-talk) button on your microphone, saving you one keystroke (the \*). However, there could be a carrier on the repeater's input frequency some day when you enter a command. If the carrier continues to hold up the repeater after you've released the PTT button, your command won't be executed. Entering the (\*) at the end of the command will guarantee that the command is properly terminated.
- A second reason for using the (\*) terminator is that you may enter a series of commands, one after the other, without releasing the PTT button. (You do not have to wait for the acknowledgment message before entering the next command.) You must, of course, use the (\*) terminator when entering commands from a Touch-Tone™ telephone, since there is no carrier drop for the controller to detect.

### Pound (#) as Clear or Abort Key

The pound (#) digit serves as the *Clear* or *Abort* key. It indicates to the controller that you have made an error, and you wish to clear the command buffer. (The command buffer is a holding area of the partially-entered command.)

- The (#) key only works if a command is still in the buffer, and has not been executed.
- When you enter the terminator, the command is immediately executed and it is too late to clear the buffer.
- You may start entering the next command immediately after pressing the (#) key.

- There is no acknowledgment message sent by the controller when a command is cleared.
- Any digits following the (#) digit will be considered a new command.

## DTMF Interdigit Timer

The controller uses a *DTMF Interdigit Timer* for the purpose of clearing the command buffer if a command is not completely entered.

For example, if a user accidentally presses a digit, or if a digit is *falsed* into the buffer, or if a user drives out of range or his signal flutters while entering a command, the command buffer will have only a piece of a command. If the controller had no time limit between digits, that piece of a command would stay in the buffer. The controller would confuse it with the next command it receives.

The DTMF interdigit timer works as follows:

- When you release any DTMF key, the timer is started.
- If you do not enter another DTMF digit within the time limit, the controller will clear the command buffer.
- The interdigit timer initially defaults to 5.0 seconds, but it can be reprogrammed with a different value if desired.

## DTMF Mute Delay

The controller has a *DTMF Mute* feature that prevents your DTMF commands from being repeated. This feature can be turned ON and OFF for various Receiver-Transmitter combinations using the *Enable/Disable DTMF Decoder Mute* commands on page 11-9.

Unless your controller has been fitted with the optional Audio Delay Module, there will be a short burst (40 to 50mS) of DTMF that is repeated at the beginning of a digit. This short burst occurs because the controller requires some time to detect the DTMF digit and shut OFF the audio gate.

To reduce the number of bursts, the controller will continue to mute the audio for a while after you have released the DTMF key. Therefore, if you enter a string of digits rapidly, there will be only a single burst (caused by the beginning of the first digit). If you wait too long between digits, the muting will end. The next digit you enter will cause a short burst at the beginning. The *DTMF Decoder Mute Delay* initially defaults to 0.5 seconds, but it can be reprogrammed with a different value if desired.

---

## Chapter 4

# Messages

---

The controller uses *Messages* to communicate with users of the repeater. Most of the controller's messages are remotely programmable via DTMF commands. Messages may be composed of combinations of CW (Morse) characters, beeps, DTMF characters, synthesized speech words, and various paging formats.

### Message Buffer

A portion of the controller's memory is dedicated to the *Message Buffer*. The message buffer is used to temporarily store messages that the controller is asked to send. The message buffer is a *FIFO* buffer (first-in, first-out), which means that the first message to arrive in the buffer is the first one to be sent out. The purpose of the message buffer is to prevent overruns when several of the controller's software programs want to send messages at the same time. Each program sends its message to the message buffer: The messages are then unloaded and transmitted by a program called the message handler.

### Message Handler

The *Message Handler* needs to know what kind of message it is unloading—and where it is to go—so that it can operate the proper hardware to send the message. For example, a DTMF Message requires different hardware than a speech synthesized message. A message intended for transmitter #1 requires a different path be set up than a message intended for transmitter #2.

The way to tell the message handler the type of message and the routing of the message desired is with special control characters. The control characters are defined next.

## Control Characters

*Control Characters* are small code groups which you place into a message to give instructions to the message handler. The message handler recognizes control characters because they *always begin with 99*.

When the message handler encounters a group of characters which *begin* with 99, it looks at the digits immediately following the 99 for the instructions. It then performs the desired action.

Since none of the libraries (CW, beeps, synthesized speech, etc.) have characters beginning with 99, the message handler won't confuse library characters with control characters. (Don't be concerned if you program a tone page or a custom code group that happens to contain a 99 sequence in the data. Since the character group doesn't *begin* with 99, it will be interpreted correctly.

---

**Note:** Don't confuse the 99 being discussed with the password (PW) used to enter commands, which happens to default to 99. control characters are used *only* within messages. You can change the password, but you cannot change the control characters. They must *always* begin with 99.

---

Any message that you program into the controller can contain one or more control characters. Control characters can occur anywhere in the message depending on how you want the message to be sent. Of course, you will need the Speech Synthesis Module option if you want to send a speech message, and you'll need a Telephone Interface Module option if you want to send a message to the phone line.

It's a good idea to begin every message you program with two control characters: One defines the type of message you want to send. The other selects the *routing* (audio path). If you don't specify the message type, the controller will assume you want to send a CW message. If you don't specify the routing, the controller will assume the message goes to transmitter #1, unless the phone line is engaged in control mode. In that case, all messages go to the phone line. Since many of your messages won't fit these conditions, get into the habit of specifying your choices with control characters.

The message handler executes control characters *as it finds them* in the message. It does not "look ahead" to see if you will be changing any conditions. Therefore, you must enter the control character ahead of the desired message. We list the possible control characters next, then show some examples of their use.

<b>Control Character Definitions</b>	
<b>Control Character</b>	<b>Definition</b>
9900	CW characters follow
9910	beep characters follow
9920	single-tone page follows
9930	two-tone page follows
9940	5/6-tone page follows
9950	DTMF characters follow
9960	synthesized speech characters follow
9981	route this message to transmitter #1 mixed
9982	route this message to transmitter #1 not mixed (clear)
9983	route this message to transmitter #2 mixed
9984	route to this message to transmitter #2 not mixed (clear)
9985	route this message to phone line mixed
9986	route this message to phone line not mixed (clear)
9987	do not route (cancel) to transmitter #1
9988	do not route (cancel) to transmitter #2
9989	do not route (cancel) to phone line
9999	Execute the macro that follows

As you can see, control characters 9900–9960 tell the message handler what kind of message you want. Control characters 9981–9989 tell the message handler how you want the message routed. 9999 synchronizes messages with macros. We'll discuss the 9900 through 9960 and 9999 control characters in their appropriate sections to follow. We'll discuss the Routing control characters here.

## Routing and Unrouting Control Characters

### Default

The defaults for *Routing and Unrouting Control Characters* are as follows:

- CW and beep messages default to 9981 if the phone line is not active in the control mode. That is, all CW and beep messages will be sent to transmitter #1 and will be mixed with the receiver audio (if present); but will go to the phone line if it is active.
- All pages and speech synthesized messages default to 9982 if the phone line is not active in the control mode. That is, all pages and speech messages will be sent to transmitter #1, and receiver audio will be muted. If the phone line is active in control mode, speech messages will go to it; Pages will be sent to both transmitter #1 and the phone line.

You can override these default conditions, since the “route” and “don’t route” (*Unroute* or *Cancel Route*) control characters have higher priority than the defaults. Specifying any routing will automatically cancel the default routing.

### Examples

You can stack up routing and unrouting codes within a message, and you can change your routing within a message. Here are some examples. For clarity, we’ll just show your desired message as “(message).”

To send a message to transmitter #1 along with the receiver audio, enter:

```
(PW) 15 9981 (message) *
```

If the message is a page, you will want to send it in the clear, with no receiver audio present. Enter:

```
(PW) 15 9982 (message) *
```

---

**Note:** Password 15 is the command to send a message. It is not stored in the controller, like a transmitter timeout message would be.

---

To send a message to transmitter #2, not mixed, enter:

```
(PW) 15 9984 (message) *
```

To send a message to both transmitters, not mixed, enter:

```
(PW) 15 9982 9984 (message) *
```

Routing accumulates within a message. If you enter:

```
(PW) 15 9982 (message 1) 9984 (message 2) *
```

Message 1 goes to transmitter #1, but *both* messages go to transmitter #2. If you want message 1 to go to transmitter #1 and message 2 to go to transmitter #2, you must cancel transmitter #1’s routing, like this:

```
(PW) 15 9982 (message 1) 9987 9984 (message 2) *.
```

We have been using the command “(PW) 15” in these examples, since that is the way you send a one-time message. Or, you can send a message from a macro by using this command. However, the controller supports many programmable messages, such as IDs, courtesy messages, and so on. Feel free to use control characters in these programmable messages as well as the one-time message examples.

Routing and unrouting (cancel routing) control characters are only in effect for the duration of the message. When the message ends, default routing takes over. Our suggestion, then, is to enter control characters in each message you

---

program to be sure the controller follows your wishes. Most users expect CW messages, beeps and perhaps speech messages to be mixed with repeat audio, since sending them unmixed would mute repeat audio for the duration of the message. However, pages, announcements, and so forth, may be sent unmixed to ensure they are received and decoded properly.

## Synchronizing Messages and Commands

In the controller, the Message Handler processes messages from the Message Queue. The Command Executive processes commands and macros from the Execution Queue. These queues are processed independently but simultaneously. Messages and commands queued at the same time and expected to operate in sequence can have unexpected results. That is, unless you use the message control character to keep everything in synchronization.

Suppose you want to generate a DTMF page of “1234”, then switch on logic output number 1. You might write a macro with the following commands:

```
(PW) 20 9000 (PW) 15 9950 01 02 03 04 *  
(PW) 29 9000 (PW) 70 1 *
```

However, this command sequence will not have the expected results. The first command queues the DTMF page to the message queue for execution then immediately executes the command to turn on the logic output. The logic output will change before the DTMF command has completed.

To cause the second line of the macro to wait until after the first line has sent the DTMF page, you write this as two macros:

```
(PW) 20 9000 (PW) 15 9950 01 02 03 04 9999 9001 *  
(PW) 20 9001 (PW) 70 1 *
```

“9999” in the macro 9000 is a *Message Control Character* that causes a macro to be executed when the Message Handler reaches that point in the message. The “9001” that follows the 9999 message control character is the name of the macro to execute. This sequence operates as expected because the DTMF page will complete before the command to turn on the logic output is executed.

---

**Note:** Macro names used with the 9999 *Message Control Character* must be 4 digits long. Add leading zeros if required.

---

This type of sequencing also has uses in *Autopatch* speed dial macros that dial a pager, then send a DTMF page as the message to be displayed on the dialed digital pager.

## CW Messages

### Control Character

When building a *CW Message*, the control character 9900 should be entered before the actual CW characters. If a message does not begin with a control character, the message handler will assume that the message should be sent in CW. Therefore, a CW-only message would not require the 9900. A message could be made up of mixed types, such as a series of beeps followed by CW characters. In that case, the control character 9900 is needed before the CW portion of the message.

### Format

The format for CW messages is as follows:

- Enter the control character 9900.
- Enter the various CW character codes described in the *CW Character Set Tables* which begin on page A-2 to create the desired message.
- You may end the CW message with the (\*) character, or enter another control character (99xx) and continue with another message type.

### Pre-Message Delay Character

A special *Pre-Message Delay Character*, 54, can be programmed after the control character 9900, but before the CW characters. The delay character (54) causes the message handler to pause for 1 second before sending the CW message. Any additional 54s found after the first one will be ignored. If the CW message was preceded by any other message, the 54 will be ignored.

### Wordspace Character

The *Wordspace Character*, 40, should be placed between the words in a CW message. The message handler will automatically place a wordspace at the end of a CW message, so you won't have to remember to do so. This feature prevents two adjacent CW messages from being run together. Wordspace characters can be used as pauses during a CW message. However, the length of the pause will depend upon the current sending speed of the CW (words-per-minute).

### Frequency Change

The CW frequency (pitch) may be changed before—or during—a CW message. This feature allows you to draw attention to a certain message (or part of a message).

- A 6-digit character, 59xxxx, should be entered ahead of the CW characters that are to be sent at the new frequency.
- The four digits following the 59, shown as “xxxx,” represent the new frequency and are taken from the *Tone Code Table* on page A-20.
- The frequency may be changed as often as desired within a CW message (even between each character).

The temporary frequency will stay in effect until either changed by other control codes, or until the message buffer empties. Thus, if you will be using the

Frequency Change feature, it is a good practice to specify the frequency for *each* CW message

If you wish to change the CW frequency for all CW messages, see the *Select Frequency of CW* command on page 4-11.

### **Speed Change**

The CW sending speed in WPM (words per minute) may be changed before, or during, a CW message. The speed may be varied from 5 to 40 WPM in ten steps. This feature allows you to draw attention to a certain CW message, or make it more easily copied by those with modest CW skills.

- To temporarily change the sending speed of a CW message, enter a 2-digit character from 60 to 69 ahead of the CW characters that are to be sent at the new speed.
- The speed may be changed as often as desired within a CW message (even between each character).

The temporary sending speed will stay in effect until either changed by other control codes, or until the message buffer empties. Thus, if you will be using the *Speed Change* feature, it is a good practice to specify the frequency for *each* CW Message.

If you wish to change the sending speed for all CW messages, see the *Select Normal CW Speed* and *Select Slow CW Speed* commands on pages 4-13 and 4-14 respectively.

If you wish to allow users to slow down CW messages, see the *Send Next Message Slowly* command on page 4-12.

## CW Alphanumeric Characters

The controller features a library of 54 alphanumeric CW characters, which are comprised of numerals 0–9, letters A–Z, punctuation, and standard Morse abbreviations.

- Each character is represented by a 2-digit code from 00 to 53.
- When building a CW message, be sure to use both digits of the code.
- Do not omit leading zeroes.

The following table shows *CW Alphanumeric Characters* and their related control characters (codes).

<b>CW Alphanumeric Characters</b>			
Control Character 9900			
<b>Character</b>	<b>Code</b>	<b>Character</b>	<b>Code</b>
0	00	I	18
1	01	J	19
2	02	K	20
3	03	L	21
4	04	M	22
5	05	N	23
6	06	O	24
7	07	P	25
8	08	Q	26
9	09	R	27
A	10	S	28
B	11	T	29
C	12	U	30
D	13	V	31
E	14	W	32
F	15	X	33
G	16	Y	34
H	17	Z	35

## CW Punctuation and Related Characters

The following table shows *CW Punctuation and Related Characters* and the proper control characters (codes).

Control Character 9900		
Character/Parameter	Symbol	Code
period	.	36
comma	,	37
fraction	/	38
question	?	39
word space	space	40
end-of-message	(AR)	41
wait	(AS)	42
break	(BK)	43
double dash	(BT)	44
end-of-work	(SK)	45
hyphen	-	46
colon	:	47
semicolon	;	48
parenthesis	()	49
apostrophe	'	50
exclamation	!	51
quotation	"	52
understood	(SN)	53
1.0 second pre-message delay		54

**CW Frequency Change and Speed Change Characters**

The following table shows *CW Frequency and Speed Change Characters* and their codes.

<b>CW Frequency and Speed Changes</b>	
Control Character 9900	
<b>Change</b>	<b>Code</b>
frequency	59xxxx ( <i>xxxx = tone code</i> )
speed to 5 WPM	60
speed to 7 WPM	61
speed to 10 WPM	62
speed to 13 WPM	63
speed to 15 WPM	64
speed to 17 WPM	65
speed to 20 WPM	66
speed to 24 WPM	67
speed to 30 WPM	68
speed to 40 WPM	69

---

---

## Enable/Disable CW

Enables or disables the CW sending function.

- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---

---

### Command Form:

Command	Form	Data Digit
Enable/Disable CW	(PW) 63 01 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends nothing if disabled; OK if enabled

### Errors:

Error	Meaning
? err 1	wrong number of digits entered (disable only)
? err 2	illegal digit entered (disable only)

**Default Condition:** CW is ON (enabled)

---



---

## Select Frequency of CW

Changes the frequency (pitch) of the CW.

- Enter the password, followed by the 4-digit root number shown, followed by the 4-digit tone code for your desired frequency.
  - The tone code is taken from the *Tone Code Table* on page A-20. Do not omit leading zeroes. Tone codes may also be calculated, if desired.
  - The frequency range is 100Hz to 5KHz, although most radio systems have an audio response of 300Hz to 3KHz.
  - To select frequencies for the Owner-Fixed Frequency Beeps and CTCSS, see the applicable commands on pages 4-18 and 10-3.
- 
- 

### Command Form:

Command	Form	Data Digits
Select Frequency of CW	(PW) 06 00 xxxx *	Tone Code Table

**Acknowledgment: Sends OK**

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal code entered

**Default Condition: CW Frequency is 1500 Hz; Tone Code is 0667**

### Examples:

Let's change the frequency of the CW to 1200Hz. The tone code for 1200Hz is 0833. The command is:

```
(PW) 06 00 0833 *
```

---



---

## Send Next Message Slowly

**Entering this command before entering a command with a CW message causes the CW message to be sent slowly.**

- The actual speed is set by the *Select Slow CW Speed* command on page 4-13.
  - This command is most useful when placed into a macro for users.
  - CW speed returns to normal after the CW memory empties.
- 

### Command Form:

Command	Form
Send Next Message Slowly	(PW) 11 *

**Acknowledgment: None**

**Errors: None**

**Default Condition: CW is sent at the normal rate**

### Examples:

Assume that a macro, 3\*, exists which sends the 12-hour time. Assume also that a macro, 2\*, exists which contains the *Send Next Message Slowly* command. Then a user could enter:

2 \*

3 \*

This will cause the time-of-day to be sent at a slower rate than normal.

---

**Note:** The repeater courtesy message is also a CW message. If a user enters 2\* and then releases the mike, the courtesy message will be sent slowly. Since the speed then changes back to normal, entering a 3\* will cause the time to be sent at normal. Therefore, the user must enter the 2\* and 3\* in the same transmission.

---

---



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## Select CW Speed

**Select Normal CW Speed** changes the speed at which CW messages are normally sent.

**Select Slow CW Speed** changes the speed at which CW messages are sent when preceded by the *Send Next Message Slowly* command.

A single digit from 0–9 programs the desired speed.

- See the *CW Speed Table* below.

---



---

### Command Form:

Command	Form	Data Digit
Select Normal CW Speed	(PW) 12 x *	CW Speed Table
Select Slow CW Speed	(PW) 13 x *	CW Speed Table

Data Digit	CW Speed	Data Digit	CW Speed
0	5 WPM	5	17 WPM
1	7 WPM	6	20 WPM
2	10 WPM	7	24 WPM
3	13 WPM	8	30 WPM
4	15 WPM	9	40 WPM

---

**Note:** The above *CW Speed Table* is based on the number of milliseconds duration of an element of CW (a dit = 1 element, a dah = 3 elements). Five WPM corresponds to 240 mS/element, 7 WPM corresponds to 170 mS/element, 10 WPM corresponds to 120 mS/ element, and so on.

---

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:**

Command	Default Condition
Select Normal CW Speed	20 WPM
Select Slow CW Speed	15 WPM

**Examples:**

To change the normal CW sending speed to 17 words per minute, enter:

```
(PW) 12 5 *
```

To change the slow CW sending speed to 10 words per minute, enter:

```
(PW) 13 2 *
```

---

**Note:** There are two ways to change the speed of a CW message. One way is to use the commands shown above; this is usually done upon installation. The other method is to insert a speed change character into the message. The latter is a temporary method, since the speed returns to normal after the message is sent.

---

## Beep Messages

### Control Character

The control character 9910 must be entered before the actual beep characters when building a beep message.

---

**Note:** Any message that does not have a control character will be interpreted as a CW message.

---

### Format

The format for beep messages is as follows:

- Enter the control character 9910.
- Then enter the various beep character codes described in the *Beep Character Set Tables* beginning on page A-5 to create the desired message.
- You may end the beep message with the (\*) character, or enter another control character (99xx) and continue with another message type.

### Beep Parameters (General)

The following table shows the general parameters related to beep messages. These parameters will be discussed in more detail in the sections which follow:

<b>Beep Parameters (General)</b>	
Control Character 9910	
Parameter	Code
custom beep	57xxxxyy
custom beep delay	58xx
1 second pre-message delay	54
automatic beep gap OFF	55
automatic beep gap ON	56

### Pre-Message Delay Character

A special pre-message delay character, 54, can be programmed—after the control character 9910 but before the beep characters. The delay character (54) causes the message handler to pause for 1 second before sending the beep message. Any additional 54s found after the first one will be ignored. If the beep message was preceded by any other message, the 54 will be ignored.

## Factory-Fixed-Frequency Beeps

Forty-eight (48) beeps have been defined in frequency but have variable duration. These beeps are programmed with the character codes 00–47 and cover almost four octaves from 262Hz to 3951Hz. It is best to avoid beeps below 300Hz and above 3000Hz, since most radio systems are designed for 300–3000Hz response.

The following table shows the *Factory-Fixed Frequency Beeps*:

This table includes associated *note* values for each frequency. However, these note values are simply intended as a guide to the pitch of each beep and should not be construed as musical in nature.

Factory-Fixed Frequency Beeps								
Control Character 9910								
Freq	Note	Beep	Freq	Note	Beep	Freq	Note	Beep
262Hz	C3	00	659Hz	E4	16	1661Hz	G#5	32
277Hz	C#3	01	698Hz	F4	17	1760Hz	A5	33
294Hz	D3	02	740Hz	F#4	18	1865Hz	A#5	34
311Hz	D#3	03	784Hz	G4	19	1976Hz	B5	35
330Hz	E3	04	831Hz	G#4	20	2093Hz	C6	36
349Hz	F3	05	880Hz	A4	21	2217Hz	C#6	37
370Hz	F#3	06	932Hz	A#4	22	2349Hz	D6	38
392Hz	G3	07	988Hz	B4	23	2489Hz	D#6	39
415Hz	G#3	08	1046Hz	C5	24	2637Hz	E6	40
440Hz	A3	09	1109Hz	C#5	25	2794Hz	F6	41
466Hz	A#3	10	1175Hz	D5	26	2960Hz	F#6	42
494Hz	B3	11	1244Hz	D#5	27	3136Hz	G6	43
523Hz	C4	12	1319Hz	E5	28	3322Hz	G#6	44
554Hz	C#4	13	1397Hz	F5	29	3520Hz	A6	45
587Hz	D4	14	1480Hz	F#5	30	3729Hz	A#6	46
622Hz	D#4	15	1568Hz	G5	31	3951Hz	B6	47

### Owner-Fixed Frequency Beeps

Six (6) beeps are definable in frequency by the owner, and have variable duration. The beeps default to factory-selected frequencies upon a cold start. The frequencies may be changed, and the new frequencies will be retained upon a warm start. These beeps are programmed with the character codes 48-53.

The following table shows the *Owner-Fixed Frequency Beeps*:

<b>Owner-Fixed Frequency Beeps</b>		
Control Character 9910		
<b>Beep</b>	<b>Owner-Fixed Frequency (Fill-In)</b>	<b>Default Condition</b>
48		500Hz
49		750Hz
50		1000Hz
51		1250Hz
52		1500Hz
53		1750Hz

---



---

## Select Frequency of Owner-Fixed Frequency Beeps

### Changes the frequency (pitch) of the CW.

- Enter the password, followed by the 4-digit root number shown, followed by the 4-digit tone code for your desired frequency.
- The tone code is taken from the *Tone Code Table* on page A-20. Do not omit leading zeroes. Tone codes may also be calculated, if desired.
- The frequency range is 100Hz to 5KHz, although most radio systems have an audio response of 300Hz to 3KHz.
- To select frequencies for CW and CTCSS, see the appropriate commands on pages 4-11 and 10-3 respectively.

---



---

### Command Form:

Command	Form	Data Digits
Select Frequency of Beep 48	(PW) 06 01 xxxx *	Tone Code Table
Select Frequency of Beep 49	(PW) 06 02 xxxx *	Tone Code Table
Select Frequency of Beep 50	(PW) 06 03 xxxx *	Tone Code Table
Select Frequency of Beep 51	(PW) 06 04 xxxx *	Tone Code Table
Select Frequency of Beep 52	(PW) 06 05 xxxx *	Tone Code Table
Select Frequency of Beep 53	(PW) 06 06 xxxx *	Tone Code Table

### Acknowledgment: Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal code entered

### Default Condition:

Command	Default Condition	Tone Code
Select Frequency of Beep 48	500Hz	2000
Select Frequency of Beep 49	750Hz	1333
Select Frequency of Beep 50	1000Hz	1000
Select Frequency of Beep 51	1250Hz	0800
Select Frequency of Beep 52	1500Hz	0667
Select Frequency of Beep 53	1750Hz	0571

**Examples:**

Let's change the frequency of beep 48 to 600Hz. The tone code for 600Hz is 1667. The command is:

```
(PW) 06 01 1667 *
```

## Custom Beeps

*Custom Beeps* are defined *on-the-fly* in both frequency and duration.

- An 8-digit character, 57xxxxyy, defines the custom beep.
- The four digits following the 57, shown as xxxx, represent the frequency and are taken from the *Tone Code Table* on page A-20.
- The next two digits, shown as yy, represent the duration in tens of milliseconds.

Custom beeps allow you to create a unique message with any frequency and any duration to 990mS. As an example, let's define a custom beep of 1275Hz for 70mS. The custom beep code would be 57078407.

## Custom Beep Delay

Duration for *Custom Beep Delays* is defined *on-the-fly*.

- A 4-digit character, 58xx, defines the custom delay.
- The two digits following the 58, shown as xx, represent the duration of the delay in tens of milliseconds.

Although custom delays can be placed anywhere in a beep message, they go well with custom beeps if you need to create a truly unique or specialized signalling burst. For example, a string of custom beeps and custom delays could be used to generate a string of ASCII characters of the proper tones for use with modems.

## Beep Gap Change Characters

*Beep Gap Change Characters* are used to introduce a silent period between beeps. Ten (10) such characters have been defined from 10mS to 320mS using the codes 60-69. Beep gap change characters may be used alone to separate groups of beeps, or can be automatically placed after every beep by using the *Automatic Beep Gap ON Character* (described on page 4-22). This parameter is not changed at the end of the beep message.

The following table shows *Beep Gap Change* control characters:

<b>Beep Gap Change Characters</b>	
Control Character 9910	
Beep Gap Change	Code
10mS	60
20mS	61
30mS	62
40mS	63
60mS	64
80mS	65
120mS	66
160mS	67
240mS	68
320mS	69

**Note:** Any time a beep gap change character is entered, its duration is remembered by the message handler. When the automatic beep gap ON character is encountered, the message handler will use the duration that it remembered from the previous beep gap change character. This is also true of the custom beep delay character.

---

### Beep Duration Change Characters

*Beep Duration Change* characters are used to set the duration of the beep characters that follow. Ten (10) beep duration change characters have been defined from 10mS to 320mS using the codes 70–79. The beep duration may be changed as often as desired within a beep message (even between each beep). This parameter is not changed at the end of the beep message.

The following table shows *Beep Duration Change Characters*:

Beep Duration Change Characters	
Control Character 9910	
Beep Duration Change	Code
10mS	70
20mS	71
30mS	72
40mS	73
60mS	74
80mS	75
120mS	76
160mS	77
240mS	78
320mS	79

**Note:** Any time a beep duration change is made (including a custom beep), the duration will be remembered by the message handler. When any succeeding beep is encountered, the message handler will use the duration that it remembered from the previous beep duration change.

---

### Automatic Beep Gap ON Character

The *Automatic Beep Gap ON Character*, 56, causes the message handler to place a gap between each beep. The duration of the gap depends on that last gap that was encountered. It defaults to 10mS upon a cold start.

### **Automatic Beep Gap OFF Character**

The *Automatic Beep Gap OFF Character*, 55, causes the message handler to send the beeps that follow in a series without any gaps between them.

### **Defaults**

Upon a cold start, the following defaults will be forced:

- Beep duration = 60mS
- Beep gap duration = 10mS
- Automatic beep gap = OFF

## **Single Tone Page Messages**

### **Control Character**

The control character 9920 must be entered before the actual page code when building a *Single-Tone Page Message*. If several single-tone pages are to be sent, control character 9920 must exist before each page code.

### **Format**

The format for single-tone page message is as follows:

- Enter the control character 9920.
- Enter four digits representing the frequency of the page tone, taken from the *Tone Code Table* on page A-20.
- Enter two digits representing the duration of the page tone in tenths of seconds.
- The range of duration is 0.1 to 9.9 seconds.
- You may end the message with the (\*) character, or enter another control character (99xx) and continue with another message type.

For example, the format of a single-tone page of 1050Hz of 8.0 seconds (National Weather Service standard page) is 9920095280.

### **Delays**

A 1-second *Pre-Page Delay* is created by the message handler for the first page in a group. If additional pages follow, the pre-page delay is eliminated in succeeding pages. A 3-second *Post-Page Delay* is created by the message handler for all single-tone pages.

## Two-Tone Sequential Page Messages

### Control Character

the control character 9930 must be entered before the actual page code when building a *Two-Tone Sequential Page Message*. If several two-tone pages are to be sent, the control character 9930 must exist before each two-tone page code.

### Format

The format for two-tone sequential page messages is as follows:

- Enter the control character 9930.
- Enter four digits representing the frequency of the first tone, taken from the *Tone Code Table* on page A-20.
- Enter two digits representing the duration of the first tone in tenths of seconds. The range of duration is 0.1 to 9.9 seconds.
- Enter four digits representing the frequency of the second tone, taken from the *Tone Code Table*.
- Enter two digits representing the duration of the second tone in tenths of seconds.
- The range of duration is 0.1 to 9.9 seconds.
- You may end the message with the (\*) character, or enter another control character (99xx) and continue with another message type.

For example, the format of a two-tone sequential page of 349.0Hz for 1.0 seconds followed by 433.7Hz for 3.0 seconds is 9930286510230630.

### Delays

A 1-second pre-page delay is created by the message handler for the first page in a group. If additional pages follow, the pre-page delay is eliminated in succeeding pages. A 1.3-second post-page delay is created by the message handler for all two-tone sequential pages.

## Five/Six-Tone Page Messages

### Control Character

The control character 9940 must be entered before the actual page code when building a *5/6-Tone Page Message*. If several 5/6-tone pages are to be sent, control character 9940 must exist before each 5/6-tone page code.

### Format

The format for five/six-tone page messages is as follows:

- Enter the control character, 9940.
- Enter the preamble digit (0–9), followed by the five digits (0–9), followed by 1 if you wish to send the X (*dual address*) tone, or 0 if you do not wish to send the X tone.
- You may end the message with the (\*) character.
- If you wish to enter another control character (99xx) and continue with another message type, you must add another digit to the end of the 5/6-tone page. This is required because the normal format results in an odd number of characters (11), and the message handler requires even numbers of characters in each message.

For example, the format of the 5/6-tone page 1-13657X is 99401136571. If no X tone is desired, the format is 99401136570. If this page were to be sent twice in the same message, a *bogus* digit would be added at the end of the first page to restore evenness to the command. The format would be 99401136571 0 99401136571. (Once again, the space is shown for clarity.)

---

**Note:** The message handler *always* requires a preamble digit. It will automatically substitute the R tone for a repeated digit.

---

### Delays

A 1-second *Pre-Page Delay* is created by the message handler for the first page in a group. If additional pages follow, the pre-page delay is eliminated in succeeding page. A 1-second *Post-Page Delay* is created by the message handler for all 5/6-tone pages.

## DTMF Page Messages

### Control Character

The control character 9950 should be entered before the actual DTMF character codes when building a *DTMF Page Message*. (Remember, if a Message does not begin with a control character, the message handler will assume the message should be sent in CW!)

### Format

The format for DTMF page message is as follows:

- Enter the control character 9950.
- Then enter the various DTMF character codes described in the *DTMF Character Set Tables* beginning on page A-8 to create the desired message/page.
- You may end the DTMF message with the (\*) character, or enter another control character (99xx) and continue with another page type.

### Delays

A 1-second *Pre-Page Delay* is created by the message handler for the first page in a group. If additional pages follow, the pre-page delay is eliminated in succeeding pages. A 1-second *Post-Page Delay* is created by the message handler for all DTMF pages. If desired, a DTMF page can consist of several DTMF digits, a pause, more DTMF digits, and so on. This feature allows you to place a series of DTMF pages within one message.

### Defaults

Until changed by the codes which follow, the DTMF tone duration is 100mS and the gap between DTMF characters is 100mS.

## DTMF Characters

There are 16 *DTMF Characters*: numerals 0 through 9, letters A through D, and the symbols (\*) and (#). Each character has a two-digit code, shown in the *DTMF Characters Table* which follows (reprinted on page A-8). Enter the appropriate two-digit code for each DTMF character that you wish to send.

The following table shows *DTMF Characters* and their related control characters (codes):

<b>DTMF Characters</b>			
Control Character 9950			
<b>DTMF Character</b>	<b>Code</b>	<b>DTMF Character</b>	<b>Code</b>
0	00	8	08
1	01	9	09
2	02	A	10
3	03	B	11
4	04	C	12
5	05	D	13
6	06	*	14
7	07	#	15

## DTMF Duration Change Characters

*DTMF Duration Change Characters* are used to set the duration of the DTMF characters that follow. Ten (10) DTMF duration change characters have been defined from 30mS to 200mS using the codes 20–29. The DTMF Duration may be changed as often as desired within a DTMF message. This parameter is not changed at the end of the DTMF message.

The following table shows *DTMF Duration Change Characters*:

<b>DTMF Duration Change Characters</b>	
Control Character 9950	
<b>DTMF Duration Change</b>	<b>Code</b>
30mS	20
40mS	21
50mS	22
60mS	23
70mS	24
80mS	25
90mS	26
100mS	27
150mS	28
200mS	29

## DTMF Custom Duration Change Characters

The easiest way to change the duration of the DTMF characters is to use the 2-digit codes mentioned above. However, you may require other durations, so the controller allows you to choose a *Custom DTMF Duration Change*. This parameter may be set from 10mS to 9900mS (9.9seconds).

- Use the code “50xx,” where xx is a number from 01 to 99, to get durations from 10mS to 990mS.
- Use the code “51xx,” where xx is a number from 01 to 99 to get durations from 100mS to 9900mS.

Once you change the duration, it will stay at the new value indefinitely, or until changed again by another code.

## DTMF Gap Change Characters

Every DTMF character sent by the controller is followed by a *DTMF Gap*, or silent period. You may wish to change the duration of the DTMF characters from the default duration of 100mS. Ten of the most common durations are shown in the *DTMF Gap Change Characters Table*. If you wish to change the gap to one of the values shown, enter the two-digit code corresponding to your choice. If the gap you want is not in the table, go to the custom DTMF gap change description immediately below. Once you change the duration, it will stay at the new value indefinitely, or until changed again by another code.

The following table shows *DTMF Gap Change Characters*:

<b>DTMF Gap Change Characters</b>	
Control Character 9950	
DTMF Gap Change	Code
20mS	30
30mS	31
40mS	32
50mS	33
60mS	34
70mS	35
80mS	36
90mS	37
100mS	38
150mS	39

## DTMF Custom Gap Change Characters

The easiest way to change the duration of the gap is to use the 2-digit codes mentioned above. However, you may require other gap durations, so the controller allows you to choose a *Custom DTMF Gap Change*. Duration of the gap may be set from 10mS to 9900mS (9.9seconds).

- Use the code “52xx,” where xx is a number from 01 to 99, to get durations from 10mS to 990mS.

- Use the code “53xx,” where xx is a number from 01 to 99 to get durations from 100mS to 9900mS.

Once you change the DTMF gap, it will stay at the new value indefinitely, or until changed again by another code.

---

**Note:** If you intend to program a large number of DTMF pages with varying tone durations and, it would be a good idea to set up the proper duration values at the beginning of each individual page. Otherwise, the old values from the previous page will be used for the new page.

---

### DTMF Pause Characters

Unlike a DTMF gap, which is automatically sent after each DTMF character, a *DTMF Pause Character* may be inserted anywhere in a DTMF page. These pauses are typically used to separate individual pages within a multi-page message. Ten common pause durations are shown in the *DTMF Pause Characters Table*. If you wish to insert a pause into a page, enter the two-digit code corresponding to your choice.

If the DTMF Pause you want is not in the table, go to the custom DTMF pause description below.

The following table shows *DTMF Pause Characters*:

<b>DTMF Pause Characters</b>	
Control Character 9950	
DTMF Pause	Code
100mS	40
200mS	41
300mS	42
400mS	43
500mS	44
600mS	45
700mS	46
800mS	47
900mS	48
1000mS	49

### DTMF Custom Pause Characters

The easiest way to insert a pause is to use the 2-digit codes mentioned above. However, you may require other pauses, so the controller allows you to choose a *Custom DTMF Pause*. Duration may be set from 10mS to 9900mS (9.9seconds).

- Use the code “54xx,” where xx is a number from 01 to 99, to get durations from 10mS to 990mS.

- Use the code “55xx,” where xx is a number from 01 to 99 to get durations from 100mS to 9900mS.

---

**Note:** Since each DTMF character is followed by a DTMF gap, be sure to add the DTMF gap duration to the DTMF pause duration if you want an accurate idea of the time between two DTMF pages.

Pauses are additive. A long pause may be created by placing a series of pauses together within the DTMF page.

---

### DTMF Custom Changes (Duration • Gap • Pause)

The following table shows *DTMF Custom Changes* affecting duration, gap, and pause. it is generally related to preceding sections.

<b>DTMF Custom Changes (Duration Gap Pause)</b>		
Control Character 9950		
DTMF Custom Change	Code	Data Digit
custom DTMF duration change (10990mS)	50xx	0199 x 10mS
custom DTMF duration change (1009900mS)	51xx	0199 x 100mS
custom DTMF gap change (10990mS)	52xx	0199 x 10mS
custom DTMF gap change (1009900mS)	53xx	0199 x 100mS
custom DTMF pause (10990mS)	54xx	0199 x 10mS
custom DTMF pause (1009900mS)	55xx	0199 x 100mS
to ignore each custom DTMF change code		enter 00 for xx in any of above codes

### DTMF-Related Notes

The DTMF decoder is turned OFF during DTMF pages to prevent the page from being acted on by the controller. Since the DTMF encoder is shared between the DTMF paging function and the DTMF autopatch function, there may be a delay in paging while a number is dialed (or vice versa).

---

## DTMF Character Set Tables Explained

The preceding section is somewhat complicated. Therefore, in an effort to clarify some of the main points, the following explanation is given.

**Format.** The page begins with a 1.0-second delay, unless it was preceded with a page. Then the delay is 50mS. When the page is finished, a 1.0-second post delay occurs. If desired, a DTMF page can consist of several DTMF digits, a pause, some more digits, a pause, and so on. This allows a series of pages all contained in one message.

**Defaults.** Until changed by one of the above codes, the DTMF digit duration is 100mS and the gap between digits is 100mS. Once a DTMF duration change or a DTMF gap change is made, it remains in effect indefinitely, until changed by another code. If the user expects to require DTMF pages of varying durations and gaps, it would be wise to set up the proper DTMF duration change and DTMF gap change codes at the beginning of each page.

**DTMF Custom Changes.** *DTMF Custom Changes* allow the user to choose durations, gaps, and pauses which are not listed in the various tables above. These DTMF Custom Changes are found in their own table labeled “*DTMF Custom Changes (Duration • Gap • Pause)*” on page 4-30 and are reprinted on page A-10. The advantages in using codes from the regular tables (*not the DTMF Custom Changes Table*) is that such codes require only two keystrokes. DTMF Custom changes are more flexible, but require four keystrokes. If 00 is entered for xx, the DTMF custom change will be ignored.

**DTMF Pauses.** Pauses are additive. Therefore, a series of *DTMF Pause Characters* adds to the total DTMF pause. Since the DTMF encoder is shared with the autopatch, there may be a short delay in either the DTMF page or the autopatch dialing if both are asked to generate DTMF digits at the same time.

**Each DTMF digit is always followed by a DTMF Gap.** Therefore, the duration of a *DTMF Gap Change Character* adds to the duration of a *DTMF Pause Character* when calculating the delay between the last digit of one page and the first digit of the next page.

### Examples

To generate a simple page of the DTMF characters “1, 2, 3, A, B, C” at the default durations of 100mS and the default DTMF gap of 100mS, you would enter this:

```
(PW) 15 9950 01 02 03 10 11 12 *
```

To send the same characters, but with a duration of 50mS and a gap width of 50mS, you would enter this:

```
(PW) 15 9950 22 33 01 02 03 10 11 12 *
```

You can change the durations and gaps anywhere in the message. Here is a page with 1, 2, 3 sent at 50mS/50mS and A, B, C sent at 150mS/100mS with a 1-second pause between the two pages:

```
(PW) 15 9950 22 33 01 02 03 49 28 38 10 11 12 *
```

---

**Note:** The digit duration will now be at 150mS, and the gap will now be at 100mS, since those are the last parameters which were used.

---

You can use DTMF custom duration change characters and DTMF custom gap characters if you have special requirements. In this example, we will generate two pages. The first will be “1, 2, 3” at 160mS/110mS. Then we’ll have a 5-second pause, followed by “A, B, C” at 300mS/120mS

```
(PW) 15 9950 5016 5211 01 02 03 5550 5030 5212 10 11 12 *
```

Here’s the explanation: 9950 = control character to generate a DTMF Page; 5016 = DTMF custom duration change, 16 x 10mS = 160mS; 5211 = DTMF custom gap change, 11 x 10mS = 110mS; 5550 = DTMF custom pause change, 10 x 100 mS = 5 seconds; 5030 = DTMF custom duration change, 30 x 10mS = 300mS; and 5212 = DTMF custom gap change, 12 x 10mS = 120mS.

## Synthesized Speech Messages

### Control Character

The control character 9960 must be entered before the actual speech word codes when building a synthesized speech message.

### Format

The format for *Synthesized Speech Messages* is as follows:

- Enter the control character 9960.
- Then enter the various speech word codes described in the *Synthesized Speech Vocabulary Tables* beginning on page A-11 to create the desired message.
- Each word is represented by a four-digit code.
- When building a synthesized speech message, be sure to use all four digits of the code (do not omit leading zeroes).
- You may end the synthesized speech message with the (\*) character, or enter another control character (99xx) and continue with another message type.

### Delay Character

A special *Pre-Message Delay Character*, 0000, can be programmed after the control character 9960 but before the word characters. The 0000 causes the message handler to pause for 1 second before sending the synthesized speech message. Any additional 0000s found after the first one will be ignored. If the synthesized speech message was preceded by any other message, the 0000 will be ignored.

### Pause Character

The *Pause Character* should be used to separate word groups in a synthesized speech message. This character is shown in the vocabulary as (*pause*).

### Timeout Timer

When a synthesized speech message is encountered by the message handler, the message handler attempts to communicate with the speech synthesis module and starts a 5-second *Timeout Timer*. If the module is disconnected or inoperative, the message handler will disregard the message after the timer expires.

### Synthesized Speech Vocabulary

Synthesized speech messages utilize the *Synthesized Speech Vocabulary Tables* beginning on page A-11. There are tables for male and female voice, as well as sound effects.

## Tone Codes

When entering tone frequencies for CW, beep, or paging messages, a *Tone Code* is required. Tone Codes are 4-digit numbers representing the period of

the tone sine wave in microseconds. Tone codes may be either taken from the *Tone Code Table* or calculated.

### Tone Code Table Explained

The *Tone Code Table* was created to simplify your programming efforts by listing frequencies from 100Hz to 3KHz (in 5Hz increments), and the appropriate tone code for each frequency. The complete *Tone Code Table* begins on page A-20 and look similar to this:

<b>Tone Code Table (continued)</b>									
All Frequencies in Hz									
Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code
100	9999	225	4444	350	2857	475	2105	600	1666
105	9523	230	4347	355	2816	480	2083	605	1652
110	9090	235	4255	360	2777	485	2061	610	1639
115	8695	240	4166	365	2739	490	2040	615	1626
120	8333	245	4081	370	2702	495	2020	620	1612

**Note:** Most radio systems have a response of 300Hz to 3KHz, and will not pass tone frequencies outside this range.

### Calculating Tone Codes

If you wish to program a tone frequency that is not listed in the *Tone Code Table*, you will need to calculate its tone code. (This is particularly true of paging tones, which are specified to tenths of Hertz.) To assist you in calculating your tone codes, the following explanation is offered.

To determine your tone code, simply take the reciprocal of the tone frequency. It is easily done on a calculator:

- Enter 1,000,000, then divide this number by the tone frequency in Hertz.
- The quotient, rounded off to a 4-digit whole number, is the tone code.
- If the result is 999 or less, you must insert a leading zero.

Here are some examples:

- The tone frequency is 1200Hz. What is the tone code? Dividing 1,000,000 by 1200 yields 833.3, so the tone code is 0833.
- The tone frequency of a single-tone page is 1050Hz. What is the tone code? Dividing 1,000,000 by 1050 yields 952.4, so the tone code is 0952.
- The tone frequency is 398.1Hz. What is the tone code? Dividing 1,000,000 by 398.1 yields 2511.9, so the tone code is 2512.

## Run-Time Variables

*Run-Time Variables* (RTV) are small code groups which you place into a message to be expanded at “run time” (the instant the message is actually transmitted by the controller). The message handler recognizes run-time variables because they always begin with 98.

When the message handler encounters an RTV, it forms the appropriate message and transmits it in place of the RTV code. You could, for example, announce the time or date as part of an ID, autopatch termination, or other occasion. You may precede and/or follow the RTV with other messages, routing codes, and so on. RTVs may be placed in succession to form a single expression.

<b>Run-Time Variables</b>		
<b>Run-Time Variable</b>	<b>Meaning</b>	<b>Example</b>
9810	hour & minute, 12-hr format, CW	2 45
9811	AM/PM, CW	PM
9812	hour & minute, 24-hr format, CW	14 45
9813	day of week, CW	WED
9814	month, CW	JAN
9815	day of Month, CW	1
9816	Seconds, CW	27 in CW
9820	hour & minute, 12-hr format, male	two forty-five (male)
9821	AM/PM, male voice	PM (male)
9822	hour & minute, 12-hr format, female	two forty-five (female)
9823	AM/PM, female voice	PM (female)
9824	hour & minute, 24-hr format, male	14 hours, 45 minutes (male)
9825	same as 9824 without “hours” & “minutes”	fourteen forty-five (male)
9826	day of week, male voice	Wednesday (male)
9827	cardinal day-of-month, male voice	one (male)
9828	ordinal day-of-month, male voice	first (male)
9829	month, male voice	January (male)
9830	“good morning/good afternoon/good evening” (female voice)	good afternoon (female)
9831	“morning/afternoon/evening”	afternoon (male)
9832	Seconds, male voice	Twenty-seven (male)
9896	Call Count, CW	105
9897	Call Count, male voice	One zero five (male)
9898	Software Version, CW	203
9899	Software Version, male voice	Two point zero three (male)

A feature of the clock and calendar RTVs is that the current time and date are read and stored at the first RTV encountered in a message. If the time or date “rolls over” during the message transmission, it will not affect the time or date being sent.

**RTV Notes**

- 9820 and 9822, which are spoken 12-hour time RTVs, will say “o’clock” on the hour (xx:00). Midnight to 11:59 = A.M.
- 9827 is used with the month outside the U.S., as in this example: “One January.” 9828 is used with the month inside the U.S., as in this example: “January First.”
- 9830 and 9831 switch from “afternoon” to “evening” at 6:00 PM
- The real-time clock and calendar features leap-year correction.
- 9816 and 9832, seconds in CW or speech, can be used to accurately set the clock. (See *Chapter 8, Clock and Calendar.*)

---

**Note:** The voiced run-time variables require that your controller be fitted with a speech synthesis module.

---

Here are some ideas: To send the time and AM or PM in voice, enter

```
(PW) 15 9820 9821 *
```

You would hear “two forty-five PM” or something similar.

To say “the time is ( ),” enter

```
(PW) 15 9960 0500 0514 0253 9820 9821 *
```

9960 is the control character for synthesized speech.

To say the software version, enter:

```
(PW) 15 9899 *
```

You can create similar commands to send “today is ( ),” “the date is ( ),” and so on. Dumping the autopatch could announce “call complete at ( ).” The ID could include “it is (Monday) (morning) on W0XYZ repeater.”

---

**Note:** It is not necessary to place the control code 9900 in front of CW run-time variables or the control code 9960 in front of voiced run-time variables. The RTV automatically inserts these control codes into the message. However, you must enter control codes *after* the RTV if you have a different type of message to follow

---

---



---

## Select Programmable Messages

Selects or changes the various messages sent by the controller.

- Enter the password, followed by the 4-digit root number shown, followed by the desired message.
- Any message may have any combination of message types, including CW, beeps, page tones, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes).
- You must count the control character. Therefore, any message could have 46 CW characters, 23 synthesized speech words, and so on.
- To delete a message, enter the password, the 4-digit root number, and the (\*) (do not enter any message).
- See the *Select Initial and Normal ID Tail Message* commands on page 12-8 for other programmable messages.

---



---

### Command Form:

Command	Form
Select Courtesy Message	(PW) 31 10 (message) *
Select Dropout Message	(PW) 31 13 (message) *
Select Pre-Timeout Message	(PW) 31 16 (message) *
Select Post-Timeout Message	(PW) 31 19 (message) *
Select Initial ID Message for TX1	(PW) 31 30 (message) *
Select Initial ID Message for TX2	(PW) 31 33 (message) *
Select Normal ID Message for TX1	(PW) 31 31 (message) *
Select Normal ID Message for TX2	(PW) 31 34 (message) *
Select Autopatch Dialing Message	(PW) 31 40 (message) *
Select Autopatch Timeout Warning Message	(PW) 31 41 (message) *
Select Phone Line Answer Message	(PW) 31 50 (message) *
Select Reverse Patch Ringout Message	(PW) 31 51 (message) *

---

**Note:** Since the default routing is to transmitter #1, no routing character is needed for either TX1 ID. However, you must enter a routing character when programming IDs for TX2, or the message will go to TX1 instead.

---

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	too many digits entered
? err 2	illegal digit entered

**Default Condition:**

Command	Default Condition
Select Courtesy Message	60mS 440Hz beep (9910 74 09)
Select Dropout Message	(deleted)
Select Pre-Timeout Message	TO (CW)
Select Post-Timeout Message	TO (CW)
Select Initial ID Message for TX1	ID (CW)
Select Initial ID Message for TX2	9983 ID (CW letters with TX2 routing)
Select Normal ID Message for TX1	ID (CW)
Select Normal ID Message for TX2	9983 ID (CW letters with TX2 routing)
Select Autopatch Dialing Message	AS (CW <i>wait</i> )
Select Autopatch Timeout Warning Message	AR (CW <i>end-of-message</i> )
Select Phone Line Answer Message	3 beeps (9910 585076 09 2133)
Select Reverse Patch Ringout Message	55 (CW)

**Examples:**

Let's change the normal ID message to *W0XYZ/R* in CW. It is a good idea to preface any CW message with the CW control character, 9900. Now, looking up *W0XYZ/R* in the *CW Character Set Tables* beginning on page A-2, we find:

```
32 00 33 34 35 38 27.
```

The entire command to change the normal ID message looks like this:

```
(PW) 31 31 9900 32 00 33 34 35 38 27 *
```

may be entered in a continuous string of digits as follows:

```
(PW) 3131990032003334353827 *
```

Let's program a longer callsign into the initial ID message, using *DE W9XYZ/R CGO* (Chicago) in CW as the message. The command looks like this:

```
(PW) 31 30 9900 13 14 40 32 09 33 34 35 38 27 40 12 16 24 *
```

---

**Note:** Wordspace character, 40, has been used twice. This separates the *DE* from the *W9XYZ/R*, and separates the *W9XYZ/R* from *CGO*.

---

Let's now change the courtesy message to a burst of 2 beeps. We want the two beeps to be 25 and 21, we want them each to be 40mS in duration, and we want no gap between them.

Looking up this information in the *Beep Character Set Tables* beginning on page A-5, we find: 55 turns the automatic beep gap OFF; 73 changes the beep duration to 40mS; the control character for a beep message is 9910. Therefore, the complete command to change the courtesy message looks like:

```
(PW) 31 10 9910 55 73 25 21 *
```

---



---

## Review Programmable Messages

Plays back the various messages that have been programmed into the controller.

- Enter the password, followed by the 4-digit root number shown.
  - The controller will send the appropriate message for your examination.
  - If you wish to change the message, see the *Select Programmable Messages* command on page 4-35.
- 
- 

### Command Form:

Command	Form
Review Courtesy Message	(PW) 34 10 *
Review Dropout Message	(PW) 34 13 *
Review Pre-Timeout Message	(PW) 34 16 *
Review Post-Timeout Message	(PW) 34 19 *
Review Initial ID Message for TX1	(PW) 34 30 *
Review Initial ID Message for TX2	(PW) 34 33 *
Review Normal ID Message for TX1	(PW) 34 31 *
Review Normal ID Message for TX2	(PW) 34 34 *
Review Autopatch Dialing Message	(PW) 34 40 *
Review Autopatch Timeout Warning Message	(PW) 34 41 *
Review Phone Line Answer Message	(PW) 34 50 *
Review Reverse Patch Ringout Message	(PW) 34 51 *

**Acknowledgment:** Sends the appropriate message

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default:** None

---



---

## Select/Review/Play User Messages

Selects, changes, or reviews general purpose user-defined messages.

- Enter the password, followed by the 4-digit root number shown, followed by the desired message.
- Any message may have any combination of message types, including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes).
- You must count the control character. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*) (do not enter any message).

---



---

### Command Form:

Command	Form
Select User Message #1	(PW) 31 70 (message) *
Select User Message #2	(PW) 31 71 (message) *
Select User Message #3	(PW) 31 72 (message) *
Select User Message #4	(PW) 31 73 (message) *
Review/Play User Message #1	(PW) 34 70 *
Review/Play User Message #2	(PW) 34 71 *
Review/Play User Message #3	(PW) 34 72 *
Review/Play User Message #4	(PW) 34 73 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No message.

---



---

## Send Message

Sends a message when commanded.

Unlike the various *Select Programmable Messages* commands on page 4-35, this command *does not* store the message in memory. It has two purposes:

- You can experiment with different messages types by entering this command and listening for the results.
- You can place this command into a macro so that a message is sent when the macro is executed.

---



---

### Command Form:

Command	Form
Send Message	(PW) 15 (message) *

**Acknowledgment:** Sends the message

### Errors:

Error	Meaning
? err 1	too many digits entered

**Default:** None

### Examples:

Let's send some CW characters, some beep characters, then some CW characters again. The CW characters will be A, B, and C; the beeps will be 25 through 30 at 80mS durations with 20mS gaps between them; and the final CW characters will be 1, 2, and 30 WPM and 1000Hz frequency.

Looking up the *CW Alphanumeric Characters Table* beginning on page A-2, we see that the control character is 9900; A, B, and C are 10 11 12 respectively. Looking up the *Beep Character Set Tables* beginning on page A-5, we see that the control character is 9910;

- To get 80mS beep durations, we must enter 75 (from the *Beep Duration Change Characters Table*)
- To get 20mS gaps we must enter 56 to turn the automatic beep gaps ON (from the *Beep Parameters (General) Table*), and 61 to get 20mS beep gaps (from the *Beep Gap Change Characters Table*).

Going to the *CW Frequency and Speed Changes Table* on page A-4, we see that the control character is 9900 again. To get 30 WPM we must enter:

To get 1000Hz frequency, we must enter:

```
591000; and 1, 2, 3 is 01 02 03.
```

Therefore, our complete command to send this message is:

```
(PW) 15990010111299107556612526272829309900659100 0010203*
```

You may never have a need for a message like this, but this example shows the flexibility available in the controller.

---



---

## Select/Review Command Response Messages

Selects, changes, or reviews command response messages that are sent when command responses are enabled.

- Enter the password, followed by the 4-digit root number shown, followed by the desired message.
- Any message may have any combination of message types, including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes).
- You must count the control character. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*) (do not enter any message).

---



---

### Command Form:

Command	Form	Default
Select OK Command Response Message	(PW) 31 01 (message) *	OK in CW
Select Error 1 Command Response Message	(PW) 31 02 (message) *	?ERR1 in CW
Select Error 2 Command Response Message	(PW) 31 03 (message) *	?ERR2 in CW
Review OK Command Response Message	(PW) 34 01 *	none
Review Error 1 Command Response Message	(PW) 34 02 *	none
Review Error 2 Command Response Message	(PW) 34 03 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** See default column of table.

---



---

## Select/Review Programmable Messages

Selects, changes, or reviews programmable messages.

- Enter the password, followed by the 4-digit root number shown, followed by the desired message.
- Any message may have any combination of message types, including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes).
- You must count the control character. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*) (do not enter any message).

---



---

### Command Form:

Command	Form	Default
Select Warm Reset Message	(PW) 31 00 (message) *	?RES in CW
Review Warm Reset Message	(PW) 34 00 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** See default column of table.



---

## Chapter 5

# Security

---

One of the *Security* features used by the computer is a dual-password system. There are two levels of command privileges.

- The operators holding the *Master Password* are the higher level group, since the master password may be used with all control commands.
- The operators holding the *Control Operator Password* are the lower level group, since their password only works with certain owner-designated control commands.

You may select the commands that are available to the control operators, which range from none to all commands.

- The master password and the control operator password may be 2, 4, or 6 digits long.
- The passwords may contain the numbers 0-9, and the lettered keys A, B, C, and D.

To enhance security at your site, you can disable the *Front Panel Display*.

---



---

## Assign Control Operator Password

### Assigns a new password for control operators.

- The new *Control Operator Password* may be 2, 4, or 6 digits in length.
- The new *Control Operator Password* may be any combination of the numbers 0-9 and the letters A-D.
- Autopatch passwords are explained in the *Autopatch* section on page 7-2.
- Remote base passwords are explained in the *Remote Base Interface* section on page 21-1.

---



---

#### Command Form:

Command	Form
Assign Control Operator Password	(PW) 92 (new control operator password) *

**Acknowledgment:** Sends OK

#### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** No *Control Operator Password* is assigned

#### Examples:

Assume there there is no control operator password, the default condition. To assign it to 95, enter this:

```
(PW) 92 95 *
```

"(PW)" must be the master password, since no control operator password exists.

If the master password is 2A3B4C, enter this:

```
2A3B4C 92 95 *
```

---



---

## Assign Master Password

### Assigns a new master password.

- The new *Master Password* may be 2, 4, or 6 digits in length.
- The new *Master Password* may be any combination of the numbers 0-9 and the letters A-D.
- Autopatch passwords are explained in the *Autopatch* section on page 7-2.
- Remote base passwords are explained in the *Remote Base Interface* section on page 21-1.

---



---

#### Command Form:

Command	Form
Assign Master Password	(PW) 93 (new master password) *

**Acknowledgment:** Sends OK

#### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** *Master Password* defaults to 99

#### Examples:

Assume that the present master password is 99, the default password. To change it to 1234, enter this:

```
99 93 1234 *
```

The new password is 1234 at this time. To change it to 2A3B4C, enter this:

```
1234 93 2A3B4C *
```

---



---

## Assign Control Operator Privilege Level

Limits access of control operators to the repeater functions by assigning privilege levels to control commands.

- Enter the root number of the command for which a privilege level change is desired, then enter a 0 or 1 for the privilege level.
  - 0 = control command may be used by *either* the master or the control operator password.
  - 1 = control command may be used *only* by the master password.
- 
- 

### Command Form:

Command	Form	Data Digit
Assign Control Operator Privilege Level	(PW) 94 (command root number) x*	0 = used by either password 1 = used by only master password

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** All commands may be used by either password.

### Example:

Assume the control operators have full privileges, the default condition. To prevent control operators from changing either the master password or the control operator password, enter this:

```
(PW) 94 92 1 *
```

```
(PW) 94 93 1 *
```

Root 92 is the *Assign Control Operator Password* command on page 5-2.

Root 93 is the *Assign Master Password* command on page 5-3.

---

Note: If you want to prevent a control operator from accessing more than one root code in a row, use the *Assign Control Operator Privilege Level to a Range of Commands* command (see page 5-5.)

---

---



---

## Assign Control Operator Privilege Level to a Range of Commands

**Changes the Control Operator Privilege on a range of commands.**

- Enter the first and last root number of the command for which a privilege level change is desired, then enter a 0 or 1 for the privilege level.
- 0 = control command may be used by *either* the master or the control operator password.
- 1 = control command may be used *only* by the master password.

---



---

### Command Form:

Command	Form	Data Digit
Assign Control Operator Privilege Level to a Range of Commands	(PW) 94 (first root number) (last root number) x*	0 = used by either password 1 = used by only master password

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** All commands may be used by either password.

### Example:

Assume that you want to reset all privilege level entries for use by both passwords, enter the following:

```
(PW) 94 00 99 0 *
```

Assume that you want to prevent control operators from changing passwords or a privilege level enter the following:

```
(PW) 94 92 94 1 *
```

---

Note: If you want to prevent a control operator from accessing a single root code use the *Assign Control Operator Privilege Level* command (see page 5-4.)

---

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## Enable/Disable Front Panel Display

### Controls the Front Panel Display.

- By default the Front Panel Display is enabled.
  - The Front Panel Display may be disabled to improve site security.
  - The Power LED is always on.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Front Panel Display	(PW) 63 99 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Front Panel Display is enabled.

---

## Chapter 6

# Macros

---

One of the most powerful features of your controller is its ability to store and recall strings of commands in memory areas. These strings of commands are called *Macros*. The names of the macros, and their contents, are fully programmable. The default condition of the controller is empty; no macros exist until you create them.

There are many advantages in using macros instead of the full programming commands, including:

- **Time Savings.** Often-used or long commands can be stored in macros, then executed by entering just the *Macro Names*.
- **Fewer Errors.** There is a much smaller likelihood of making an error when entering a short macro name instead of a long series of digits. Mobile and portable operators will appreciate the need to enter just a few digits to place an autopatch call to an often- dialed number.
- **Better Security.** Create a library of macros for your users and restrict the actual programming passwords to yourself and a few control operators. If a macro becomes abused, rename or delete it.
- **Better Control.** Your controller can execute macros from Logic Inputs or certain events, giving you more control over your system.

### Quantity of Macros

Your controller supports a total of 280 macros. If you use, for example, 220 macros for autopatch autodial commands, you will still have 60 macros available for your user library.

### Size of Macros

Each macro may contain a maximum of 100 digits (keystrokes). Therefore, a macro may contain a single command of 100 digits, or more commands of fewer digits. The macro loses two digits each time you store (append) an additional command, and it loses one more if the appended command has an odd number of digits. Thus, a macro can't contain a single command of 100

digits, or two commands totalling 98 digits, or three commands totalling 96, and so forth.

If the amount of memory remaining in a macro is insufficient to store a desired command, there may still be enough room to store the name of another macro. “Chaining” another macro to the original macro expands the storage capacity by another 100 digits.

---

**Note:** Commands must reside completely within a macro. You may not store part of a command in a macro and continue it in another macro.

---

## Names of Macros

You name the macro when you create it. Creating a macro causes the controller to put the macro name in a directory so it can find the macro at execution time. A macro can be renamed, since the controller can easily replace the old macro name in the directory with a new one. A macro can be deleted, since the controller can erase the name in the directory.

You can give a macro any name that is 1, 2, 3, or 4 characters in length and does not contain a (\*) or (#). Thus, you may use the characters 0 through 9 and the lettered keys (A, B, C, and D). Names you could use included “7,” “123,” “1234,” “3AC6,” and so on.

If the *Macro Name* has leading zeros, they will be ignored by the controller. For example, the following macro names will all refer to the same macro: 5, 05, 005, 0005. You may execute the macro by entering any of these names. When you chain a macro to another macro, you may enter the macro name into the original macro by skipping the leading zeros.

---

**Note:** It is important to know that many of the programming commands in this manual require a macro name to be entered in 4 digits, because the 4 digits act as placeholders. You must use leading zeros if necessary, since skipping them will cause the command to have the wrong format. Therefore, when creating a new macro, or using any of the other commands that specify a 4-digit macro name, enter leading zeros if the name has fewer than 4 digits.

---

## Contents of Macros

You may store any sequence of digits into a macro except for the (\*) and (#). The (\*) is entered last, to terminate the command and indicate the end of the data to be stored. Since the (\*) and (#) cannot occur in the data being stored, you must store one command at a time. Store the first command in a macro when you create it, and store any additional commands using the *Append To Macro* command on page 6-7.

A macro, then, can store programming commands, other macro names, or both. You can create *Master Macros* which contain the names of other macros,

and by simply entering the name of the master macro, you will cause all of them to be executed.

## Sequence of Execution

When a macro is executed, the commands (or other macro names) stored in that macro are executed in the order they were stored. For example, assume that a certain macro contains a programming command, then a macro name, then another programming command. When this macro is executed, the first programming command will be executed first. Then, the “imbedded” macro will be fully executed. (This means that if the imbedded macro contains other commands and other macros, they will all be executed before the remaining items in the imbedded macro are executed.) Finally, the last programming command in the macro will be executed. Your controller has the ability to queue up to 40 commands or macros at one time.

## Cautions

*Do not create a loop* by creating a macro that calls its own name. Likewise, do not create a series of macros that will eventually loop back and call the originating macro. For example, don't create a macro named 65, which calls macro 66, which calls macro 67, which calls 65. The result will be a locked up system that will require you enter 40 commands by hand to reinitialize itself, or a trip to the site to do a warm start.

---

**Note:** The controller does not check the validity of the data stored in macros; it simply stores whatever data you specify. If you create errors in the data you store in macros, or if you change a command password after commands using the password are stored in macros, the macros will not execute properly.

---

## Applications of Macros

You can execute a macro by entering its name, followed by the (\*). You can skip the (\*) if you have turned ON the command execution on carrier drop feature using the *Enable/Disable End-of-Transmission Command Execution* commands (page 16-6). You can instruct the controller to automatically execute macros based on hardware or software. There are many of these *Event-Triggered Macros* described throughout the manual. (Examples can be found on pages 7-10, 16-2, and 16-4.)

If you create a macro that contains the autopatch sequence, the macro becomes an *Autodial Code*. you can personalize the autodial by having it identify the call with a message. here's how its done.

- Create a macro, using the desired macro name, the autopatch access password, and the telephone number.
- Append a command to the macro, using the same macro name, that sends the message: (PW) 15 (your message) \*

Whenever the macro name is entered, the controller will dial the telephone number and announce the call as you programmed it. Autodials are great for club members who often call family or friends.

Emergency autodials can also be created.

- Start the macro with commands to *Reset The Autopatch Timeout Timer* (page 7-16), and perhaps enable the CTCSS encoder (for remote tape recorders). (See page 10-2.)
- Reverse these commands using the *Select Autopatch Dump-Triggered Macro* command on page 7-10.

Some groups use the autopatch only for emergency calls. In that case, publicize the macros that dial emergency services. Keep the autopatch access password concealed so that only macros can be used to access the autopatch.

Since macros can store any commands, not just autopatch commands, you can create macros which change the personality of the repeater. An *Emergency Status Macro* might change the ID and tail messages, and the autopatch timeout timer; a *Normal Status Macro* could change these parameters back to the usual settings.

A macro can be created to announce the beginning of a net by sending a tone page and a speech synthesized message. Enter another macro to announce the club meeting as part of the ID message a week before the meeting occurs. (Long strings of digits are unnecessary each time if you program the macros beforehand.)

A library of macros can be created to serve your club members. Some quick examples might include:

- Send the time or date.
- Generate DTMF pages to activate selective call decoders (and the new handholds that have built-in DTMF decoders).
- Redial the autopatch or extend its timeout timer.
- Reset the repeater timeout timer.
- Pulse a tape cartridge machine that plays the latest club announcements.

## Create New Macro

Places the name of the new macro in a directory, then places the digits following the macro name into a storage area in memory.

- A new macro is a macro with a name that has not been used before.
- The digits that are stored in memory are shown below as *Command*, in the command form section. Command may be either a control command, or the name of another macro.
- If you are storing a control command, do not forget to include the control command's password. In other words, the *command* stored into a macro must be a complete, executable command or macro.

### Command Form:

Command	Form
Create New Macro	(PW) 20 (macro name, command) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	too few digits entered
? name used	macro name already exists in the directory
? dir full	directory is filled with the maximum number of macros
? too big	the command being entered for storage exceeds the storage area allowed for a macro

**Default Condition:** No Macros exist

### Examples:

Assume we wish to create a macro that turns ON Logic Output #1. The control command would be:

```
(PW) 70 1 *
```

Since we do not wish to disclose the password to our users, we can simply place this command into a macro. Let's call the macro 6A (assume our users have 16-button DTMF keyboards). Enter the following:

(PW) 20 006A (PW) 70 1 \*

- If additional commands are to be executed by entering 6A, they can be appended. See the *Append to Macro* command on page 6-7.

---

**Note:** The macro name is entered with leading zeroes, since the name chosen is less than 4 digits long. Also, the command following the macro name is a complete command, including password.

The acknowledgment message *OK* simply indicates that the *Create New Macro* command was entered correctly, and that the controller created a new directory entry with some digits stored in memory. It does not guarantee that the digits it stored represented an executable command. It is possible to store garbage digits in a macro just as easily as legitimate commands.

---

## Append To Macro

This command is used to attach additional commands to a macro.

- The macro name (to be appended) must already exist in the directory.
- The stored information, shown below as *Command*, in the command form section, may be a control command or another macro name (if you wish to chain together several macros).

### Command Form:

Command	Form
Append to Macro	(PW) 29 (macro name, command)*

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	too few digits entered
? not found	macro name does not exist in directory
? too big	command being entered exceeds the storage area remaining for this macro

**Default:** None

### Examples:

Assume that a macro has been created to turn ON Logic Output #1, and that its name is 6A. We wish to append a command that dials a telephone number (i.e. accesses the autopatch). This way, entering 6A will result in the controller both dialing the number and turning on the output.

Assuming the autopatch password is 10 (the default), and the number we wish to dial is 663-6000, the command to dial is:

```
(PW) 29 006A 10 6636000 *
```

**Note:** The macro 6A must already exist before this additional command may be appended. See the *Create New Macro* command on page 6-5.

Additional commands may be appended to a macro until the storage space for that macro is used up.

- If more commands are needed than can fit into a single macro, simply append the name of another macro to the original macro.
- This new macro is created and appended similarly to the original macro.
- If the new macro is filled, append another.
- This process can continue until the limit of 40 chained commands is reached.

---

**Note:** The acknowledgment message *OK* simply indicates that the *Append To Macro* command was entered correctly, and that the controller appended whatever digits were given after the macro name. It does not guarantee that the digits it stored represented an executable command. It is possible to store “garbage” digits in a macro just as easily as legitimate commands.

---

## List Macro

Examines the contents of a macro and sends it in either CW or speech.

- Entering one of these commands causes the controller to send all stored digits in CW or speech. In CW the (\*) character is sent as a fraction bar (/); in speech, the (\*) character is sent as the word “enter”.
- The macro name must be entered using 4 digits.
- If the macro you wish to list has a shorter name, enter leading zeros.

### Command Form:

Command	Form
List Macro in CW	(PW) 33 (macro name) *
List Macro in Speech	(PW) 35 (macro name) *

**Acknowledgment:** Sends the contents of the macro in CW or speech.

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? not found	macro name does not exist in the directory

**Default Condition:** None.

### Example:

Assume that a macro exists with the name 6A. It contains two commands as discussed in the *Create New Macro* and *Append To Macro* commands (see pages 6-5 and 6-7). To make the example clearer, assume that the password is 99.

When the commands were originally placed into the macro, they looked like this:

```
(PW) 70 1 * and 10 663 6000 *
```

To examine this macro in CW, we would enter:

```
(PW) 33 006A *
```

The controller would then send:

```
9 9 7 0 1 / 1 0 6 6 3 6 0 0 0 /
```

To examine this macro in speech, we would enter:

(PW) 35 006A \*

The controller would then speak:

“Nine nine seven zero one enter one zero six six three six zero zero zero enter”

---



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## Erase Macro

Erases an existing macro.

- The macro name must be entered as 4 digits.
  - If the name of the macro you are erasing has a shorter name, enter leading zeroes.
  - If you wish to erase all macros, see the *Erase All Macros* command on page 6-11.
- 
- 

### Command Form:

Command	Form
Erase Macro	(PW) 21 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	macro name does not exist in the directory

**Default:** None

### Examples:

Assume that a macro exists under the macro name 6A, and that it contains several commands. To erase this macro, enter:

```
(PW) 21 006A *
```

After the above command is entered, macro 6A will no longer exist. The storage area used by this macro will be released, and another macro can be created to take its place. Macro name 6A, since it is now erased from the directory, can be used as the name of a new macro.

---

---

## Erase All Macros

Erases all existing macros. **••• USE WITH CARE •••**

- If accidentally entered all macros will be lost.
  - The zeroes in the command must be entered as a precaution to avoid accidents.
  - If you wish to erase one or more selected macros, see the *Erase Macro* command on page 6-10.
- 
- 

### Command Form:

Command	Form
Erase All Macros	(PW) 22 00 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	zeroes were not entered

**Default:** None

## Rename Macro

Changes the name of an existing macro.

- The digits (contents) stored under the macro's name are not affected.
- The macro names (old and new) must be entered using 4 digits.
- If either (or both) is shorter than 4 digits, enter leading zeroes.

### Command Form:

Command	Form
Rename Macro	(PW) 27 (old name, new name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? not found	old name does not exist in the directory
? name used	new name already exists in the directory

**Default:** None

### Examples:

Assume that a macro exists under the name 6A, and that we wish to change its name to 1000. Enter the following command:

```
(PW) 27 006A 1000 *
```

**Note:** A macro name of 1000 would cause a conflict if the autopatch password were left at its default value of 10. Be sure to select your macro names and passwords carefully.

Assume that we now wish to change its name to 789. Enter the following command:

```
(PW) 27 1000 0789 *
```

Finally, let's change its name once more to simply D. Enter the following command:

```
(PW) 27 0789 000D *
```

Here is a wrap-up of what we have done.

- Before its name was changed, the macro was executed by entering 6A.
- After the first name change, it was executed by entering 1000\*.
- After the second name change, it was executed by entering 789\* .
- After the third name change, it was executed by entering D.

You can see that a macro can have a short or long name, and its name can be made up of numerals or letters (A, B, C, or D).

---



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## Pause

Causes the controller to stop the execution of the commands that follow for the programmed amount of time.

- This results in a delay occurring between commands.
- Enter 3 digits corresponding to the number of seconds of pause desired.

---



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### Command Form:

Command	Form	Data Digit
Pause	(PW) 98 xxx *	(001–255) = (1–255) seconds

**Acknowledgment:** None

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No Pause

### Examples:

To delay command execution 2 seconds, enter:

(PW) 98 2 \*

To delay command execution 10 seconds, enter:

(PW) 98 10 \*

---

**Note:** Very long delays are not recommended, as the controller will not store commands which are input via DTMF during this time. However, macro execution will not be affected, and *Pause* commands may be stored as desired in strings of macros.

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## Select Power ON-Triggered Macro

Assigns a macro to be executed when the controller goes through a warm startup.

- Enter a 4-digit macro name, using leading zeros if the macro is less than 4 digits long.
- To delete the assignment, enter no macro name.

---



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### Command Form:

Command	Form
Select Power ON-Triggered Macro	(PW) 26 00 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default:** None

### Examples:

This command is useful for initializing hardware at the repeater site following a power interruption. A macro can be created that momentarily switches ON one of the logic outputs; this macro is then triggered by a restart. By the way, this command has no effect after a cold start since all macros are deleted anyway.

As an example of how this command may be used, assume that macro 3456\* has been created. This command changes the CW frequency to a high pitch. To trigger this macro from a restart enter:

```
(PW) 26 00 3456 *
```

If power at the repeater site should fail and return later, the controller will notify you since the CW pitch is now higher. You may enter a macro or a control command that changes the CW pitch back to normal, awaiting the next power *glitch*.

---

## *Chapter 7*

# Telephone Interface Functions

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This section of the manual describes the autopatch, phone line control mode, and reverse patch features of your controller. We use the term *Autopatch* to describe a telephone call originated by the repeater user. *Reverse Patch* calls are originated by a telephone user.

---

# Autopatch

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Your controller has many features that allow you to customize the operation of the autopatch. The following discussion is simply an overview of autopatch operation. Details begin on page 7-3.

## Accessing the Autopatch

The Autopatch can be accessed in several ways:

- You can manually enter the required DTMF digits via your radio's DTMF keyboard. You can program the controller to require an Autopatch Access Password ahead of the telephone number, or you can program the controller to require only the telephone number.
- You can manually enter a macro name via your radio's DTMF keyboard. This previously-programmed macro would contain an autopatch access password and telephone number as described above. The macro feature requires far fewer digits to be entered to dial the autopatch, but requires you store the numbers you wish to dial into macros before you can use the macros.
- You can program the *COR Pulse-Triggered Macro* feature to execute one of the macros mentioned above. (See page 16-4.) Then, a user would only need to key his/her microphone PTT button several times to access the autopatch and dial an emergency number. Only one number can be dialed this way. Likewise, any of the *Event-Triggered Macros* can be used to dial the autopatch by creating an "autodial" type of macro, then loading that macro name into the proper event command.

## Store-and-Forward Operation.

The autopatch dialer software uses *Store-and-Forward* Operation. This means that the controller takes no action until the entire telephone number has been entered. It then checks the number to see if it is acceptable. If acceptable, the number is dialed using pulse (rotary) format or regenerated DTMF format. This method is far superior to the older *star (\*) up* patch, in which phone line access is granted with just a DTMF (\*).

The advantages of store-and-forward operation are:

- There is never a prolonged dial tone that results from a user entering the (\*), then not placing the call.
- Since the controller regenerates all DTMF digits going to the telephone line, noisy or inaccurate tones from the receiver cannot cause misdials.
- The controller is never stuck in a mode where it must wait for a specific command type to be entered before it can continue operation.
- In the store-and-forward scheme, every access command is completely self-contained. Therefore, any other command can be entered before and

after an *Access Autopatch* command. (The *Access Autopatch* commands begin on page 7-28.)

- Other commands you might want to use during an autopatch include: *Dump Autopatch Using a Code* (page 7-15), *Redial Last Number* (page 7-44), *Reset Autopatch Timeout Timer* (page 7-26), or even access the patch to place a new call (entering a new call while already in an autopatch will cause the original call to be dumped and a new call to be dialed).

## Dumping the Autopatch

The autopatch can be dumped in three ways:

- You can enter the *Dump Autopatch Using a Code* command on page 7-15. This is not recommended, since the control code contains a programming password which should be kept secure.
- You can enter a macro name. This previously-programmed macro would contain the autopatch dump control code. This is the recommended method.
- You can enter the (#) digit. This method works if you wish to have a simple, one-character dump code which has little security. The *Enable/Disable Pound (# Dump)* command is switchable ON or OFF (See page 7-12).

## Autopatch Setup and Configuration

### Autopatch Dialer

The *Autopatch Dialer* software looks for the lettered characters *B*, *C*, and *D* in a phone number. The purposes of these three characters is as follows:

- B = pause in dialing (see page 7-11).
- C = dial the digits that follow in pulse (rotary) mode.
- D = dial the digits that follow in DTMF mode.

You will need a 16-button DTMF keyboard to enter these characters. (If you program a phone number with the B, C, and D characters into a macro, and if this macro name does not have any lettered characters, then a standard 12-button keyboard can be used to enter the macro name.)

As you can see, the lettered characters are useful in instructing the controller how to dial a special number. The lettered characters themselves are not dialed. The call screening process—*Autopatch Call Types Table* (page 7-35), *Accepted Number Table* (page 7-38), and *Rejected Number Table* (page 7-38)—ignores the lettered characters. You may freely place Bs, Cs and Ds in a phone number and still have the number accurately screened for restrictions. When a telephone number contains both rotary and DTMF dialing modes, it requires that the *Enable/Disable Autopatch Dialing Mixed-Mode* command be enabled. (See page 7-10.)

The lettered characters have only a temporary effect. Once the phone number is dialed, the dialer will assume the next call will be dialed using the Standard Mode. (By the way, the *Select Autopatch Dialing Mode* command (on page 7-6) is used to select the standard mode.)

## Examples

Let's use some examples to illustrate this feature. Assume the standard mode of dialing is rotary. Assume you must dial a local 7-digit number such as 987-6543, pause for a second dial tone, then dial another number in DTMF, such as 234 567 890. Enter your telephone number like this:

987 6543 B D 234 567 890

You will have to make an entry into the *Accepted Number Table* (page 7-38) so that the controller will allow this 16-digit number. You can allow "9876543234567890" or you can allow sixteen "A"s (which would allow any 16-digit number to be dialed). In the above example, the controller would dial 9876543 in rotary (pulse) format, pause 5-seconds, then dial 234567890 in DTMF.

## Autopatch Conversation Control

During a standard half-duplex autopatch, the mobile operator always has control of the conversation. When the mobile is transmitting, audio from the receiver is fed to the phone line. Audio from the phone line is not allowed to feed the transmitter. If *Enable/Disable Autopatch Privacy* is turned OFF (disabled), the mobile audio is allowed to repeat. If *Enable/Disable Autopatch Privacy* is turned ON (enabled), the mobile audio is not allowed to repeat. (See page 7-18 for discussion of this command.)

When the mobile is listening, audio from the receiver is not allowed to feed the phone line. Audio from the phone line is fed to the transmitter.

With this scheme, the mobile operator can cut off the telephone party by simply pushing the PTT button.

During a full-duplex autopatch, audio feeds both ways for the duration of the conversation. Operators do not have the ability to cut off the telephone party with PTT, but must control the call with only the *Dump Autopatch Using a Code* command on page 7-15.

## Autopatch Dialing Mode

The autopatch is capable of dialing the telephone number in three ways:

- Ten pulses per second (PPS), rotary.
- Twenty pulses per second (PPS), rotary.
- DTMF (Touch Tone™).

Ten PPS is the standard method. Twenty PPS works with some exchanges. Use Touch Tone if you have the service in your area and have a Touch Tone line at the repeater site.

---



---

## Select Autopatch Dialing Mode

Programs the type of autopatch dialing.

- Enter one digit representing the dialing mode from the table below.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Autopatch Dialing Mode	(PW) 61 x *	1 = 10 PPS 2 = 20 PPS 3 = DTMF
Data Digit	Explanation	
1	10 pulses per second, rotary dialing	
2	20 pulses per second, rotary dialing	
3	DTMF (Touch Tone™) dialing (5 digits per second)	

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Autopatch Dialing Mode is 10 PPS rotary

### Examples:

To change the dialing mode to 20 pulses per second, enter the following:

(PW) 61 2 \*

To change the dialing mode to DTMF (Touch Tone™), enter the following:

(PW) 61 3 \*

---

---

## Select (Review) Autopatch Dialing Message

This message is sent over the repeater transmitter when the controller starts to dial the autopatch telephone number.

- Lets a user know the autopatch command was entered correctly. Otherwise, a delay before ringing (especially when rotary dialing) may convince the user that a call was rejected.
- 
- 

### Command Form:

Command	Form
Select Autopatch Dialing Message	(PW) 31 40 (message) *
Review Autopatch Dialing Message	(PW) 34 40 (message) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Sends AS (wait) in CW

## Select (Review) Autopatch Error Messages

One of these messages is sent over the repeater transmitter when a telephone number cannot be dialed.

- The *Off Message* is sent when the Autopatch is off.
- The *Busy Message* is sent when the *Busy Logic Input* is active.
- The *Reject Message* is sent when the phone number entered by the user or programmed in a macro matches an entry in the Reject Table.
- The *Error Message* is sent when a phone number entered by the user or programmed in a macro does not match one of the enabled Call Types or Accept Table entries.
- The *No-Redial-Number Message* is sent when a redial command has been entered and there is no phone number in the redial buffer.
- If an autopatch message is not programmed, the default CW message will be sent only when *Command Responses* are enabled.

### Command Form:

Command	Form	Default
Select Autopatch Off Message	(PW) 31 44 (message) *	OFF in CW
Select Autopatch Busy Message	(PW) 31 42 (message) *	BZ in CW
Select Autopatch Reject Message	(PW) 31 46 (message) *	?REJ in CW
Select Autopatch Error Message	(PW) 31 45 (message) *	?ERR in CW
Select Autopatch No-Redial-Number Message	(PW) 31 47 (message) *	CLR in CW
Review Autopatch Off Message	(PW) 34 44 *	none
Review Autopatch Busy Message	(PW) 34 42 *	none
Review Autopatch Reject Message	(PW) 34 46 *	none
Review Autopatch Error Message	(PW) 34 45 *	none
Review Autopatch No-Redial-Number Message	(PW) 34 47 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The default CW message is sent only if *Command Responses* are enabled.

## Select (Review) Autopatch Dump Message

This message is sent over the repeater transmitter when an autopatch or reverse patch is terminated.

- Lets the user know that an autopatch or reverse patch was successfully terminated.
- This message is not sent when *Phone Line Control Mode* call is terminated.

### Command Form:

Command	Form	Default
Select Autopatch Dump Message	(PW) 31 43 (message) *	none
Review Autopatch Dump Message	(PW) 34 43 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No message.

### Example:

To program the dump message to say “Call complete at (time) on (day) (date)”, e.g. “Call complete at 12:23 PM on Monday July 21st”, enter the following:

```
(PW) 31 43 9960 0067 0088 0039 9820
      9821 0358 9826 9829 9828 *
```

---



---

## Enable/Disable Autopatch Dialing Mixed-Mode

Controls whether mixed-mode dialing is allowed on the autopatch.

- *Mixed-Mode* dialing means both rotary and DTMF dialing are allowed.
  - The dialer will dial only in the way allowed by the Select Autopatch Dialing Mode command on page 7-6.
  - If mixed-mode dialing is turned OFF (disabled), the controller will ignore any *C* and *D* characters in the phone number. (*C* means dial in rotary, *D* means dial in DTMF.)
  - If mixed-mode dialing is turned ON (enabled), the dialer will switch back and forth between rotary and DTMF dialing, according to *C* and *D* characters found in the telephone number.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Autopatch Dialing Mixed-Mode	(PW) 63 04 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** *Autopatch Dialing Mixed-Mode* Is OFF (disabled)

## Select Pause (“B”) Digit Time

Programs the amount the Pause Digit in a phone number delays.

- When the user dials a telephone number or a macro is programmed to dial a telephone number, a pause digit (the DTMF character “B”) provides a programmable delay (see page 7-3 for use).
- Enter 1, 2, or 3 digits representing the desired time of the pause in tenths of seconds.
- The range of the time is 0.1 second to 10.0 seconds.

**Command Form:**

Command	Form	Data Digit
Select Pause (“B”) Digit Time	(PW) 49 96 xxx *	(001-100 in sst – seconds and tenths) = (00.1-10.0) seconds

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** 5 seconds.

**Example:**

To set the pause digit to 2 seconds, enter the following:

```
(PW) 49 96 20 *
```

**Note:** See Page 7-3, for instructions on using the pause digit when dialing.

---



---

## Enable/Disable Pound Down (# Dump)

Allows the autopatch to be terminated with either the pound (#) key or the longer control command.

- Some users want the ability to dump (hang up) the autopatch by entering only the (#) key.
  - When turned ON (enabled), the autopatch can be dumped with either the (#) key or the longer control command.
  - When turned OFF (disabled), the autopatch must be dumped with the control command (or a macro containing the control command).
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Pound Down (# Dump)	(PW) 63 05 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** *Pound Down* is OFF (disabled)

---

**Note:** The (#) key still retains its other meaning (clear the command buffer) whether or not the pound down feature is enabled. That is, if the (#) key is pressed when a partial command is in the buffer, the controller will only clear the command buffer. If there is an autopatch or reverse patch in progress at that time, it will not be dumped. However, if there are no characters in the command buffer when the (#) key is pressed, the autopatch or reverse patch in progress will be dumped.

Since the (#) key needs to be pressed for only a short time, it is easy for troublemakers to dump a call in progress. This is the reason for allowing the pound-down feature to be enabled and disabled.)

---

---



---

## Select Dialing Prefix

Defines a dialing sequence that will precede any outgoing call.

- A dialing prefix is automatically dialed by the autopatch when an outgoing call is made.
- The prefix can contain up to 16 codes that represent DTMF/rotary digits, pauses, or commands to switch from DTMF to rotary dialing and back.
- The prefix is not dialed when the *Go Off-Hook* command is entered.
- Delete the dialing prefix by entering the command with no prefix codes.

---



---

### Command Form:

Command	Form	Data Digits
Select Dialing Prefix	(PW) 83 10 (prefix) *	see table below
Delete Dialing Prefix	(PW) 83 10 *	none

### Acknowledgment: Sends OK

Code	Function	Code	Function
00	DTMF or rotary digit 0	11	DTMF digit B
01	DTMF or rotary digit 1	12	DTMF digit C
02	DTMF or rotary digit 2	13	DTMF digit D
03	DTMF or rotary digit 3	14	DTMF digit *
04	DTMF or rotary digit 4	15	DTMF digit #
05	DTMF or rotary digit 5	16	1-second pause
06	DTMF or rotary digit 6	17	2-second pause
07	DTMF or rotary digit 7	18	5-second pause
08	DTMF or rotary digit 8	19	10-second pause
09	DTMF or rotary digit 9	20	dial the following digits in rotary mode
10	DTMF digit A	21	dial the following digits in DTMF mode

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No dialing prefix is defined.

**Example 1:**

If you have your autopatch plugged into an extension on a PBX and need to dial 9 to get an outside line, enter the following:

```
(PW) 83 10 09 16 *          ; dial 9, 1-second pause
```

**Example 2:**

If you want outgoing calls from your autopatch to block your phone number from a Caller ID display unit, enter the following:

```
(PW) 83 10 14 06 07 16 * ; dial *67, 1-second pause
```

**Example 3:**

If you want to set up your autopatch to dial an outside line on a PBX by default, but still want to be able to dial other extensions on the PBX, you can set the default prefix in your *Autopatch Dump-Triggered Macro* (see page 7-16) by entering:

```
(PW) 83 10 09 16 *          ; dial 9, 1-second pause
```

This way your default *Dialing Prefix* is always reset after every call.

Then, create a macro that you dial before making a call to an extension on the PBX. Create a macro by entering:

```
(PW) 20 0001 (PW) 83 10 *    ; clear prefix
```

To make a call to an extension, enter:

```
1 * (APW) (extension number) *
```

For this example, assume your *Autopatch Password* is 10 and you are dialing an extension of 123, then you would enter:

```
1 * 10 123 *
```

When you dump the call, the *Autopatch Dump-Triggered Macro* will reset the *Dialing Prefix* to the default.

---

---

## Dump Autopatch Using a Code

Terminates (hangs up) either an autopatch or a reverse patch call.

- Since you will not want to divulge the password system to the autopatch users, we suggest that this command be placed into the macro of your choice. The macro would be used to dump all calls.

---

---

### Command Form:

Command	Form
Dump Autopatch Using a Code	(PW) 83 *

**Acknowledgment:** None

**Errors:** None

**Default Condition:** None

---

**Note:** The controller also supports *pound down* dumping, described in the *Enable/Disable Pound Down (# Dump)* command section on page 7-12.

---

---



---

## Select Autopatch Access- and Dump-Triggered Macro

Assigns macros to be executed upon accessing or dumping the autopatch.

- Enter the 4 digit macro name, using leading zeroes if the macro name is less than 4 digits.
  - To delete the assignment, enter the command with no macro name specified.
  - Also see the *Select Autopatch Receiver-Specific Access-Triggered Macros* on page 7-67.
- 
- 

### Command Form:

Command	Form
Select Autopatch Access-Triggered Macro	(PW) 26 12 (macro name) *
Select Autopatch Dump-Triggered Macro	(PW) 26 13 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No Macros Exist

---

**Note:** The *Autopatch Dump-Triggered Macro* will be executed if the autopatch “times out.” If a series of calls are made without dumping the autopatch between calls, the autopatch dump-triggered macro will be executed at the end of the last call.

---

### Examples:

These commands make the autopatch much more flexible. For example, a tape recorder can be turned ON and OFF by connecting it to a logic output. It could then be either activated or de-activated by the autopatch access-triggered and dump-triggered macros. The tape recorder can be located at a remote site connected to a CTCSS decoder and receiver on the repeater’s output frequency. The autopatch access-triggered and dump-triggered macros can turn the controller’s CTCSS Encoder ON and OFF—and change its frequency.

## Enable/Disable Full-Duplex Mode

Places the autopatch in or out of full-duplex mode.

Full-Duplex operation means that audio is gated both ways at the same time, allowing the mobile to talk and listen simultaneously (assuming the mobile is equipped with full-duplex RF gear). A disadvantage of full-duplex operation is that the mobile cannot simply press the PTT button to quiet the voice of the phoned party.

Normal operation of the autopatch is Half-Duplex, meaning that audio is gated from the phone line to the transmitter when the mobile is listening, and gated from the receiver to the phone line when the mobile is talking.

- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- *Full-Duplex Mode* will automatically be disabled when the call is dumped.

### Command Form:

Command	Form	Data Digit
Enable/Disable Full-Duplex Mode	(PW) 63 07 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** *Full-Duplex Mode* is OFF (disabled)

---



---

## Enable/Disable Autopatch Privacy

Turns the Autopatch Privacy feature ON or OFF.

- When ON (enabled), the audio from the repeater receiver is not transmitted (repeated) during an autopatch.
  - When OFF (disabled), the audio is transmitted (repeated) similarly to the normal operation of the repeater.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Autopatch Privacy	(PW) 63 06 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** *Autopatch Privacy* is OFF (disabled)

### Examples:

This feature is temporary and remains in effect for the duration of only one autopatch call. At the end of the call it is automatically turned OFF. This command can be placed in a macro with the *Access Autopatch* commands (beginning on page 7-28), thus making that macro a “privacy speed dial.”

It is important for control operators to ensure that amateur autopatches do not involve business calls. This should be considered when allowing the use of the *Enable/Disable Autopatch Privacy*, as the content of the conversation is not easily determined by control operators.

---



---

## Enable/Disable Repeater-to-Phone DTMF Mute

Allows—or disallows—DTMF digits feeding the phone line from the repeater.

This command does not affect the dialing of telephone numbers, since this feature is in effect after the dialing is finished. The purpose of the command is to prevent troublemakers from dialing a second phone number after a called party hangs up. (Some exchanges return a “second dial tone” under those conditions.)

- DTMF digits are detected and muted from the phone line when this feature is ON (enabled).
  - This feature would have to be turned OFF (disabled), however, when a mobile station wishes to call a number and remotely control a device via DTMF digits.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Repeater-to-Phone DTMF Mute	(PW) 63 08 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default:** *Repeater-to-Phone DTMF Mute* if OFF (disabled).

---

---

## Enable/Disable ID Messages During Autopatch

Allows the Identifier to operate during an autopatch and reverse patch.

- Enter this command to allow the identifier to operate during an autopatch.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
  - By default, the identifier is disabled during an autopatch.
  - This command has no effect if executed during an autopatch. This command will take effect on the next autopatch.
- 
- 

### Command Form:

Command	Form	Data Digits
Enable/Disable ID During Autopatch	(PW) 63 09 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Disabled.

### Example:

To enable the identifier during a patch, enter the following:

(PW) 63 09 1 \*

To disable the identifier during a patch, enter the following:

(PW) 63 09 0 \*

## Require Dump Before Next Call

Requires that a phone call in progress be dumped before another call can be made.

- Enter this command to prevent another call from being made before the current call is dumped by the user or timeout timer.
- By default, another call can be made while one is in progress. The current call will automatically be dumped.
- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- This inhibits a user from dumping the patch with any command except the patch dump command.

### Command Form:

Command	Form	Data Digits
Require Dump Before Next Call	(PW) 63 10 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Disabled, dump is not require before a new call.

### Example:

To require that a current call is dumped before another call is made, enter the following:

(PW) 63 10 1 \*

To allow another call to be made while a call is in progress, enter the following:

(PW) 63 10 0 \*

---

---

## Select Receiver-to-Autopatch-Triggered Macros

Allows the programmer to execute macros based on receiver-to-autopatch activity.

- Macros can be executed based on receiver-to-autopatch activity.
  - Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
  - If the macro name has fewer than 4 digits, enter leading zeros.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Assign Macro to Any-Receiver-Active to Autopatch	(PW) 26 06 (macro name) *
Assign Macro to All-Receivers-Inactive to Autopatch	(PW) 26 07 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.

---



---

## Landline Hookflash

Causes a Hookflash to occur on the phone line.

- A hookflash (also called a flash) is an indication to a phone system to perform an action, for example to pick up another call that is waiting or to conference another party during an outgoing call.
  - Enter this command to cause a hookflash.
  - This command has no effect when no autopatch or reverse patch has been made.
- 
- 

### Command Form:

Command	Form
Landline Hookflash	(PW) 83 1 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None

### Example:

Cause a hookflash on the phone line during an autopatch:

(PW) 83 1 \*

---

**Note:** This command will have either no effect or will disconnect your call if your phone line is not equipped to respond to a hookflash.

---

## Autopatch Timeout Timer

The *Autopatch Timeout Timer* controls the duration of the call. If the call exceeds the time limit, it will be terminated by the controller.

When the time is within 30 seconds of “timing out,” the autopatch timeout timer will start sending short Autopatch Timeout Warning Messages in CW. These messages are sent every 5 seconds, and are programmable. A user may extend the duration of his/her call by entering the *Reset Autopatch Timeout Timer* command on page 7-26.

If the repeater owner does not want to make the *Reset Autopatch Timeout Timer* command available to users, he/she should simply not create a macro containing it. The command will remain a control command, protected by its password.

## Select Autopatch Timeout Timer

Programs the maximum duration of an autopatch call.

- After the root number, enter 1, 2, or 3 digits representing the desired time in tenths of minutes.
- The range of the timer is 0.1 minutes to 54.6 minutes. For example, 1 = 0.1 minutes (6 seconds); 30 = 3.0 minutes; 546 = 54.6 minutes.
- Leading zeroes are not required, so entering 030 for 3.0 minutes is the same as entering 30.
- Enter 000 for infinity (timer disabled).

### Command Form:

Command	Form	Data Digit
Select Autopatch Timeout Timer	(PW) 65 xxx *	000 = infinity (001–546) = (0.1–54.6) minutes

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit, or out of limit

**Default Condition:** *Autopatch Timeout Timer* is 3.0 minutes

### Examples:

To set the timeout timer to 4.5 minutes, enter:

(PW) 65 45 \*

To set the timeout timer to infinity, enter:

(PW) 65 000 \*

To set the timer to 54.6 minutes (the maximum allowed without disabling the autopatch timeout timer), enter

(PW) 65 546 \*

---

---

## Reset Autopatch Timeout Timer

Resets the Autopatch Timeout Timer.

- Allows call to proceed for another period of time as set by the *Select Autopatch Timeout Timer* command on page 7-25.
- 
- 

### Command Form:

Command	Form
Reset Autopatch Timeout Timer	(PW) 81 *

**Acknowledgment:** None

**Errors:** None

**Default Condition:** None

---



---

## Select (Review) Autopatch Timeout Warning Message

Programs (and reviews) the message that is sent during the last 30 seconds—before timeout—of the autopatch call.

- The Autopatch Timeout Warning Message is sent by the controller every 5 seconds for the last 30 seconds of an autopatch call.
  - If the mobile station unkeys for a few seconds during the last 30 seconds of the timer, the operator will recognize that the call is about to be terminated.
  - Maximum message length is 25 characters.
- 
- 

### Command Form:

Command	Form
Select Autopatch Timeout Warning Message	(PW) 31 41 (message) *
Review Autopatch Timeout Warning Message	(PW) 34 41 *

**Acknowledgment:** Sends the *Autopatch Timeout Warning Message* (or OK, if none)

### Errors:

Error	Meaning
? err 1	too many digits entered
? err 2	illegal CW Character entered

**Default Condition:** *Autopatch Timeout Warning Message* is AR in CW

### Examples:

We suggest the autopatch timeout warning messages be noticeable enough that the mobile takes immediate action to either terminate the call or reset the autopatch timer. A sequence of beeps or DTMF digits might be a good attention-getting message in this application.

## Autopatch Access and Passwords

If security of the autopatch is important, you can require users to enter an *Autopatch Access Password* immediately before the phone number to be dialed.

If security is not a concern, the autopatch can be accessed by simply entering the phone number itself. The pages which follow list the commands involved in choosing the access you want.

For special applications, you can just pickup the phone the way you would at home (see page 7-34).

---



---

## Access Autopatch (With Password)

Accesses the autopatch using the password method.

- Enter the *Autopatch Access Password*, followed by the telephone number, and the star (\*), if required. All digits are entered in a continuous string.
  - Entering only the autopatch access password will not result in a dial tone.
  - The autopatch access password may be any 2,4 or 6 digits.
  - The phone number may be up to 35 digits in length, and may contain special command digits (A, B, C, D).
  - See the *Change Autopatch Access Password* on page 7-32 if you wish to change the password.
- 
- 

### Command Form:

Command	Form
Access Autopatch (With Password)	(autopatch access password) (phone number) *

**Acknowledgment:** Sends the *Autopatch Dialing Message*

### Errors:

Error	Meaning
OFF	autopatch is OFF (disabled)
? REJ	rejected (number in Rejected Number Table)
? ERR	rejected (number not allowed by AP Call Type)
BZ	phone line is busy (Model 7K controller only)

**Default Condition:** *Autopatch Access Password* is set to 10.

### Examples:

Assume that the autopatch access password is 10, and that the number you wish to dial is 456-7890. To access the autopatch, enter:

10 4567890

When the above number is entered the controller will screen the telephone number. (See the *Autopatch Call Types* and *Autopatch Restrictions* sections on page 7-35 and 7-38 respectively.) If the number is acceptable, the controller will send the autopatch dialing message and dial the number. If the number is not acceptable, the controller will send one of the error messages listed above.

---



---

## Access Autopatch (Without Password)

Accesses the autopatch without using the password method.

- Enter the telephone number, and the star (\*), if required. All digits are entered in a continuous string.
  - The phone number may be up to 35 digits in length, and may contain special command digits (A, B, C, D).
  - See the *Enable/Disable Autopatch Access Without Password* command on page 7-33.
- 
- 

### Command Form:

Command	Form
Access Autopatch (Without Password)	(phone number) *

**Acknowledgment:** Sends the *Autopatch Dialing Message*

### Errors:

Error	Meaning
OFF	autopatch is full OFF (disabled)
? REJ	rejected (number in Rejected Number Table)
? ERR	rejected (number not allowed by AP Call Type)
BZ	phone line is busy (Model 7K controller only)

**Default Condition:** *Access Autopatch (Without Password)* is OFF (disabled)

### Examples:

Assume that a number you wish to call is 456-7890. Enter the following:

4567890 \*

When the above command is entered, the controller will screen the telephone number 456-7890 according to the following tables you may have programmed:

- *Autopatch Call Types Table* (page 7-35).
- *Accepted Number Table* (page 7-38).
- *Rejected Number Table* (page 7-38).

and dial the number.

If the number is not acceptable, the controller will send one of the error messages cited above.

**Note:** The controller will examine the command *after* it has searched the Macro Name Table. If a macro named “911” is found, it will be executed. If there is no macro named “911,” the autopatch will dial 911 (if enabled).

The controller has no problem with telephone numbers that begin with the same digits as macros if their lengths are different. In other words, the controller will properly execute a macro named “6636,” and it will properly dial “663-6000,” even though the first four digits are the same.

Remember, commands are not executed until the terminator is received. Therefore, “6636” and “6636000” are entirely different commands to the controller.

(By the way, the *Macro Name Table* exists only in the controller’s memory. As such, it does not appear in print anywhere in this manual.)

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## Change Autopatch Access Password

Replaces the old Autopatch Access Password with a new one.

- The password referred to in this command is the *Autopatch Access Password*. It is different from both the *Master* and *Control Operator Passwords*. It is only used to access the autopatch and not to modify control functions.
  - New autopatch access password is a 2, 4 or 6 digit number of any combination of 0–9 and A–D.
- 
- 

### Command Form:

Command	Form
Change Autopatch Access Password	(PW) 23 (new Autopatch Access Password) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** *Autopatch Access Password* is set to 10.

### Examples:

Assume that the autopatch access password is 10, and that you wish it changed to A5. Enter the following command:

```
(PW) 23 A5 *
```

---

**Note:** This will prevent users without 16-button DTMF pads from accessing the autopatch.

---

Now assume that the autopatch access password is to be changed again, this time to 6146. Enter the following command:

```
(PW) 23 6146 *
```

---



---

## Enable/Disable Autopatch Access Without Password

Allows the autopatch to be accessed without using the Autopatch Access Password.

- The autopatch can be accessed in two ways—with—or without an autopatch access password.
  - To access the autopatch *without* using the autopatch access password, this command must be ON (enabled).
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Autopatch Access Without Password	(PW) 63 11 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Defaults to OFF (cold start); Retained (warm start)

### Examples:

Assume that the *Enable/Disable Autopatch Access Without Password* feature is OFF (disabled), and you wish to turn it ON (enabled). Enter the following:

```
(PW) 63 11 1 *
```

If you wish to turn the feature OFF, enter the following:

```
(PW) 63 11 0 *
```

---

---

## Go Off-Hook

Causes the phone line to go off-hook.

- Enter this command to cause the phone line to go off-hook without dialing a phone number. This is like picking up a phone and getting dial tone.
  - A second version of the command ignores the *Busy Logic Input*. This is like picking up an extension telephone while the telephone line is already in use.
  - This command has no effect if an autopatch or reverse patch is in progress.
- 
- 

### Command Form:

Command	Form
Go Off-Hook	(PW) 83 2 *
Go Off-Hook, Ignore Busy Logic Input	(PW) 83 3 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None

### Example:

To go off-hook on the patch, enter the following:

(PW) 83 2 \*

To go off-hook on the patch even if the *Busy Logic Input* signals that the line is busy, enter the following:

(PW) 83 3 \*

## Autopatch Call Types

There are eight categories of telephone numbers recognized by the controller. They are *Autopatch Call Types*. The *Select Autopatch Call Types* command (on page 7-36) allows you to program the types of telephone calls that can be made through the autopatch.

<b>Autopatch Call Types</b>	
<b>Numbers</b>	<b>Call Types</b>
0	operator
xxx-xxxx	7-digit local call
xxx-xxx-xxxx	10-digit local call
0-xxx-xxxx	operator-assisted 7-digit call
1-xxx-xxxx	7-digit long distance call
0-xxx-xxx-xxxx	operator assisted 10-digit call
1-xxx-xxx-xxxx	10-digit call long distance call
1-800-xxx-xxxx/1-888-xxx-xxxx	toll free call

The controller may be programmed to allow any or all of the above autopatch call types. In addition, it may be turned OFF (disabled) completely.

As you can see, this is a somewhat general way of screening calls. It has the advantage of being programmed via a standard 12-button DTMF pad.

To screen call types more closely, see the *Autopatch Restrictions* section on page 7-38. Autopatch restrictions allow screening by the individual digits, shown as "x"s in the table above. A 16-button DTMF pad is required to screen by blocks of numbers.

## Select Autopatch Call Types

Selects the types of calls permitted by the autopatch.

- Entering this command will dump any autopatch call in progress.
- If the call type being selected is different from the one currently selected, the autopatch redialer memory is cleared.
- Enter up to 8 digits from the *Autopatch Call Types Table* below.
- Entering no digits turns off the autopatch.
- Entering any digit from 0-8 will permit accepted numbers.

### Command Form:

Command	Form	Data Digits
Select Autopatch Call Types	(PW) 60 x *	(0-8) Autopatch Call Types Table below

Data Digit	Autopatch Call Types	Explanation
none	no calls permitted	autopatch OFF (disabled)
0	accepted numbers only	accepted numbers only (see page 7-38)
1	0	operator
2	xxx-xxxx	7-digit local call
3	0-xxx-xxxx	7-digit operator-assisted/credit card call
4	1-xxx-xxxx	7-digit long distance call
5	0-xxx-xxx-xxxx	10-digit operator-assisted/credit card call
6	1-xxx-xxx-xxxx	10-digit long distance call
7	1-800-xxx-xxxx 1-888-xxx-xxxx	toll free call
8	xxx-xxx-xxxx	10-digit local call

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Autopatch is OFF (disabled), no calls permitted.

**Examples:**

To turn the autopatch OFF (disabled), enter the following:

(PW) 60 \*

To permit only accepted numbers, operator calls, and 7-digit local calls, enter the following:

(PW) 60 0 1 2 \*

In the above example, the 0 would not have to be entered, since the 1 or 2 already permits accepted numbers. To permit all 9 types of calls, enter the following:

(PW) 60 0 1 2 3 4 5 6 7 8 \*

## Autopatch Restrictions

A feature of the autopatch is the ability to restrict calls to certain groups of telephone numbers. This is done by building two tables in the controller's memory:

- An *Accepted Number Table*.
- A *Rejected Number Table*.

---

**Note:** Since these tables are only resident in memory, neither appear in this manual. Programmers of the repeater may wish to keep a notebook of accepted and rejected numbers.

---

Each time an autopatch call is placed, the telephone number is compared to both tables. A decision is then made to allow—or not allow—the call to go through.

Both the *Accepted* and *Rejected Number Tables* may contain specific telephone numbers, or telephone numbers with “wild card” characters. This feature allows *groups* of accepted or rejected numbers to be compared to the number being dialed.

## Uses of Autopatch Restrictions

There are many uses for autopatch restrictions:

- Certain troublesome numbers can be placed in the *Rejected Number Table* using the command on page 7-42, and will not be dialed by either entering the number via command or via macros.
- Commercial phone numbers could be restricted and “hints” could be made to unpaid members.
- In major cities, it is possible to place a long-distance call to another exchange by dialing a simple 7-digit number. To prevent the repeater phone line from accumulating monthly long-distance charges, simply place the local exchange numbers in the *Accepted Number Table*. Program the *Select Autopatch Call Types* for only accepted numbers. (See page 7-36.)
- In some areas, important numbers (such as police or ambulance) require a long-distance call. Since the owner may not want to open the repeater to all long-distance calls, he may simply program those few important numbers into the *Accepted Number Table*. Other long-distance calls will not be permitted if the *Autopatch Call Types Table* does not include them. (See *Autopatch Call Types* section on page 7-35 and the *Select Autopatch Call Types* command on page 7-36.)
- Since the *Autopatch Call Types Table* does not include all types of calls which might exist, the autopatch restrictions feature may be used again. For example, some areas of the county have 911 emergency service. The

*Select Autopatch Call Types* command does not have a category for three-digit numbers, so 911 may be placed into the *Accepted Number Table* using the command on page 7-40.

---



---

## Clear (or Enter) Accepted Number Table

Clears ALL accepted numbers from the Accepted Number Table—or—enters an accepted number into same.

- The *Accepted Number Table* exists only in the controller's memory. As such, there is no printing of it in this manual.
  - Up to 40 entries are permitted.
  - One phone number up to 18 digits long may be entered in each command.
  - The phone number may be a specific number or it may contain the "A" character as a wild card.
  - To clear the *Accepted Number Table*, enter nothing after the 68 root number.
  - To insert the phone number into the *Accepted Number Table*, enter the phone number after the 68.
- 
- 

### Command Form:

Command	Form
Clear All Accepted Numbers From Table	(PW) 68 *
Enter Accepted Number Into Table	(PW) 68 (phone number) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	too many digits entered (more than 18)
? err 2	illegal character entered (B, C, or D)
? full	table is full

**Default Condition:** Accepted Number Table is empty

### Examples

Two telephone numbers, 911 and 234-5678, are to be accepted numbers. To add them to the *Accepted Number Table*, enter the following:

```
(PW) 68 911 *
```

```
(PW) 68 234 5678 *
```

**Note:** Only the phone number goes into the table, not the autopatch access password plus the phone number. Two commands are needed, since only one phone number may be entered at a time. These numbers will not be permitted if the autopatch is completely OFF (disabled). At least one of the autopatch call types must be selected if accepted numbers are to be permitted.

Now assume that all numbers in are code 414 are to be accepted. To accomplish this enter the following:

```
(PW) 68 1 414 AAA AAAA *
```

The autopatch will now accept 1-(414)-000-0000 through 1-(414)-999-9999.

The "A" in the above example is used as a wild card to specify any number 0–9 is accepted.

---



---

## Clear (or Enter) Rejected Number Table

Clears ALL rejected numbers from the Rejected Number Table—or— enters a rejected number into same.

- The *Rejected Number Table* exists only in the controller's memory. As such, there is no printing of it in this manual.
  - Up to 40 entries are permitted.
  - One phone number up to 18 digits long may be entered in each command.
  - The phone number may be a specific number or it may contain the A character as a wild card.
  - To clear the *Rejected Number Table*, enter nothing after the 67 root number.
  - To insert the phone number into the Rejected Number Table, enter the phone number after the 67.
- 
- 

### Command Form:

Command	Form
Clear All Rejected Numbers From Table	(PW) 67 *
Enter Rejected Number Into Table	(PW) 67 (phone number) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	too many digits entered (more than 18)
? err 2	illegal character entered (B, C, or D)
? full	table is full

**Default Condition:** Rejected Number Table is empty

### Examples:

Two telephone numbers, 345-6789 and 987-6543, are not permitted to be dialed. To place them into the *Rejected Number Table*, enter the following:

```
(PW) 67 345 6789 *
```

```
(PW) 67 987 6543 *
```

**Note:** Only the phone number goes into the table, not the autopatch access password plus the phone number. Two command entries are needed, since only one phone number may be entered at a time.

---

Now assume that all numbers in the 246 exchange are to be rejected. To accomplish this, enter the following:

```
(PW) 67 246 AAAA *
```

The “A” is used as a wild card to specify any number 0–9 is rejected. After this command is entered, the autopatch will reject any call to a 7-digit number with 246 exchange (246-0000) through (246-9999).

## Autopatch Redialer

The *Autopatch Redialer* feature uses the *Redial Last Number* command (on page 7-45) and allows you to redial an autopatch call without entering the entire command over again. This is particularly useful if the number you called was busy, or a no-answer, or if you forgot to mention something to the called party.

The *Redial Last Number* command works up to 30 minutes from the time the last call was placed. If more than 30 minutes have elapsed, the controller will send CLR (dialer cleared). The 30 minute autopatch redialer timer will be reset at each redial attempt.

---

**Note:** It is recommended that users do not use the *Redial Last Number* command if they have not been monitoring the repeater for a while, since another call may have been placed since their call.

---

The *Clear Autopatch Redialer* command (page 7-46) may be used after the autopatch call is made to clear the dialer memory. This ensures that no user can redial the last number, and protects the original caller (and called party) from potential troublemakers.

Dialer memory is also cleared during either a warm or cold start, and when the *Select Autopatch Call Types* command (page 7-36) changes the selected call type.

Macros which have been created for autopatch “express dialing” also leave a number in the dialer memory. Therefore, entering a Redial Last Number command following one of these macros will result in a call to the express dialed party.

An attempt to access the autopatch that is not successful—such as dialing a long-distance number which is rejected—will not clear the autopatch redialer. It also will not affect the autopatch redialer timer.

---

---

## Redial Last Number

Redials the last valid number entered into the autopatch.

- The *Redial Last Number* command works up to 30 minutes from the time the last call was placed.
- If more than 30 minutes have elapsed, the controller will send CLR (dialer cleared) at each redial attempt.
- The 30 minute autopatch redialer timer will be reset at each redial.
- Do not use the *Redial Last Number* command if you have not been monitoring the repeater for a while, since another call may have been placed since your last call.

---

---

**Command Form:**

Command	Form
Redial Last Number	(PW) 84 *

**Acknowledgment:** None

**Errors:** None

**Default Condition:** *Autopatch Redialer* memory is cleared

---

---

## Clear Autopatch Redialer

Clears the Autopatch Redialer memory after an autopatch call.

- After this command is executed, entering the *Redial Last Number* command on page 7-45 causes the controller to send CLR. The number will not be dialed.
- 
- 

### Command Form:

Command	Form
Clear Autopatch Redialer	(PW) 85 *

**Acknowledgment:** None

**Errors:** None

**Default Condition:** *Autopatch Redialer* memory is cleared

## Autopatch Call Counter

The *Autopatch Call Counter* keeps track of the number of autopatch calls attempted. A call is attempted if the controller accepts the phone number as being valid and begins to dial.

- The call counter starts at 000 and increments by one for each call. After reaching 999 calls, the counter will start over at 000.
- The counter may be read in CW by entering the *Send Autopatch Call Count* command on page 7-49. The counter may be cleared (forced to 000) by entering the *Clear Autopatch Call Counter* command on page 7-48.
- The counter value may also be included in a CW or speech message. (See page 4-35.)
- Uses for the call counter include monitoring autopatch activity, and reducing the activity in cases where there are monthly limits on the number of calls allowed.

---

---

## Clear Autopatch Call Counter

Clears the Autopatch Call Counter.

- Enter the command in the form below.
- 
- 

### Command Form:

Command	Form
Clear Autopatch Call Counter	(PW) 69 *

**Acknowledgment:** Sends "CALLS 000" in CW

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** *Autopatch Call Counter* is set to 000.

---



---

## Send Autopatch Call Count

Sends the Autopatch Call Count in CW

- Enter the command in the form below.
  - The *Autopatch Call Count* can also be included in a message and sent in either CW or Speech. (See page 4-35.)
- 
- 

### Command Form:

Command	Form
Send Autopatch Call Count	(PW) 86 *

**Acknowledgment:** Sends "CALLS xxx" in CW

**Errors:** None

**Default Condition:** *Autopatch Call Counter* is set to 000.

### Example:

Assume that fifteen autopatch calls have been made to date. Enter the following command:

(PW) 86 \*

The following CW message will be sent in response:

CALLS 015

---

# Phone Line Control Mode

---

## Phone Line Busy Input

The *Phone Line Busy Input* is used to inform the controller that the phone line is being used by another device, and that it should not access the line. This input is normally held high by a pullup resistor. When this input is pulled down to ground by an external device, it is asserted active.

If a “line relay” is connected to a standard telephone, its contacts can “busy-out” the controller when the telephone is picked up.

The controller will ignore ringing on the phone line when the phone line busy input is active. This feature is necessary, since the controller may be sharing the phone line with a rotary phone. The rotary phone, when dialed, creates interruptions in the phone line voltage which appear as ringing signals to the controller. Such activity could cause the controller to go off-hook.

## Phone Line Busy Output

The controller activates the *Phone Line Busy Output* during autopatches and phone line control sessions to inform other devices at the repeater site that the phone line is in use.

The *Phone Line Busy Output* is an open-drain power MOSFET device and may be used the same way as logic outputs.

If several controllers are sharing the same phone line, connect all of the *Phone Line Busy Inputs* and *Phone Line Busy Outputs* together. The first controller to access the phone line will “busy-out” the remaining controllers.

## Phone Line Answer Modes

*Mode* programs the controller for the way you want it to operate when it receives incoming ringing signals from the phone company. *Mode* is single digit 0 to 4.

### **Mode 0**

This is the Do Not Answer Mode.

### **Mode 1**

After a delay of 00–99 incoming rings, begin ringout for reverse patch at a rate

---

of 1 ringout message for each incoming ring. If answered by a mobile, connect. If unanswered by the ringout limit of 00–99 rings, ignore further incoming ringing.

In Mode 1, the controller does not connect the calling party to the mobile until the mobile answers the call. The calling party hears only the ringback until actually connected to a mobile. Setting the ring-in delay to zero means that the ringout begins on the first incoming ring; a delay of 1 means that the ringout begins after delaying one ring, or at the beginning of the second incoming ring. Setting the ringout limit to zero is the same as putting the controller into Mode 0; it can't ring out with a zero limit, so it will appear to ignore incoming ringing.

### **Mode 2**

After a delay of 00–99 incoming rings, begin ringout for reverse patch at a rate of 1 ringout message for each incoming ring. If answered by a mobile, connect. If unanswered by the ringout limit of 00–99 rings, connect and go into phone line control mode. Commands may be entered for 40 seconds. The line will then disconnect unless the *Select Phone Line Off-Hook Timer* command (on page 7-57) is used to extend the timer.

This mode behaves the same as Mode 1, except that the controller will allow access to the phone line when the ringout limit is reached. While in phone line control mode, another reverse patch command could be entered if desired. Setting the ringout limit to zero is the same as putting the controller in Mode 3; it can't ring out with a zero limit, so it will go into phone line control mode after the delay is finished.

### **Mode 3**

After a delay of 00–99 incoming rings, connect and go into phone line control mode. Commands may be entered for 40 seconds. The phone line will disconnect unless the *Select Phone Line Off-Hook Timer* command (page 7-57) is used to extend the timer.

Setting the ring-in delay to zero means the controller will answer on the first incoming ring; a delay of 1 means the controller will answer after delaying one ring, or on the second ring. The ringout limit serves to set the number of ringouts if the *Trigger Reverse Patch* command (page 7-60) is entered. If the ringout limit is set to zero, the line will disconnect when a *Trigger Reverse Patch* command is entered.

### **Mode 4**

After a delay of 00–99 incoming rings, connect and go into phone line control mode. The controller will look for DTMF digits; if no digits are received in 40 seconds, begin ringout for reverse patch at the rate of one ringout message every 6 seconds. If answered by a mobile, connect. If unanswered by the ringout limit of 00–99 rings, disconnect. If DTMF digits are received in the first 10 seconds, go into phone line control mode. The controller will not ring out for the reverse patch. Commands may be entered for 10 seconds. The phone line will then disconnect unless the *Select Phone Line Off-Hook Timer* command is used to extend the timer.

**Note:** When the phone line is in a phone line control mode, you have 40 seconds to either enter your command(s) or “buy” more time. A short command can easily be entered in the 40 seconds allowed. However, if you have several programming jobs to do, be sure to enter the *Select Phone Line Off-Hook Timer* command (page 7-57) to prevent the controller from hanging up during programming. The Phone line timer can be reloaded at any time. If you ask for a lot of time, be sure to dump the call when you have finished programming. If you simply hang up, the controller will keep the phone off-hook until the timer expires. No autopatch, reverse patch, or control by phone line operations can occur while the phone line timer runs.

---

## Ring-In Delay

*Ring-In Delay* is a two-digit number representing the number of rings the controller ignores before performing operations. One of the benefits of having ring-in delay is that it allows someone to pick up the phone if there is a phone in parallel with the controller. If, for example, a maintenance phone line at a radio or TV transmitter site can be used for repeater control purposes, you want to be sure that the site owner can pick up the phone before the controller goes off-hook. If no one picks up the phone after, say, 8 rings, the controller can assume that the call is for it. Ring-in delay can be programmed from 00 to 99 rings.

## Ringout Limit

*Ringout Limit* is a two-digit number representing the number of times the controller may send the *Reverse Patch Ringout Message* (See the *Reverse Patch* section on page 7-59.) Placing a limit on reverse patch ringout messages prevents the annoyance of too many messages on a busy repeater. The ringout limit can be programmed from 00 to 99 rings. If a control operator is programming the controller, for example, and then triggers the reverse patch by command, the number of ringouts will be set by the ringout limit value previously commanded.

---



---

## Select Phone Line Answer Mode

Selects one of the Phone Line Answer Modes (and associated Ring-In Delay and Ringout Limit).

- Mode 0 is for “do not answer.”
  - Modes 1–4 are fully discussed in the *Phone Line Answer Modes* section on page 7-50.
  - Ring-in delay is 00 to 99 rings.
  - Ringout limit is 00 to 99 rings.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Phone Line Answer Mode (Do Not Answer Only)	(PW) 64 x *	x = 0 (do not answer)
Select Phone Line Answer Mode	(PW) 64 x yy zz *	x = mode 1–4 see page 7-50 y = ring-in delay (00–99) = (00–99) rings z = ringout limit (00–99) = (00–99) rings

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Mode = 3, Ring-In Delay = 2, Ringout Limit = 10

---

---

## Select (Review) Phone Line Answer Message

Allows selection (or review) of the message that the controller sends when it answers the phone line.

- The message is sent to the caller.
- 
- 

### Command Form:

Command	Form
Select Phone Line Answer Message	(PW) 31 50 (message) *
Review Phone Line Answer Message	(PW) 34 50 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Sends 3 Beeps

---



---

## Select Phone Line Answer Macro

Assigns macro to be triggered when the controller answers the phone line (Phone Line Answer Modes 2, 3, and 4).

- Enter the 4-digit macro name desired.
  - Use leading zeros if needed.
  - To delete the *Phone Line Answer Macro*, enter the command with no macro name [i.e., (PW) 26 16 \*].
- 
- 

### Command Form:

Command	Form
Select Phone Line Answer Macro	(PW) 26 16 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	too many digits entered
? err 2	illegal digit entered

**Default Condition:** No macro is assigned to this function

### Example:

If macro 1234 is to be executed when the controller answers the phone line (modes 2, 3, or 4), the command is:

```
(PW) 26 16 1234 *
```

---



---

## Select Control Mode Dump-Triggered Macro

Assigns a macro to be executed upon dumping the patch in Phone Line Control Mode.

- Enter the 4-digit macro name using leading zeroes if the macro name is less than 4 digits.
  - To delete the assignment, enter the command with no macro name.
- 
- 

### Command Form:

Command	Form
Select Control Mode Dump-Triggered Macro	(PW) 26 81 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macro assigned.

---

Note: The *Phone Line Control Mode Dump-Triggered Macro* will be executed if the patch “times out” while in *Phone Line Control Mode*.

---

### Example:

This command makes the patch much more flexible. The dump macro can be used to change messages, logic outputs, or to send a message.

To assign macro 9001 to execute when the patch is dumped from *Phone Line Control Mode*, enter the following:

```
(PW) 26 81 9001 *
```

---



---

## Select Phone Line Off-Hook Timer

Reloads the phone line off-hook timer.

If you will be programming the controller and will need about ten minutes to do the work, you may reload the timer for the required ten minutes. The timer may be reloaded at any time after that, as well. Do not load the timer for very long times unless you need them. If the phone line should become disconnected, the controller will remain off-hook for the duration of the timer.

- After the root number, enter 1, 2, or 3 digits representing the desired time in tenths of minutes.
- The range of the timer is 0.1 minutes to 54.6 minutes. For example, 1 = 0.1 minutes (6 seconds); 30 = 3.0 minutes; 546 = 54.6 minutes.
- Leading zeroes are not required, so entering 030 for 3.0 minutes is the same as entering 30.
- Enter 000 for infinity (timer disabled).
- After the autopatch is dumped, the *Phone Line Off-Hook Timer* is reset to 40 seconds.

---



---

### Command Form:

Command	Form	Data Digit
Select Phone Line Off-Hook Timer	(PW) 79 xxx *	000 = infinity (001–546) = (0.1–54.6) minutes

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** 40 seconds

---



---

## Monitor/Talk Out Via Phone

Allows the control operator to monitor or join the repeater conversation.

- These features are accessible from the phone line when in *Phone Line Control Mode*.
  - Multiple receivers can be selected simultaneously. Audio will be routed by priority. Select the priority using the *Select Audio Routing Priority* command described on page 13-3.
  - Both transmitters can be selected simultaneously. Audio will be routed to both transmitters.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
  - When the autopatch is dumped, all *Monitor/Talk Out* paths are disabled.
- 
- 

### Command Form:

Command	Form	Data Digit
Monitor Receiver #1 (Rx1)	(PW) 63 23 x *	0 = OFF (disabled) 1 = ON (enabled)
Monitor Receiver #2 (Rx2)	(PW) 63 24 x *	0 = OFF (disabled) 1 = ON (enabled)
Monitor Receiver #3 (Rx3)	(PW) 63 25 x *	0 = OFF (disabled) 1 = ON (enabled)
Talk Out Transmitter #1 (Tx1)	(PW) 63 26 x *	0 = OFF (disabled) 1 = ON (enabled)
Talk Out Transmitter #2 (Tx2)	(PW) 63 27 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** All paths are disabled.

### Examples:

The telephone caller (control operator) retains the DTMF decoder when monitoring or talking out. The *Select Phone Line Off-Hook Timer* command controls the length of the session (see page 7-57). You may monitor one or more receivers then enable and disable talk out on one or both transmitters during a conversation on the repeater.

## Reverse Patch

---

The *Reverse Patch* feature allows users to dial a number for the repeater site, and be connected to a repeater user. The reverse patch can be used in two ways. The controller can signal via a CW message that a user has dialed the site, or the controller can wait for a command from the telephone party before signalling via CW.

In the first mode, the telephone party never has access to the DTMF decoder. The only function that a call to the site number possesses is to trigger a reverse patch signal.

In the second mode, the telephone party is similar to a control operator. He/she will be able to enter any command. To trigger a reverse patch, the proper command will have to be entered from a Touch Tone™ telephone.

The first mode may be necessary in several situations. For example, in areas without Touch Tone™ service, the controller will have to be configured to trigger a reverse patch without requiring a command. Other exchanges reverse the polarity of the telephone line loop voltage going to the telephone set after the dialing process; this disables the DTMF encoder in the telephone. These situations can be fixed by using a separate DTMF encoder in the first case, and using a bridge rectifier to feed unipolar DC to the DTMF encoder in the second case. However, it will still be difficult to trigger the Reverse Patch from a pay phone, or a phone not equipped with DTMF capability, in rotary exchanges.

---

---

## Trigger Reverse Patch

Causes the reverse patch sequence to start when entered from the phone line.

- The DTMF decoder is switched from the phone line back to the repeater receiver.
- 
- 

### Command Form:

Command	Form
Trigger Reverse Patch	(PW) 87 *

**Acknowledgment:** None

**Errors:** None

**Default:** Reverse Patch is OFF (disabled)

---

---

## Answer Reverse Patch

Connects the telephone party to the repeater when entered from the repeater receiver.

- The call progresses the same way as a standard autopatch.
- 
- 

### Command Form:

Command	Form
Answer Reverse Patch	(PW) 88 *

**Acknowledgment:** None

**Errors:** None

**Default:** Reverse Patch is OFF (disabled)

---

---

## Select (Review) Reverse Patch Ringout Message

This message is sent over the repeater transmitter when the *Trigger Reverse Patch* command is invoked.

- The message is repeated at each ring, or at timed intervals, by the reverse patch program.
  - Do not make the message too long, to prevent messages from becoming stacked up in the message handler.
- 
- 

### Command Form:

Command	Form
Select Reverse Patch Ringout Message	(PW) 31 51 (message) *
Review Reverse Patch Ringout Message	(PW) 34 51 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** *Reverse Patch Ringout Message* Is "55" In CW

---



---

## Select Reverse Patch Ring-Triggered Macro

Assigns a macro to be executed at the end of each ring on the phone line.

- This macro is repeated at each ring by the reverse patch program.
  - Enter the 4-digit macro name using leading zeroes if the macro name is less than 4 digits.
  - To delete the assignment, enter the command with no macro name.
- 
- 

### Command Form:

Command	Form
Select Ring-Triggered Macro	(PW) 26 80 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macro assigned.

### Example:

To assign macro 9001 to execute at each ring, enter the following:

```
(PW) 26 80 9001 *
```

---

## Multiple Port Access

---

The Autopatch can be configured for access by multiple controller ports. These ports can be linked or operating separately. Because of the highly flexible nature of the *S-COM* command set, a number of commands must be entered to configure the Autopatch for access by multiple ports. If dynamic reconfiguration is required, several macros must be created that properly reconfigure the autopatch as paths are changed.

The default configuration of the Autopatch is the same as it was in firmware versions before V2.03:

- Autopatch commands can be entered from any port.
- Autopatch command response messages, eg. Access, Dump, Busy, Error, go only to transmitter #1.
- Audio to the phone line comes only from receiver #1.
- Audio from the phone line goes only to transmitter #1.

If this is your intended configuration, you don't need to make any of the configuration changes described in this section. Proceed to configure access for multiple ports.

In order to properly accept commands from multiple receivers and to route autopatch audio and response messages to both transmitters, several new commands have been defined:

- Additional link paths have been defined for all receivers and both transmitters. See the *Enable/Disable Path* command on page 13-2.
- Autopatch response messages, eg. Access, Dump, Busy, Error, are now routable to either or both transmitters. See *Select Autopatch Command Response Message Routing* on page 7-68.
- Autopatch access-triggered macros are now specific to each receiver. The original access-triggered macro is executed when a receiver-specific macro has not been defined. See *Select Autopatch Access-Triggered Macro* on page 7-67.

## Autopatch Audio Routing

By default, the path from receiver #1 to the autopatch and the path from the autopatch to transmitter #1 are enabled. To change the audio paths, use the *Enable/Disable Path* command (see page 13-2).

For example, to allow audio from receivers #1 and #2 to be heard on the phone line, enable paths 8 and 9 by entering the following commands:

```
(PW)63 87 1 * ; Rx1 to AP Enabled
(PW)63 88 1 * ; Rx2 to AP Enabled
```

To allow phone line audio to be heard on transmitters #1 and #2, enable paths 10 and 11 by entering the following commands:

```
(PW)63 90 1 * ; AP to Tx1 Enabled
(PW)63 91 1 * ; AP to Tx2 Enabled
```

To allow audio from only receiver #2 to be heard on the phone line, disable path 8 and enable path 9 by entering the following commands:

```
(PW)63 87 0 * ; Rx1 to AP Disabled
(PW)63 88 1 * ; Rx2 to AP Enabled
```

To allow phone line audio to be heard only on transmitter #2, disable path 10 and enable path 11 by entering the following commands:

```
(PW)63 90 0 * ; AP to Tx1 Disabled
(PW)63 91 1 * ; AP to Tx2 Enabled
```

If your configuration never changes, you may enter the commands once to set up the routing that you require. If your configuration will change, you should create macros to enable and disable the appropriate paths (see examples later in this section).

## Autopatch Command Response Message Routing

By default, when the autopatch is accessed, the *Autopatch Dialing Message* (see page 7-7) is routed to transmitter #1. When the autopatch is dumped, the *Autopatch Dump Message* (see page 7-9) is routed to transmitter #1. In a system that is configured to operate ports Rx1/Tx1 and Rx2/Tx2 separately, the autopatch message should go back to the port that originated the command. Otherwise, the users on the other port could become confused by an autopatch that appears to come up by itself. If ports Rx1/Tx1 and Rx2/Tx2 are linked, the autopatch messages should go out both ports. The *Select Autopatch Command Response Message Routing* command (see page 7-68) selects the routing of these messages.

For example, to route command responses to both transmitters, enter the following commands:

```
(PW) 91 00 12 * ; Rx1 AP Resp Msgs to Tx1 and Tx2
(PW) 91 01 12 * ; Rx2 AP Resp Msgs to Tx1 and Tx2
```

To route receiver #1 command responses to transmitter #1 and receiver #2 command responses to transmitter #2, enter the following commands:

```
(PW) 91 00 1 * ; Rx1 AP Resp Msgs to Tx1
(PW) 91 01 2 * ; Rx2 AP Resp Msgs to Tx2
```

## Receiver-Specific Autopatch Access

In order to be able to set up the audio routing properly, receiver-specific access-triggered macros have been defined (see page 7-69). These macros are executed when the autopatch is accessed from a specific receiver. If a receiver-specific access-triggered macro is not defined, the original access-triggered macro, now the default, is executed (see page 7-16).

When the Rx1/Tx1 and Rx2/Tx2 ports are linked together and you don't intend to have the users be able to link and delink the ports, you can just configure the paths as defined in the section above.

When the ports are not linked, you need to define separate macros for receiver #1 and receiver #2. These macros will configure the audio routing for autopatch access from each port. To setup the routing for receiver #1, enter the following commands:

```
(PW) 20 9000 (PW) 63 87 1 * ; Rx1 to AP Enabled
(PW) 29 9000 (PW) 63 90 1 * ; AP to Tx1 Enabled
(PW) 29 9000 (PW) 63 88 0 * ; Rx2 to AP Disabled
(PW) 29 9000 (PW) 63 91 0 * ; AP to Tx2 Disabled
(PW) 26 75 9000 * ; Assign Rx1 Macro
```

To setup the routing for receiver #2, enter the following commands:

```
(PW) 20 9001 (PW) 63 88 1 * ; Rx2 to AP Enabled
(PW) 29 9001 (PW) 63 91 1 * ; AP to Tx2 Enabled
(PW) 29 9001 (PW) 63 87 0 * ; Rx1 to AP Disabled
(PW) 29 9001 (PW) 63 90 0 * ; AP to Tx1 Disabled
(PW) 26 76 9001 * ; Assign Rx2 Macro
```

## Preventing Multiple Accesses

When Rx1/Tx1 and Rx2/Tx2 are not linked, it is important to prevent an autopatch in progress on one port from being interrupted by an access on the other port. The *Require Dump Before Next Call* command configures this option (see page 7-21). To prevent this access, enter the following command:

```
(PW) 63 10 1 * ;Require Dump Before Next Call
```

---



---

## Select Autopatch Receiver-Specific Access-Triggered Macros

Assigns macros to be executed upon accessing the autopatch from a specific receiver.

- Each receiver can be assigned its own access-triggered macro.
  - If a macro is not assigned for a specific receiver, the default access-triggered macro is executed (see page 7-10).
  - Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
  - If the macro name has fewer than 4 digits, enter leading zeros.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Assign Rx1 Autopatch Access-Triggered Macro	(PW) 26 75 (macro name) *
Assign Rx2 Autopatch Access-Triggered Macro	(PW) 26 76 (macro name) *
Assign Rx3 Autopatch Access-Triggered Macro	(PW) 26 77 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.

---



---

## Select Autopatch Command Response Message Routing

Allows programmer to specify where to route autopatch command response messages by receiver.

- Each receiver can be assigned its command response message routing when accessing the autopatch.
  - This command affects the Dialing, Dump, Off, Busy, Reject, Error, and No-Redial-Number messages. (See pages 7-6, 7-51, and 7-52.)
  - Enter the password, the 4-digit root number, and 1 or 2 digits representing the transmitters to play command responses messages, and the (\*).
- 
- 

### Command Form:

Command	Form	Data Digit
Select Rx1 Autopatch Command Response Message Routing	(PW) 91 00 x x *	1 = Tx1 2 = Tx2
Select Rx2 Autopatch Command Response Message Routing	(PW) 91 01 x x *	1 = Tx1 2 = Tx2
Select Rx3 Autopatch Command Response Message Routing	(PW) 91 02 x x *	1 = Tx1 2 = Tx2

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.

---

## Chapter 8

# Clock and Calendar

---

The *Controller* features a year 2000-compliant hardware real-time clock and calendar circuit with a lithium power source. Accurate time keeping is maintained during loss of main power.

To announce the time or date, you place special codes called *Message Run-Time Variables* into messages. See page 4-35 for more information.

The clock and calendar circuit is accurate to  $\pm 1$  minute per month. For improved accuracy, commands are provided to manually or automatically adjust the clock to compensate for drift.

---



---

## Set Clock and Calendar

Sets the clock and calendar.

- Enter all parameters shown below each time that you set the *Clock and Calendar*.
- All parameters consist of two digits except the day-of-week, which is one digit.
- The year parameter is needed for leap year correction.
- The clock and calendar is set when you release the (\*) button.
- Seconds are automatically set to 00.

---



---

### Command Form:

Command	Form	Data Digit
Set Clock and Calendar	(PW) 25 (year, month, day-of-month, day-of-week, hour, minute)*	from table below

Data Digit	Explanation
00-99	year
01-12 (January is 01)	month
01-31	day-of-month
0-6 (Sunday is 0)	day-of-week
00-23 (24-hour format)	hour
00-59	minute

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal parameter: any lettered key; month = 00 or greater than 12; day-of-month = 0 or greater than 31; day-of-week greater than 6; hour greater than 23; minute greater than 59.

**Default Condition:** 00:00:00 on Wednesday, January 1, 1993.

**Example:**

Let's set the clock to 6:02 PM on Saturday, March 21, 1992.

The year is 92, the month is 03, the day-of-month is 21, the day-of-week is 6, the hour is 18, and the minute is 02. The entire command is:

```
(PW) 25 92 03 21 6 18 02 *
```

---



---

## Adjust Daylight Savings Time

**Forces the clock to add, or subtract, 1-hour.**

- This command simplifies the semiannual job of resetting the clock for customers affected by Daylight Savings Time. Instead of resetting the entire clock and calendar, use this command to add or subtract one hour.
- Don't use the "fall back" command between midnight and 00:59 AM. Otherwise, the hour will change to 23 (11:xx PM), but the day won't roll back. You will gain another day at midnight.
- Don't use the "spring ahead" command between 11:00 PM and midnight. Otherwise, the hour will change to 00, but the day won't roll forward. You will lose a day.
- If you are using the Scheduler to automatically "fall back", use the version of the "fall back" command with the inhibit. This prevents the scheduler from executing the command more than once.

---



---

### Command Form:

Command	Form	Data Digit
Adjust Daylight Savings Time	(PW) 48 x *	0 = "fall back" (subtract 1 from hours) 1 = "spring ahead" (add 1 to hours) 2 = "fall back" prevented from being executed a second time for 61 minutes.

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None

**Example:**

To manually set the clock 1-hour ahead, enter the command:

```
(PW) 48 1 *
```

To automatically set the clock 1-hour ahead on March 30, 1997, at 2 AM using the *Scheduler*, create a macro (9000 for this example) and a *Scheduler* setpoint (00 for this example):

```
(PW) 20 9000 MPW 48 1 *  
(PW) 28 00 9000 03 30 02 00 *
```

To manually set the clock 1-hour behind, enter the command:

```
(PW) 48 0 *
```

To automatically set the clock 1-hour behind on October 26, 1997, at 2 AM using the *Scheduler*, create a macro (9001 for this example) and a *Scheduler* setpoint (01 for this example):

```
(PW) 20 9001 MPW 48 2 *  
(PW) 28 01 9001 10 26 02 00 *
```

---

**Note:** See Chapter 9, *Scheduler*, for more information on setting a *Scheduler* setpoint.

---

---



---

## Reset Clock Seconds

**Forces the clock to set the seconds to zero.**

- This command simplifies the periodic synchronization of the clock to a time reference, either manually or automatically.
- If the seconds of the clock are ahead of the time reference by 1 to 29 seconds, the seconds will be reset to zero.
- If the seconds of the clock are behind the time reference by 1 to 30 seconds, the seconds will be reset to zero and the minute and hour will be incremented, if required.
- Don't use this command between 11:59 PM and 00:01 AM. Otherwise, the time will be adjusted, but the day will be wrong.

---



---

### Command Form:

Command	Form	Data Digit
Reset Clock Seconds	(PW) 48 3 *	

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** None

### Example:

To manually reset the seconds of the clock, enter the command:

```
(PW) 48 3 *
```

When entering the command, press and hold the star (\*) at the end of the command. Release the star when your time reference signals its zero mark. This will zero the seconds of the clock in synchronization with your time reference.

To automatically reset the seconds of the clock from external hardware, connect the hardware to a *Logic Input*. Create a macro (9000 in this example) and assign it to a *Logic Input* (the Hi-To-Low transition of #1 in this example):

```
(PW) 20 9000 (PW) 48 3 *
(PW) 26 20 9000 *
```

---

**Note:** See Chapter 14, *Logic Inputs*, for more information on using *Logic Inputs*.

---

---



---

## Adjust Clock Seconds

### Forces the clock to add or subtract seconds.

- This command simplifies the periodic synchronization of the clock without a time reference.
- This command is usually used with the *Scheduler* to allow the controller to adjust its own time.
- Don't use this command between 11:59 PM and 00:01 AM. Otherwise, the time will be adjusted, but the day will be wrong.
- Use the *Message Run-Time Variable* 9816, "Seconds, CW", or 9832 "Seconds, male voice" to check the amount of correction required.
- If you are using the *Scheduler* to automatically subtract seconds from the clock, use the version of the *Subtract Clock Seconds* command with the inhibit. This prevents the scheduler from executing the command more than once.

---



---

### Command Form:

Command	Form	Data Digit
Add Clock Seconds	(PW) 48 4 (seconds) *	01-30 seconds
Subtract Clock Seconds	(PW) 48 5 (seconds)	01-30 seconds
Subtract Clock Seconds, Inhibited For 2 Minutes	(PW) 48 6 (seconds)	01-30 seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None

### Example:

Using the *Scheduler*, the accuracy of the clock over long periods of time can be improved. To know how much adjustment will be required, use the *Reset Clock Seconds* command to manually synchronize the clock to a time reference. A week later, enter the command to speak the seconds, for example:

```
(PW) 15 9832 *
```

When entering the command, press and hold the star (\*) at the end of the command. Release the star when your time reference signals its zero mark. This will cause the controller to speak the seconds reading on the clock at that time.

Note the amount that the clock is off from the reference. This is the amount of drift in the clock over a week. Take these readings each week at approximately the same time to understand the amount of drift.

Since the adjustment commands will only adjust the clock up to 29 seconds ahead or 30 seconds behind, you will need to set a *Scheduler* setpoint that occurs when the drift is less than that. Once-a-week or once-a-month may be appropriate depending on your situation.

To automatically adjust the seconds of the clock (subtract 7 seconds for this example) on the first Monday of every month at 2:00 AM using the *Scheduler*, create a macro (9000 for this example) and a *Scheduler* setpoint (00 for this example):

```
(PW) 20 9000 MPW 48 6 07 *  
(PW) 28 00 9000 99 42 02 00 *
```

Note that the ambient temperature that the controller is subjected to may change the amount, and direction, of the clock drift. You may need to change the adjustment at different times of the year.

---

**Note:** See Chapter 9, *Scheduler*, for more information on setting a *Scheduler* setpoint.

---

---

## Chapter 9

# Scheduler

---

The *7K Controller* features a powerful Scheduler program which accepts up to 100 time/date *Setpoints*. Each setpoint can be programmed to execute a macro based on the month, day-of-month, day-of-week, hour, and minute of the real-time clock and calendar, eg. midnight, December 31st. *Wildcards* can be used to program recurring setpoints, eg. 9:00 AM on the first Saturday of each month.

The setpoints are compared to the real-time clock/calendar at the start of each new minute. If a match is found, the setpoint's accompanying *Macro* command is executed.

Since the real-time clock has a lithium power source, time-keeping is not affected by loss of main power.

Leap years are automatically adjusted. The real-time clock and Scheduler are Year-2000 compliant.

---



---

## Create a Setpoint

Loads a setpoint into the Scheduler program.

- You must enter all parameters required by this command. You may force the scheduler to ignore the month, day, hour, or minute by entering the *wildcard* code, 99, for that particular parameter.
- The Scheduler supports 100 setpoints numbered 00 through 99. You may create up to 10 setpoints which execute at the same minute. If more than one setpoint executes at the same minute, the setpoints will be executed with the lowest numbered setpoint first, the next higher setpoint second, and so on.
- If the controller loses main power, time-keeping will continue, however, setpoints will not be executed, since the microprocessor will be down. Setpoints missed during the power failure will not be executed when power returns.

---



---

### Command Form:

Command	Form	Data Digit
Create setpoint	(PW) 28 (setpoint number, macro, month, day, hour, minute) *	from table below. (Use Day Code Table for <i>day</i> parameter.)

Data Digits	Explanation
00-99	setpoint number, two digits
xxxx	macro, 4 digits
01-12 or 99	month, 2 digits or <i>wildcard</i>
01-68 or 99	day, 2 digits (see Day Code Table, page 9-3.)
00-23 or 99	hour, 2 digits or <i>wildcard</i>
00-59 or 99	minute, 2 digits or <i>wildcard</i>

<b>Scheduler Day Code Table</b>			
<b>Day Code</b>	<b>Explanation</b>	<b>Day Code</b>	<b>Explanation</b>
01-31	calendar day-of-month	54	2nd Saturday of month
32	weekdays (Mon-Fri)	55	3rd Sunday of month
33	weekends (Sat-Sun)	56	3rd Monday of month
34	Sundays	57	3rd Tuesday of month
35	Mondays	58	3rd Wednesday of month
36	Tuesdays	59	3rd Thursday of month
37	Wednesdays	60	3rd Friday of month
38	Thursdays	61	3rd Saturday of month
39	Fridays	62	4th Sunday of month
40	Saturdays	63	4th Monday of month
41	1st Sunday of month	64	4th Tuesday of month
42	1st Monday of month	65	4th Wednesday of month
43	1st Tuesday of month	66	4th Thursday of month
44	1st Wednesday of month	67	4th Friday of month
45	1st Thursday of month	68	4th Saturday of month
46	1st Friday of month	69	5th Sunday of month
47	1st Saturday of month	70	5th Monday of month
48	2nd Sunday of month	71	5th Tuesday of month
49	2nd Monday of month	72	5th Wednesday of month
50	2nd Tuesday of month	73	5th Thursday of month
51	2nd Wednesday of month	74	5th Friday of month
52	2nd Thursday of month	75	5th Saturday of month
53	2nd Friday of month	99	every day ( <i>wild card</i> )

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No setpoints exist.

**Example:**

To execute macro 1234 every hour, on the hour, every day, every month, enter the following:

```
(PW) 28 00 1234 99 99 99 00 * (Setpoint 00)
```

To execute macro 1234 every day at 6:15 AM, every month, enter the following:

```
(PW) 28 01 1234 99 99 06 15 * (Setpoint 01)
```

To execute macro 1234 at 10:30 AM on the weekend (Saturday and Sunday), every month, enter the following:

```
(PW) 28 02 1234 99 33 10 30 * (Setpoint 02)
```

To execute macro 1234 at midnight every Saturday in June, enter the following:

```
(PW) 28 03 1234 06 40 00 00 * (Setpoint 03)
```

To execute macro 1234 at noon on April 15th, enter the following:

```
(PW) 28 04 1234 04 15 12 00 * (Setpoint 04)
```

To execute macro 1234 at 5:00 PM (17:00) on the first Thursday of every month, enter the following:

```
(PW) 28 05 1234 99 45 17 00 * (Setpoint 05)
```

It is not necessary to fill in each setpoint starting from 00. Unprogrammed setpoints that cause gaps in the sequence will be ignored by the Scheduler.

You can minimize the number of programmed setpoints with creative programming. For example, you may wish to execute a macro at 10:00 PM each day of the week *except* Sundays. Instead of creating six setpoints for Monday through Saturday, create just two: one for Saturday, and one for weekdays.

**Note:** When using *wildcards*, be sure of their function. For example, if you create a setpoint where Month = 01, Day = 01, Hour = 00, and Minute = 00, the macro will execute at midnight, January 1st. If you accidentally set Month = 01, Day = 01, Hour = 99, and Minute = 99, assuming the macro will execute at the start of January 1st, the unexpected will happen: the macro will execute every minute of every hour for as long as it is January 1st (that is, from 00:00 January 1st until and including 12:59 PM (23:59) January 1st).

---

Suggested uses for the Scheduler include:

- Change the phone number dialed by a macro.
- Enable and disable a feature based on time of day (weekends could be different from weekdays).

---



---

## Delete One or More Setpoints

Deletes a single setpoint or a range of setpoints from the Scheduler program.

- To delete a single setpoint, enter just the setpoint number.
  - To delete a range of setpoints, enter the first and last setpoint number to be deleted.
  - Enter the 2-digit setpoints 00-99. Use a leading zero, if required.
- 
- 

### Command Form:

Command	Form	Data Digit
Delete One Setpoint	(PW) 28 (setpoint) *	00-99, setpoint number
Delete Range of Setpoints	(PW) 28 (first setpoint) (last setpoint) *	00-99, setpoint number

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No setpoints exist.

### Example:

To delete setpoints 4 through 26, enter the following:

(PW) 28 04 26 \*

To delete a single setpoint, 14, enter the following:

(PW) 28 14 \*

---



---

## Enable/Disable Scheduler

Allows the Scheduler to process scheduled events (setpoints).

- Enter this command to control if the Scheduler is allowed to process the programmed scheduled events (setpoints).
- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digits
Enable/Disable Scheduler	(PW) 63 15 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Enabled.

### Example:

To disable the scheduler, enter the following:

(PW) 63 15 0 \*

To enable the scheduler, enter the following:

(PW) 63 15 1 \*

**Notes:**

---

## *Chapter 10*

# CTCSS Functions

---

The 7K Controller can control an outboard CTCSS encoder/decoder module such as the Communications Specialists TS-32.

If the CTCSS encoder is connected to the 7K, the controller can turn the tone ON and OFF through a dedicated audio gate on the main board.

If the CTCSS decoder frequency is controlled by DIP switches, the 7K can change the frequency if connections are made between the DIP switches and the 7K's PLF1 through PLF6 outputs.

---



---

## Enable/Disable CTCSS Encoder

**Turns ON and OFF a customer-supplied CTCSS encoder.**

- Feed the encoder audio output into the 7K at J2-23 (*PL Encode In*), and drive the transmitter PL input from the 7K at J2-24 (*PL Encode Out*).
- You may place the encoder into one of three modes: OFF (disabled), continuously ON (continuously enabled), and timed ON (timed enabled).
- When continuously enabled, the encoder will be enabled when Transmitter 1 is keyed and disabled just before the *Tx1 Minimum Unkey Delay*. You can adjust the *Tx1 Minimum Unkey Delay* (see page 17-15) for proper squelching of user radios.
- The *Timed ON* mode means the encoder is turned ON for an adjustable amount of time at the beginning of each repeater key-up. This time is adjustable from 2 seconds to 9 seconds.
- Enter one digit, 0 for OFF (disabled), 1 for continuously ON (enabled), and 2 through 9 for 2 to 9 seconds of timed ON operation.

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable CTCSS Encoder	(PW) 02 x *	0 = OFF (disabled) 1 = continuous ON (2-9) = (2-9) seconds timed ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** CTCSS Encoder is OFF (disabled).

### Example:

To put the CTCSS encoder into timed ON mode for 7 seconds, enter the following:

(PW) 02 7 \*

If monitoring stations have CTCSS decoders, they can hear the beginnings of QSOs and find out who's on the air, but do not have to listen to the rest of the conversation.

---



---

## Select Frequency of CTCSS

**Allows control of frequency of an external CTCSS encode/decode module.**

- Six outputs, labeled *CTCSS Frequency #1* through *CTCSS Frequency #6* are provided on the J2 connector of the 7K. If interfacing with a TS-32 encode/decode module, connect wires from *CTCSS Frequency #1* through *CTCSS Frequency #5* to the 5 DIP switches on the TS-32. Open all 5 switches.
  - In the *TS-32 Programming Table* which follows, the decimal numbers 0–63 represent the 64 possible combinations of the six outputs, with *CTCSS Frequency #1* being the least significant bit. Only 32 combinations affect the TS-32, even though 64 combinations are available to the controller.
  - Entering a 0 in the command forces all six outputs to the low state, which corresponds to the lowest frequency (67.0Hz) of the TS-32.
  - The six outputs are latched at the time a new command is given. The customer may wish to control a device that is not a CTCSS module, and should be aware that the outputs are lightly buffered by a 74C906 IC (+15V OFF/10mA ON).
- 
- 

### Command Form:

Command	Form	Data Digit
Select Frequency of CTCSS	(PW) 03 xx *	see TS-32 Programming Table

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default:** All six outputs are OFF (open)

---

**Note:** Using this command to change the CTCSS frequency does not turn ON or OFF the encoder/decoder, but simply changes the frequency. It is a way of remotely “throwing” the switches on the module.

Another command exists which uses the same six outputs to control a different device, the *MX-315 CTCSS encoder IC made by MX-COM, Inc.* The command is (PW) 05 (0– 63) \*. This command controls the latched outputs similarly to the (PW) 03 (0–63) \* command, but uses a lookup table to provide the proper bit pattern for the MX-315. *This command does not have a command page in this manual.* Contact the factory for details.

---

<b>TS-32 Programming</b>							
			Switch Number, 0 = Closed (ON) / 1 = Open (OFF)				
#	Freq	Code	5	4	3	2	1
0	67.0	XZ	0	0	0	0	0
1	71.9	XA	0	0	0	0	1
2	74.4	WA	0	0	0	1	0
3	77.0	XB	0	0	0	1	1
4	79.7	SP	0	0	1	0	0
5	82.5	YZ	0	0	1	0	1
6	85.4	YA	0	0	1	1	0
7	88.5	YB	0	0	1	1	1
8	91.5	ZZ	0	1	0	0	0
9	94.8	ZA	0	1	0	0	1
10	97.4	ZB	0	1	0	1	0
11	100.0	1Z	0	1	0	1	1
12	103.5	1A	0	1	1	0	0
13	107.2	1B	0	1	1	0	1
14	110.9	2Z	0	1	1	1	0
15	114.8	2A	0	1	1	1	1
16	118.8	2B	1	0	0	0	0
17	123.0	3Z	1	0	0	0	1
18	127.3	3A	1	0	0	1	0
19	131.8	3B	1	0	0	1	1
20	136.5	4Z	1	0	1	0	0
21	141.3	4A	1	0	1	0	1
22	146.2	4B	1	0	1	1	0
23	151.4	5Z	1	0	1	1	1
24	156.7	5A	1	1	0	0	0
25	162.2	5B	1	1	0	0	1
26	167.9	6Z	1	1	0	1	1
27	173.8	6A	1	1	0	1	1
28	179.9	6B	1	1	1	0	0
29	186.2	7Z	1	1	1	0	1
30	192.8	7A	1	1	1	1	0
31	203.5	M1	1	1	1	1	1

---

## *Chapter 11*

# **DTMF Decoder**

---

The 7K's *DTMF Decoder* may be driven by the three receiver ports and the phone line. The priorities of these devices and many other parameters regarding the decoder are programmable.

---



---

## Enable/Disable Command Response Messages

Turns ON or OFF the command responses (i.e. error and acknowledgment messages) returned to the programmer.

*Command Response Messages* are the CW messages which are sent to assist the programmer. Most commands send *OK* when properly entered, although some send back the actual message that was entered. Other responses include the various error messages that indicate bad data or incorrect number of keystrokes.

- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable Command Response Messages	(PW) 63 02 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Command Response Messages are ON (enabled)

### Examples:

When commands are placed into macros, command response messages may be undesirable. To turn them OFF, enter:

```
(PW) 63 02 0 *
```

To turn them back ON, enter:

```
(PW) 63 02 1 *
```

---



---

## Select DTMF Priority/Scan

Selects the priority of the three devices feeding the DTMF decoder, including placing one or more devices into the scan list.

- Enter four digits from the table indicating Priority Level or Scan for each of the four devices.
- You may not enter all zeroes, implying that no device has access to the decoder. You may not assign the same priority to more than one device, except for “scan” (5). You may assign priority “0” (no access) to up to 3 devices.

---



---

### Command Form:

Command	Form	Data Digit
Select DTMF Priority/Scan	(PW) 89 (RX1, RX2, RX3, PH) *	0 = no access to DTMF decoder 1 = Priority 1 (highest priority) 2 = Priority 2 3 = Priority 3 4 = Priority 4 5 = Scan this device

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	all zeroes, or digit greater than 5, or multiple devices with same priority

### Default Condition:

Device	Default
RX1	Priority 3
RX2	Priority 4
RX3	Priority 1
PH (“PH” refers to the phone line)	Priority 2

**Examples:**

You may re-arrange the priorities of the three receivers and phone line from the default condition, which assumes that RX3 is a control receiver with the highest priority. It assumes that the phone line control feature is second, followed by the repeater receiver (RX1) and then the link receiver (RX2).

In addition to assigning priorities, you may cause the DTMF decoder to sequentially scan certain (or all) devices. Scanned devices are checked for DTMF only if no priority devices are active. If DTMF is detected on a scanned device, the decoder will remain connected to the device until either the device goes inactive, the *DTMF Interdigit Timer* expires, or a priority device goes active.

The more devices you scan, the slower the response to DTMF will be. (Users may have to hold the first DTMF digit slightly longer to “capture” the decoder.) There are no priorities within the scan list; whichever device has DTMF first will capture the DTMF decoder.

If you wish to give the phone line top priority, RX1 next priority, and scan RX2 and RX3, enter this:

(PW) 89 2 5 5 1 \*

---



---

## Select DTMF Decoder Access Mode

Selects one of six possible DTMF Decoder Access Modes for each receiver.

- Enter one digit, 0 through 5, from the table below.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Rx1-to-DTMF Decoder Access Mode	(PW) 57 06 x *	DTMF Decoder Access Mode Table (below)
Select Rx2-to-DTMF Decoder Access Mode	(PW) 57 07 x *	DTMF Decoder Access Mode Table (below)
Select Rx3-to-DTMF Decoder Access Mode	(PW) 57 08 x *	DTMF Decoder Access Mode Table (below)

Mode	DTMF Access	Explanation
0	No Access	Activity on the COR and PL inputs is ignored.
1	Carrier Access	Activity on the COR input will allow access to the DTMF decoder. Activity on the PL input is ignored.
2	PL Access	Activity on the PL input will allow access to the DTMF decoder. Activity on the COR input is ignored.
3	And-PL Access	Activity on both the COR and PL inputs simultaneously will allow access to the DTMF decoder.
4	Or-PL Access	Activity on either the COR or PL inputs will allow access to the DTMF decoder.
5	Anti-PL Access	Activity on the COR input simultaneously with no activity on the PL input will allow access to the DTMF decoder.

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** DTMF Decoder Access is Mode 1 (Carrier Access) on all receivers.

---

---

**Note:** These commands only affect the DTMF Decoder access mode. They may be different from receiver access modes, if desired.

---

---

**Warning:** If you set the DTMF Decoder Access Mode on all receivers to Mode 0 (No Access) you will only be able to control the controller via the phone line!

---

**Example:**

To prevent DTMF commands from being decoded from Receiver 2, enter the following command to change the mode to Mode 0 (No Access):

```
(PW) 57 07 0 *
```

Assume that the DTMF decoder for Receiver 1 is in Mode 1 (Carrier Access), and that Mode 2 (PL Access) is desired. Enter the following command to change the mode on Receiver 1:

```
(PW) 57 06 2 *
```

A better mode for many repeater installations is Mode 3 (And-PL Access). This mode has better rejection of adjacent-channel interference than Mode 2 (PL Access), since noise falsing from unsquelched audio is eliminated. Enter the following command to change the mode on Receiver 1:

```
(PW) 57 06 3 *
```

Mode 4 (Or-PL Access) allows both Carrier Access and PL Access operation. Since PL is more easily detected, PL users will find increased range. Carrier Access users are unaffected. The squelch may be tightened to suppress band opening problems.

Mode 5 (Anti-PL) is used when the repeater is on the same channel with a PL-accessed repeater. Users of the second system are kept out of the Anti-PL system.

---



---

## Select DTMF Decoder Interdigit Timer

Programs the maximum amount of time allowed between DTMF digits received by the controller.

- If a delay occurs that is greater than the value specified in the command, the command buffer in the controller will be cleared.
  - Enter two digits in the range 01 to 99, representing 0.1 to 9.9 seconds.
- 
- 

### Command Form:

Command	Form	Data Digit
Select DTMF Decoder Interdigit Timer	(PW) 82 xx *	(01–99) = (0.1–9.9) seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** DTMF Decoder Interdigit Time is 5.0 seconds

---



---

## Select DTMF Decoder Mute Delay

Sets the amount of muting that occurs after a DTMF digit is received by the controller.

- Enter one digit representing the delay duration; 0.0 through 0.9 seconds.
- 
- 

### Command Form:

Command	Form	Data Digit
Select DTMF Decoder Mute Delay	(PW) 96 x *	(0–9) = (0.0–0.9) seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** DTMF Decoder Mute Delay is 0.5 seconds

### Examples:

When a DTMF digit is recognized by the controller, it mutes the audio so that the digit is not re-transmitted. Since some time is required by the controller to decode the digit, a short burst of tone is re-transmitted. A timer is started for the purpose of delaying the muting. This allows a string of DTMF digits to be entered, with all but the first one fully muted. The *Select DTMF Decoder Mute Delay* command shown above controls this timer.

- If set to zero, the muting will end when the DTMF digit is released.
- If set to 9, the muting will last 0.9 seconds beyond the release of the DTMF digit.

Since a voice will occasionally trip the DTMF decoder, a long mute delay may not be desired.

If a DTMF digit is held down for a continuous period of time, the controller will stop muting after 10 seconds.

To change the mute delay to 0.3 seconds, for example, enter the following command:

```
(PW) 96 3 *
```

---



---

## Enable/Disable DTMF Decoder Mute

Turns ON or OFF DTMF muting between any receiver and transmitter pair.

- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable RX1-TX1 DTMF Mute	(PW) 63 50 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2-TX1 DTMF Mute	(PW) 63 51 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3-TX1 DTMF Mute	(PW) 63 52 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX1-TX2 DTMF Mute	(PW) 63 53 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2-TX2 DTMF Mute	(PW) 63 54 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3-TX2 DTMF Mute	(PW) 63 55 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** All DTMF Decoder Mutes are ON (enabled)

### Examples:

DTMF Muting is usually left ON (enabled) to prevent annoying DTMF digits from being repeated, and to prevent listeners from learning command codes.

If it becomes necessary to signal some device that is monitoring Transmitter 1 or 2, you may turn OFF the muting associated with the desired receiver(s) and transmitter(s).

---



---

## Enable/Disable DTMF Long Tones

Turns ON or OFF the controller's ability to execute macros based on reception of long DTMF characters.

- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable DTMF Long Tones	(PW) 63 68 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** DTMF Long Tone feature is OFF (disabled)

### Examples:

A *Long Tone* is a DTMF digit sent by a user that lasts continuously for 3.0 seconds or longer. The controller can execute a different macro for each of the 16 possible long DTMF characters. This system is compatible with the ARRL's nationwide "LiTZ" (Long-Tone Zero) program, which asks amateurs to monitor for a 3-second DTMF "0" sent by a user who is in an emergency situation.

The macro is executed on the trailing edge of the DTMF character. Since the long tone is treated similar to a logic input by the controller, it becomes a stand-alone signal instead of a character for the command buffer. There must not be any other characters in the command buffer when the long tone is received. The long tone character itself will not be stored into the command buffer.

After you have enabled this feature, see the *Select DTMF Long Tone Macros* command on page 11-11 for information on assigning the appropriate macros to the long DTMF characters.

---



---

## Select DTMF Long Tone Macros

Assigns a macro to be executed by the Long Tone shown.

- Enter the password, the 4-digit root number, the macro you wish to have executed by the long tone, and the (\*).
  - If the macro has fewer than 4 digits, enter leading zeroes
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Assign Macro to Long Tone Zero	(PW) 26 50 (macro name) *
Assign Macro to Long Tone One	(PW) 26 51 (macro name) *
Assign Macro to Long Tone Two	(PW) 26 52 (macro name) *
Assign Macro to Long Tone Three	(PW) 26 53 (macro name) *
Assign Macro to Long Tone Four	(PW) 26 54 (macro name) *
Assign Macro to Long Tone Five	(PW) 26 55 (macro name) *
Assign Macro to Long Tone Six	(PW) 26 56 (macro name) *
Assign Macro to Long Tone Seven	(PW) 26 57 (macro name) *
Assign Macro to Long Tone Eight	(PW) 26 58 (macro name) *
Assign Macro to Long Tone Nine	(PW) 26 59 (macro name) *
Assign Macro to Long Tone A	(PW) 26 60 (macro name) *
Assign Macro to Long Tone B	(PW) 26 61 (macro name) *
Assign Macro to Long Tone C	(PW) 26 62 (macro name) *
Assign Macro to Long Tone D	(PW) 26 63 (macro name) *
Assign Macro to Long Tone Star (*)	(PW) 26 64 (macro name) *
Assign Macro to Long Tone Pound (#)	(PW) 26 65 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned

---

---

---

## Select DTMF Digit-Decoded Macro

Assigns a macro to be triggered when a DTMF digit is decoded.

- Can be used to implement a DTMF cover tone.
  - Enter the 4-digit macro name desired. Use leading zeros if needed.
  - To delete a macro, enter the command with no macro name.
- 
- 

### Command Form:

Command	Form
Select DTMF Digit-Decoded Macro	(PW) 26 49 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None assigned.

---

# Chapter 12

# Identifier

---

The Controller supports separate *Identifiers* (ID) for Transmitter #1 (Tx1) and Transmitter #2 (Tx2). These identifiers are triggered by incoming signals from the users and identify the transmitters only while they are being used.

---

**Note:** Due to the separate identifiers feature, many of the commands and messages are specific to a particular transmitter. In the following text, all references to commands, messages, macros, and so forth, may not include distinctions for each transmitter. For example, we might refer to an *Initial ID Message* command, when in fact, there are two commands that are similar: *Select Initial ID Message for Tx1* and *Select Initial ID message for Tx2*. Therefore, users should be careful to choose the proper command form from the command pages.

---

The first signal to be received will start an *ID Cycle*. Since the identifier is “polite”, it will attempt to wait for the signal to disappear before sending an identifier message. If the initial signal is received continuously until the identifier timer expires, the *Initial ID Message* will be sent and the *Impolite ID Macro* will be executed. Normally, following the initial keyup, the *Initial ID Message* is sent and the *Initial ID Macro* is executed for each transmitter that was keyed

During a conversation, the controller looks for the input signal to drop during the *ID Pending Interval* prior to the expiration of the *ID Message Interval* timer. If the signal drops during this period, the *Normal ID Message* is sent and the *Polite ID Macro* is executed. If the signal does not drop by the time the *ID Message Interval* time expires, the *Impolite ID Message* is sent and the *Impolite ID Macro* is executed.

Because the controller “looks ahead” up to the *ID Pending Interval* time for the signal to drop (as required by the polite ID feature), the identification may not happen at precisely the same interval each time. If the *ID Message Interval* is set to 10 minutes and the *ID Pending Interval* is set to 30 seconds, for example, the identification can take place from 9 minutes 30 seconds to 10 minutes after the initial signal is received. The *Select ID Message Interval for*

*Tx1 and Tx2* command (see page 12-5) sets the *maximum* interval between identifications. The *Select ID Pending Interval for Tx1 and Tx2* command (see page 12-6) sets the amount of time that the controller “looks ahead” to insert a polite ID and *Select ID Message Interval* minus *Select ID Pending Interval* sets the minimum time between IDs on an active system.

When the conversation is finished and the ID timer expires for the last time, the *Normal ID Message* is sent and the *Polite ID Macro* is executed. The identifier always has the “last word”. No additional identification will be sent until a new ID cycle is begun by an incoming signal.

You may program messages into the identifier by using the *Select Identifier Messages* commands on page 12-3.

- The *Initial ID Message* may contain a greeting, club name, city, CTCSS frequency, or other such information in addition to the callsign.
- The *Normal ID Message* is usually short, containing only the callsign, since it is sent occasionally throughout a conversation between user transmissions.
- The *Impolite ID Message* should be as short and inconspicuous as possible since it is sent over a user’s transmission when a *Normal ID Message* cannot be inserted between users’ transmissions.

The ID messages can be deleted and the ID macros used instead. For example, the *Initial ID Macro* can pulse a logic output, starting a tape cartridge machine or digital voice recorder on which the identification and greeting are recorded.

---



---

## Select (Review) Identifier Messages

Define the Initial ID, Normal ID, and Impolite ID Messages for Tx1 and Tx2.

- Any message may be a combination of message types including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes). You must count the control characters. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*); do not enter any message.
- If an Impolite ID Message is not programmed, the Normal ID message is sent.

---



---

### Command Form:

Command	Form	Default
Select Initial ID Message for TX1	(PW) 31 30 (message) *	ID in CW
Select Normal ID Message for TX1	(PW) 31 31 (message) *	ID in CW
Select Impolite ID Message for TX1	(PW) 31 32 (message) *	none
Select Initial ID Message for TX2	(PW) 31 33 (message) *	9983 ID in CW
Select Normal ID Message for TX2	(PW) 31 34 (message) *	9983 ID in CW
Select Impolite ID Message for TX2	(PW) 31 35 (message) *	none
Review Initial ID Message for TX1	(PW) 34 30 *	none
Review Normal ID Message for TX1	(PW) 34 31 *	none
Review Impolite ID Message for TX1	(PW) 34 32 *	none
Review Initial ID Message for TX2	(PW) 34 33 *	none
Review Normal ID Message for TX2	(PW) 34 34 *	none
Review Impolite ID Message for TX2	(PW) 34 35 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** TX1 is ID, TX2 is 9983 ID, both in CW.

---

**Note:** Be sure to enter a routing code for messages to TX2 or the message will go to TX1 instead.

---

---



---

## Select ID-Triggered Macros

Assigns macros to be triggered at the appropriate ID events.

- Enter the 4-digit macro name desired. Use leading zeros if needed.
  - To delete a macro, enter the command with no macro name, i.e. (PW) 26 05 \*.
- 
- 

### Command Form:

Command	Form
Select Impolite ID Macro for TX1	(PW) 26 05 (macro name) *
Select Impolite ID Macro for TX2	(PW) 26 48 (macro name) *
Select Initial ID Macro for TX1	(PW) 26 03 (macro name) *
Select Initial ID Macro for TX2	(PW) 26 46 (macro name) *
Select Polite ID Macro for TX1	(PW) 26 04 (macro name) *
Select Polite ID Macro for TX2	(PW) 26 47 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No ID-Triggered Macros are assigned

### Examples:

An *ID-Triggered Macro* is useful when some device is to be energized at ID time instead of the controller's internal message generation. For example, macro 1234 can be created to pulse a logic output. This output can be wired to the start line of a tape cartridge machine. The macro name is programmed into the initial ID macro for TX1, so that the taped message is played only on initial identifications. The command is:

```
(PW) 26 03 1234 *
```

---



---

## Select ID Message Interval

Programs the maximum interval at which ID messages occur.

- Because of the polite nature of the identifier, an ID may be earlier if there is a recent carrier drop. (*Select ID Pending Interval For Tx1 and Tx2* on page 12-6.)
  - Enter 3 digits, 005 to 300, representing 0.5 to 30.0 minutes.
  - Repeaters in US amateur service must identify at least every 10 minutes.
- 
- 

### Command Form:

Command	Form	Data Digit
Select ID Message Interval for TX1 and TX2	(PW) 51 xxx *	(005–300) = (0.5–30.0) minutes

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** ID Message Interval is 3.0 minutes

### Examples:

To change the ID message interval to 4.5 minutes, enter the following command:

(PW) 51 45 \*

To change the ID message interval to (9.9 minutes), enter the following command:

(PW) 51 99 \*

---



---

## Select ID Pending Interval For Tx1 and Tx2

Programs the amount of time the controller “looks ahead” to send a polite ID.

- The *Pending ID Interval* is the amount of time before the end of the *ID Message Interval* (see page 12-5) that the controller looks for the repeater’s carrier to drop to insert a polite ID.
  - A longer interval allows more time for a polite ID to occur, but can cause an ID to occur more often than required.
  - Enter 1, 2, 3, or 4 digits, leading zeroes are not required.
- 
- 

### Command Form:

Command	Form	Data Digits
Select ID Pending Interval for Tx1 and Tx2	(PW) 49 97 xxxx *	(0300-1800) = 30.0-180.0 seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The ID Pending Interval is 30 seconds.

### Example:

To select an ID Pending Interval of 2 minutes (120.0 seconds), enter the following:

(PW) 49 97 1200 \*

---



---

## Reset Initial ID Message To Normal

Causes the Initial Id Message to be the same as the Normal ID Message.

---



---

### Command Form:

Command	Form
Reset Initial ID Message to Normal for TX1	(PW) 54 *

**Acknowledgment:** Sends OK Command Response Message.

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** Both Initial and Normal ID Messages are ID in CW.

### Examples:

On occasion, you may want to change the initial ID message to something special. For example, you could program W8ABC/R MRY XMAS, or W2XYZ/R SWAPFEST SAT, etc. When the season or event is over simply enter:

(PW) 54 \*

---

---

## Send Initial ID Message

Forces the identifier to send the Initial ID Message for TX1, along with any ID Tail Message that may be selected.

---

---

### Command Form:

Command	Form
Send Initial ID Message for TX1	(PW) 55 *

**Acknowledgment:** Sends ID

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default:** None

---



---

## Select (Review) Programmable Tail Messages for Tx1

Defines the Initial and Normal ID Programmable Tail Messages for Tx1.

- A Tail Message is sent immediately after its associated ID Message.
- Tail Messages provide a simple way to turn on and off a supplemental message using the *Select (Review) Initial and Normal ID Tail Messages Command* (see page 12-11).
- Any *Programmable Tail Message* may be a combination of message types including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes). You must count the control characters. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*); do not enter any message.
- This command only establishes the contents of the programmable message. Use the *Select (Review) Initial and Normal ID Tail Messages Command* (see page 12-11) to enable the message.

---



---

### Command Form:

Command	Form	Default
Select Initial ID Programmable Tail Message for TX1	(PW) 31 28 (message) *	none
Select Normal ID Programmable Tail Message for TX1	(PW) 31 29 (message) *	none
Review Initial ID Programmable Tail Message for TX1	(PW) 34 28 *	none
Review Normal ID Programmable Tail Message for TX1	(PW) 34 29 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No message is programmed.

### Example:

To program the *Initial ID Programmable Tail Message for TX1* to say "Net at 8 PM", enter the command:

```
(PW) 31 28 9960 0331 0039 0129 0369 0287 *
```

---



---

## Select (Review) Initial and Normal ID Tail Messages

Defines the Initial and Normal ID Tail Messages for Tx1.

- *Tail Messages* are short CW or programmable messages that can be appended to an ID message.
  - The *Tail Number* (Data Digit “x”) can be 1 or 2 digits selected from the following table.
  - Enter the command with no *Tail Number* to disable the *Tail Message*.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Initial ID Tail Message for TX1	(PW) 50 0 xx *	Tail Message Table (below)
Select Normal ID Tail Message for TX1	(PW) 50 1 xx *	Tail Message Table (below)
Review Initial ID Tail Message for TX1	(PW) 50 0 99 *	none
Review Normal ID Tail Message for TX1	(PW) 50 1 99 *	none

Data Digit	Message	Data Digit	Message	Data Digit	Message
0	(no message)	6	WX in CW	12	/R in CW
1	FEST in CW	7	ALERT in CW	13	LINK in CW
2	DUES in CW	8	WATCH in CW	14	RMT in CW
3	MEET in CW	9	WARN in CW	15	BAT in CW
4	NET in CW	10	RACES in CW	98	(programmable)
5	HI in CW	11	TGIF in CW	(none)	(no message)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Both Initial and Normal ID Tail Messages default to none.

### Example:

To select NET in CW as an Initial ID Tail Message for TX1, enter the command:

(PW) 50 0 4 \*

---



---

## Enable/Disable ID Messages During Autopatch

Allows the Identifier to operate during an autopatch and reverse patch.

- Enter this command to allow the identifier to operate during an autopatch.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
  - By default, the identifier is disabled during an autopatch.
  - This command has no effect if executed during an autopatch. This command will take effect on the next autopatch
- 
- 

### Command Form:

Command	Form	Data Digits
Enable/Disable ID During Autopatch	(PW) 63 09 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Disabled.

### Example:

To enable the identifier during a patch, enter the following:

(PW) 63 09 1 \*

To disable the identifier during a patch, enter the following:

(PW) 63 09 0 \*



---

## Chapter 13

# Links

---

The 7K controller supports a total of 3 receivers, 2 transmitters, and an autopatch. Any receiver may feed any transmitter or the autopatch by turning on or off the 11 possible paths. Paths are defined in the *Enable/Disable Path* command on page 13-2. The priority of the audio routed from each receiver to each transmitter or the autopatch can be selected (see page 13-3). The Access Mode of each receiver enabled to each transmitter can be selected (see page 13-4).

---



---

## Enable/Disable Path

Enables or disables the various Paths 1 through 11.

- Path 1 connects Receiver 1 to Transmitter 1.
  - Path 2 connects Receiver 2 to Transmitter 1.
  - Path 3 connects Receiver 3 to Transmitter 1.
  - Path 4 connects Receiver 1 to Transmitter 2.
  - Path 5 connects Receiver 2 to Transmitter 2.
  - Path 6 connects Receiver 3 to Transmitter 2.
  - Path 7 connects Receiver 1 to Autopatch/Reverse Patch.
  - Path 8 connects Receiver 2 to Autopatch/Reverse Patch.
  - Path 9 connects Receiver 3 to Autopatch/Reverse Patch.
  - Path 10 connects Autopatch/Reverse Patch to Transmitter 1.
  - Path 11 connects Autopatch/Reverse Patch to Transmitter 2.
  - Paths enabled during *Phone Line Control Mode* use the *Monitor/Talk Out Via Phone* command described on page 7-45.
- 
- 

### Command Form:

Command	Form	Default
Enable/Disable Path 1 (Rx1 to Tx1)	(PW) 63 81 x *	ON (enabled)
Enable/Disable Path 2 (Rx2 to Tx1)	(PW) 63 82 x *	ON (enabled)
Enable/Disable Path 3 (Rx3 to Tx1)	(PW) 63 83 x *	ON (enabled)
Enable/Disable Path 4 (Rx1 to Tx2)	(PW) 63 84 x *	ON (enabled)
Enable/Disable Path 5 (Rx2 to Tx2)	(PW) 63 85 x *	ON (enabled)
Enable/Disable Path 6 (Rx3 to Tx2)	(PW) 63 86 x *	ON (enabled)
Enable/Disable Path 7 (Rx1 to AP)	(PW) 63 87 x *	ON (enabled)
Enable/Disable Path 8 (Rx2 to AP)	(PW) 63 88 x *	OFF (disabled)
Enable/Disable Path 9 (Rx3 to AP)	(PW) 63 89 x *	OFF (disabled)
Enable/Disable Path 10 (AP to Tx1)	(PW) 63 90 x *	ON (enabled)
Enable/Disable Path 11 (AP to Tx2)	(PW) 63 91 x *	OFF (disabled)

### Data Digit:

Digit	Meaning
0	OFF (disabled)
1	ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

---

---



---

## Select Audio Routing Priority

Selects the priority of audio routed to the transmitters or phone line.

- For routing to transmitters, audio is only routed when the receiver-to-transmitter path is enabled (*see previous page*).
- In the table, below, *AP* is the Autopatch/Reverse Patch. Audio is only routed when the receiver-to-autopatch path is enabled (*see previous page*) and an autopatch is in progress.
- In the table, below, *LL* is the landline operating in *Phone Line Control Mode*. Audio is only routed when the receiver-to-landline monitor path is enabled (*see page 7-45*) and phone line control mode is in progress.
- Enter the command to select the audio routing priority to modify; replace each 'x' with one digit, 1 through 3, representing receivers 1 through 3, in the order of priority from highest to lowest. All 3 receivers must be specified.

---



---

### Command Form:

Command	Form	Data Digit
Select Rx-to-Tx1 Audio Routing Priority	(PW) 90 00 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3
Select Rx-to-Tx2 Audio Routing Priority	(PW) 90 01 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3
Select Rx-to-AP Audio Routing Priority	(PW) 90 02 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3
Select Rx-to-LL Audio Routing Priority	(PW) 90 03 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Audio Routing Priority is Receiver 1, Receiver 2, then Receiver 3.

### Example:

To specify a priority of Receiver 2, Receiver 1, then Receiver 3 to Transmitter 1, enter:

(PW) 90 00 2 1 3 \*

## Select Path Access Mode

Selects one of 7 possible Access Modes for each receiver-to-transmitter path.

- Enter the command to select the path to modify; replace the 'x' with one digit, 0 through 6, from Patch Access Mode table below.

### Command Form:

Command	Form	Data Digit
Select Rx1-to-Tx1 Access Mode	(PW) 57 00 x *	Path Access Mode Table (below)
Select Rx2-to-Tx1 Access Mode	(PW) 57 01 x *	Path Access Mode Table (below)
Select Rx3-to-Tx1 Access Mode	(PW) 57 02 x *	Path Access Mode Table (below)
Select Rx1-to-Tx2 Access Mode	(PW) 57 03 x *	Path Access Mode Table (below)
Select Rx2-to-Tx2 Access Mode	(PW) 57 04 x *	Path Access Mode Table (below)
Select Rx3-to-Tx2 Access Mode	(PW) 57 05 x *	Path Access Mode Table (below)

### Path Access Modes:

Mode	Access	Explanation
0	No Access	Activity on the COR and PL inputs is ignored.
1	Carrier Access (COR)	Activity on the COR input will enable the path. Activity on the PL input is ignored.
2	PL Access	Activity on the PL input will enable the path. Activity on the COR input is ignored.
3	COR-And-PL Access	Activity on both the COR and PL inputs simultaneously will enable the path.
4	COR-Or-PL Access	Activity on either the COR or PL inputs will enable the path.
5	COR-And-Anti-PL Access	Activity on the COR input simultaneously with no activity on the PL input will enable the path.
6	Always Access	Activity on the COR and PL inputs is ignored. The path is always enabled.

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

---

**Default Condition:** Path Access is Mode 1 (Carrier Access) on all receivers to all transmitters.

---

**Note:** These commands only affect the path access modes. They may be different from DTMF Decoder access modes, if desired.

---

**Examples:**

To prevent audio from Receiver 2 from being routed to Transmitter 1, enter the following command to change the mode to Mode 0 (No Access):

```
(PW) 57 01 0 *
```

Assume that the path for Receiver 1 to Transmitter 1 is in Mode 1 (Carrier Access), and that Mode 2 (PL Access) is desired. Enter the following command to change the mode:

```
(PW) 57 00 2 *
```

A better mode for many repeater installations is Mode 3 (And-PL Access). This mode has better rejection of adjacent-channel interference than Mode 2 (PL Access), since noise falsing from unquelled audio is eliminated. Enter the following command to change the mode on the path from Receiver 1 to Transmitter 1 to Mode 3 (And-PL Access):

```
(PW) 57 00 3 *
```

Mode 4 (Or-PL Access) allows either Carrier Access or PL Access operation. Since PL is more easily detected, PL users will find increased range. Carrier Access users are unaffected. The squelch may be tightened to suppress band-opening problems.

Mode 5 (Anti-PL) is used when the repeater is on the same channel with a PL-accessed repeater. Users of the second system are kept out of the Anti-PL system.

Mode 6 (Always Access) can be used to troubleshoot a receiver that may be generating a bad COR signal or to enable an audio source that does not generate a COR. To enable the path from Receiver 3 to Transmitter 1 without the presence of a COR or PL signal, enter the following:

```
(PW) 57 02 6 *
```

To disable this path, enter the following:

```
(PW) 57 02 0 *
```



---

## *Chapter 14*

# Logic Inputs

---

The *7K Controller* supports six uncommitted *Logic Inputs* for detecting changes in conditions from sensors at the repeater site. In addition, the three COR inputs, the three PL inputs, and the Phone Line Busy input are capable of acting as logic inputs in addition to their normal duties.

Logic inputs are scanned for a transition from the High state to the Low state, and from the Low state to the High state. When one of these transitions is detected, the appropriate macro is executed.

Logic inputs can be used for alarms or indicators of such conditions as burglary, high water, high SWR, overtemperature, and so on. The inputs are held high with pullup resistors, and must be pulled down by the sensor.

---



---

## Assign Macro To Logic Input

Assigns a macro to be executed by the transition shown.

- Enter the password, the 4-digit root number, the macro you wish to have executed on the transition, and the (\*).
  - If the macro name has fewer than four digits, enter leading zeroes.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Assign Macro to Logic Input 1 Hi-to-Lo	(PW) 26 20 (macro name) *
Assign Macro to Logic Input 1 Lo-to-Hi	(PW) 26 21 (macro name) *
Assign Macro to Logic Input 2 Hi-to-Lo	(PW) 26 22 (macro name) *
Assign Macro to Logic Input 2 Lo-to-Hi	(PW) 26 23 (macro name) *
Assign Macro to Logic Input 3 Hi-to-Lo	(PW) 26 24 (macro name) *
Assign Macro to Logic Input 3 Lo-to-Hi	(PW) 26 25 (macro name) *
Assign Macro to Logic Input 4 Hi-to-Lo	(PW) 26 26 (macro name) *
Assign Macro to Logic Input 4 Lo-to-Hi	(PW) 26 27 (macro name) *
Assign Macro to Logic Input 5 Hi-to-Lo	(PW) 26 28 (macro name) *
Assign Macro to Logic Input 5 Lo-to-Hi	(PW) 26 29 (macro name) *
Assign Macro to Logic Input 6 Hi-to-Lo	(PW) 26 30 (macro name) *
Assign Macro to Logic Input 6 Lo-to-Hi	(PW) 26 31 (macro name) *
Assign Macro to Phone Line Busy Input Hi-to-Lo	(PW) 26 32 (macro name) *
Assign Macro to Phone Line Busy Input Lo-to-Hi	(PW) 26 33 (macro name) *
Assign Macro to COR Input 1 Hi-to-Lo	(PW) 26 34 (macro name) *
Assign Macro to COR Input 1 Lo-to-Hi	(PW) 26 35 (macro name) *
Assign Macro to COR Input 2 Hi-to-Lo	(PW) 26 36 (macro name) *
Assign Macro to COR Input 2 Lo-to-Hi	(PW) 26 37 (macro name) *
Assign Macro to COR Input 3 Hi-to-Lo	(PW) 26 38 (macro name) *
Assign Macro to COR Input 3 Lo-to-Hi	(PW) 26 39 (macro name) *
Assign Macro to PL Input 1 Hi-to-Lo	(PW) 26 40 (macro name) *
Assign Macro to PL Input 1 Lo-to-Hi	(PW) 26 41 (macro name) *
Assign Macro to PL Input 2 Hi-to-Lo	(PW) 26 42 (macro name) *
Assign Macro to PL Input 2 Lo-to-Hi	(PW) 26 43 (macro name) *
Assign Macro to PL Input 3 Hi-to-Lo	(PW) 26 44 (macro name) *
Assign Macro to PL Input 3 Lo-to-Hi	(PW) 26 45 (macro name) *

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No Macros assigned

**Examples:**

Let's assume that *Logic Input 1* has been wired to an intrusion switch. The opened switch contacts are in series between the logic input and ground. When the switch is tripped, the logic input sees a high level. We want this transition to cause the CW pitch to change. To accomplish this, you must create a macro that changes the CW pitch to the desired value. Let's assume that a macro already exists to do this, and its name is 0050.

Now, you must enter the command to assign this macro to logic input 1's low-to-high transition. The command is:

```
(PW) 26 21 0050 *
```

---

**Note:** This is now a *latched* condition. That is, once the switch is tripped and the CW pitch is changed, the pitch will stay at the new value until commanded back to normal. This may be desirable, since the switch could have been tripped late at night. You would need to keep the CW pitch changed until acknowledged, not changed back to normal when the switch goes back to its original state.

---

Other applications require that the condition not be latched. For example: A 115V relay could be wired with its coil to the 115VAC line at the repeater site. If it has a SPST contact available, the contact could be wired in series between a logic input and ground. When the relay is energized and the contact is closed, the repeater is operating from AC power. When the relay is de-energized and the contact is open, the repeater is operating from battery power. The contact provides this information to the controller, which could append *BAT* (or a similar message) to the repeater tail message. Users would know that they should limit transmissions when they hear the *BAT* message. When AC power is restored, the controller would automatically turn OFF the *BAT* message.

To program the above scenario requires two macros: one to program *BAT* into the dropout message, and one to program (nothing) into the dropout message.

Assume that two such macros already exist, and they are: 0700 programs BAT, and 0701 removes BAT.

To assign these macros to logic input 2, enter the following commands:

```
(PW) 26 22 0701 * (removes message).
```

```
(PW) 26 23 0700 * (programs message).
```

---

## *Chapter 15*

# Logic Outputs

---

The controller has seven *Logic Outputs* that are available for your use in operating auxiliary devices at the repeater site (the two transmitter PTT outputs are not included in the 7 logic outputs). These outputs can be latched ON or OFF, or can be momentarily pulsed ON or OFF.

“ON” refers to the state of an output when it is sinking current to ground; “OFF” refers to the state of an output when it is open (floating).

---



---

## Select Logic Outputs

Controls the seven Logic Outputs.

- List the outputs to be controlled by entering any combination of digits 1–7.
- 
- 

### Command Form:

Command	Form
Select Logic Outputs Latched OFF	(PW) 71 (list the outputs) *
Select Logic Outputs Latched ON	(PW) 70 (list the outputs) *
Select Logic Outputs Momentary OFF	(PW) 73 (list the outputs) *
Select Logic Outputs Momentary ON	(PW) 72 (list the outputs) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 2	illegal digit entered

**Default Condition:** All Logic Outputs are OFF (disabled)

### Examples:

There are several examples for logic outputs. To turn ON logic output 1, enter:

```
(PW) 70 1 *
```

To turn ON logic output 2, enter:

```
(PW) 70 2 * (Logic output 1 is still ON.)
```

To turn OFF both logic outputs, enter:

```
(PW) 71 1 2 *
```

To momentarily turn ON logic output 1, enter:

```
(PW) 72 1 *
```

To momentarily turn ON both logic outputs, enter:

```
(PW) 72 1 2 *
```

If logic output 2 is ON, you may momentarily turn it OFF by entering:

```
(PW) 73 2 *
```

---

## *Chapter 16*

# Receiver Functions

---

The commands in this chapter relate to the three receiver ports.

Each receiver has access to either or both transmitters, if enabled (see the *Links* chapter on page 13-1). Each receiver has access to the DTMF decoder, if enabled (see the *DTMF Decoder* chapter on page 11-1).

The usual configuration has Receiver 1 as the repeater receiver, and Receivers 2 and 3 as link receivers. Or, Receiver 3 might be a control receiver with priority access to the DTMF decoder. The final configuration is up to the programmer.

---



---

## Select Receiver Activity-Triggered Macros Select Receiver Post-Activity Timers

Allows the programmer to execute macros based on activity detected by the receivers.

Receiver Post-Activity Timers delay the macro execution for a programmable length of time after last activity.

- Each receiver has its own *Start-of-Activity Macro*, *Post-Activity Macro*, and *Post-Activity Timer*.
- The *Receiver Post-Activity Timer* starts each time receiver activity ends. When the timer expires, the macro associated with the receiver is executed. The timers require two data digits representing the delay. “00-99” equals 0.0-9.9 minute delay.
- These macros execute based solely on receiver activity, and act independently of the transmitter paths that the receivers drive.
- Be sure to set the corresponding receiver access mode for Receiver 1, 2, and 3 using the *Select Path Access Mode* commands for Rx1-to-Tx1, Rx2-to-Tx1, and/or Rx3-to-Tx1 on page 13-4.

---



---

### Command Form:

Command	Form	Data Digit
Select RX1 Start-of-Activity Macro	(PW) 26 67 (macro name) *	not applicable
Select RX1 Post-Activity Macro	(PW) 26 68 (macro name) *	not applicable
Select RX2 Start-of-Activity Macro	(PW) 26 69 (macro name) *	not applicable
Select RX2 Post-Activity Macro	(PW) 26 70 (macro name) *	not applicable
Select RX3 Start-of-Activity Macro	(PW) 26 71 (macro name) *	not applicable
Select RX3 Post-Activity Macro	(PW) 26 72 (macro name) *	not applicable
Select RX1 Post-Activity Timer	(PW) 99 00 xx *	xx = duration = 00–99 = 0.0–0.0 minutes
Select RX2 Post-Activity Timer	(PW) 99 01 xx *	xx = duration = 00–99 = 0.0–0.0 minutes
Select RX3 Post-Activity Timer	(PW) 99 02 xx *	xx = duration = 00–99 = 0.0–0.0 minutes

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros are assigned; Timers are 1.0 minute

**Examples:**

These macros execute based solely on receiver activity, and act independently of the transmitter paths that the receivers drive. The setting of the corresponding receiver path to Tx1 determines when there is receiver activity even if the corresponding path is not enabled.

If Receiver 2 is a link receiver, for example, the link can be “knocked down” (disabled) after several minutes of link inactivity.

These receiver-driven macros should not be confused with the *Repeater Activity-Triggered Macro* feature, which requires that Path 1 (Receiver 1 to Transmitter 1) be enabled. See the *Enable/Disable Path 1 (RX1 to TX1)* command on page 13-2.

---



---

## Select COR Pulse-Triggered Macro Select Pulse Parameters

Selects macro to be executed when a user keys the microphone PTT button several times in succession.

Sets required characteristics of received pulses.

The controller can execute a macro when a user keys his microphone PTT button several times in succession. Two commands are used to set up this feature: One command selects the macro to be executed, and the other sets the parameters of the pulse string. For the *Select COR Pulse-Triggered Macro* command:

- *Macro Name* is the macro to be executed.
- The macro will be executed on the falling edge of the last pulse.
- The macro will *not* be executed if any *Pulse Parameters* are not met.

Three variables affect the setting of *Pulse Parameters*:

- *Pulse Count* is the number of pulses that occur within the *Minimum Duration* and *Window Time* parameters to trigger execution of the macro. The range is 0 to 9 pulses.
- *Minimum Duration* (sometimes called *Width*) is the required duration of a pulse, measured in 10mS counts. The range is 0001 to 9999 counts, or 00.01 (10mS) to 99.99 seconds. By requiring a certain minimum duration, the controller can discriminate against narrow noise pulses. Use four digits.
- *Window Time* (sometimes called *Window*) is the overall time allowed for all the pulses to be counted and is measured in 10mS increments. The range is 0001 to 9999 counts, or 00.01 (10mS) to 99.99 seconds. Use four digits.

---



---

### Command Form:

Command	Form	Data Digit
Select COR Pulse-Triggered Macro	(PW) 26 17 (macro name) *	none exist
Select Pulse Parameters	(PW) 47 0 x yyyy zzzz *	x = pulse count = 0–9 pulses y = minimum duration = (0001–9999) = = (00.01–99.99) sec z = window time = (0001–9999) = (00.01–99.99) sec

**Acknowledgment:** Sends OK

**Errors:**

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered, or conflict in parameters

**Default:** No Macros exist;, Pulse Count is 3; Minimum Duration is 0.5 sec; Window Time Is 5.0 sec

**How it Works**

The *Window Timing Cycle* starts at the leading edge of the first *Pulse*. If the pulse is longer than the *Minimum Duration* programmed, it is counted. If the correct number of pulses is counted before the *Window* “closes,” the programmed *COR Pulse-Triggered Macro* will be executed upon the falling edge of the last counted pulse.

The controller calculates a *Maximum Pulse Duration* and *Maximum Dead Zone* (time between pulses) when you program the parameters. During a window timing cycle, the controller is timing pulses and deadzones. The window cycle will be aborted if the inter- pulse dead zone exceeds the maximum value; if any pulse exceeds the maximum value; and if any pulse is less than the minimum duration. This means that a new window timing cycle can begin as soon as the old one is either properly executed or discarded for any reason.

Pulses are created by COR and PL signals and depend upon the repeater access mode. If the repeater is in carrier access mode, the controller will count pulses at the COR input. If the repeater is in And-PL access mode, the controller will count pulses that are comprised of both COR and PL signals.

**Examples:**

To execute macro 1234 if 3 COR pulses of at least 0.5 seconds each are detected within a 5.0-second window. Enter these two commands:

```
(PW) 26 17 1234 * ;(which assigns macro "1234").
```

```
(PW) 47 0 3 0050 0500 * ;(which assigns parameters).
```

“0025” = 25 x 10mS = 250mS = 1/4 second and “0500” = 500 x 10mS = 5000mS = 5.0 seconds

The controller calculates that 4 pulses times 1/4 second each, which equals one second pulse duration. The maximum dead zone is then 4 seconds, and no pulse can exceed 4 1/ 4 seconds. The window will close if any of these timers are exceeded.

The controller will respond with an error message if the pulse count, multiplied by the minimum duration, exceeds the window time.

---



---

## Enable/Disable End-of-Transmission Command Execution

Allows commands to be terminated by ending the transmission (releasing user PTT). This is in addition to the usual (\*) character.

- The (\*) character will terminate a command in any case.
- You may enable or disable this feature separately for each receiver.
- If this feature is enabled, the command will be executed 0.25 seconds after the transmission ends.
- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable End-of-Transmission Command Execution for RX1	(PW) 63 57 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable End-of-Transmission Command Execution for RX2	(PW) 63 58 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable End-of-Transmission Command Execution for RX3	(PW) 63 59 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default condition:** End-of-Transmission Command Execution is OFF (disabled) for all receivers; (\*) character required to terminate all commands

**Examples:**

Whether or not this feature is enabled, the (\*) character will always terminate a command. This is particularly useful if an input signal keeps the receiver active after a user enters a DTMF command.

If the feature is enabled, users can simply enter a command and release the push-to-talk button instead of entering the trailing (\*). The 0.25-second delay prevents a partial command from being accidentally executed if the user's signal momentarily drops.

---



---

## Select From-Start-of-Transmission Timer

Allows controller to “disconnect” the DTMF decoder from a receiver if it appears no DTMF command will be entered during a transmission.

- The DTMF decoder is free to find another source of DTMF commands if the current user does not enter a digit within 5 seconds from start of transmission (See the *Select DTMF Priority/Scan* command on page 11-3).
  - Reduces DTMF “falsing”, since the DTMF decoder only listens during the beginning of the transmission.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable From-Start-of-Transmission Timer for RX1	(PW) 63 64 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable From-Start-of-Transmission Timer for RX2	(PW) 63 65 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable From-Start-of-Transmission Timer for RX3	(PW) 63 66 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** From-Start-of-Transmission Timer is OFF (disabled) for all receivers.

### Examples:

If this feature is disabled, the receiver will feed the DTMF decoder for the duration of the transmission (subject to its priority). (See the *Select DTMF Priority/Scan* command on page 11-3).

If this feature is enabled, the receiver will feed the DTMF decoder for the first 5 seconds of the transmission (subject to its priority). If a user wishes to enter a command and has already transmitted more than 5 seconds, he must unkey and re-key before entering the command. Once a DTMF digit is entered, the receiver will continue to feed the DTMF decoder for the remainder of the transmission.

---

---

## Chapter 17

# Transmitter Functions

---

### Transmitter Tail Sequence

There are a number of commands which control the *Transmitter Tail Sequence*. *Figure 2* will help in the understanding of them. The terms used in these commands are defined as follows.

#### **Courtesy Delay and Courtesy Message**

When a transmitting station unkeys his/her microphone, the *Courtesy Delay* starts. When the courtesy delay timer times out, the *Courtesy Message* is sent. At the same time, the repeater *Transmitter Timeout Timer* is reset. The purpose of the courtesy message is to inform the next station that he/she may now transmit for the full duration of the transmitter timeout timer. The courtesy delay encourages stations to allow a short break in their transmissions, allowing other stations to break in.

#### **Dropout Delay and Dropout Message**

After the courtesy delay resets, another timer, the *Dropout Delay* starts. When the dropout delay times out, the *Dropout Message* will be sent, and the repeater transmitter will drop. (Dropout delay is sometimes referred to as *Hang Time*.)

#### **Transmitter Timeout Timer and Timeout Message**

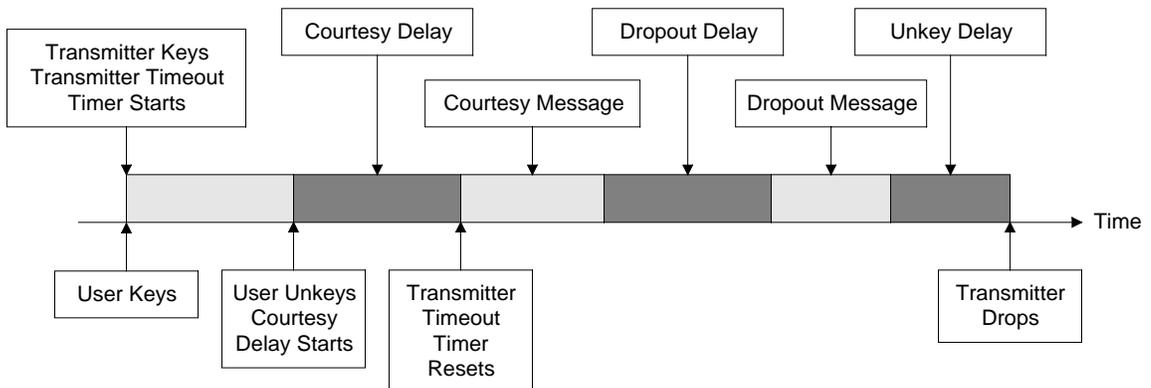
If a station transmits for a longer period than set by the *Transmitter Timeout Timer*, the *Timeout Message* will be sent and the repeater transmitter will drop.

If a station can override the offending station and enter the *Reset Transmitter Timeout Timer* command (on page 17-7), the transmitter will return to the air and the timer will be reset. When the offending station releases his/her push-to-talk button for at least one second (and no one has reset the timer for the offending station), the timeout message will be sent again to inform him/her that part of their transmission may have been lost.

## Transmitter Unkey Delay

The *Transmitter Unkey Delay* holds the transmitter keyed for a programmable period of time to prevent dropout between software keying requests. Event macros can be defined that allow actions to occur at these events, eg. to disable a CTCSS encoder before the transmitter is unkeyed (see page 17-14).

All the above delays and messages—as well as the transmitter timeout timer—are fully programmable by the trustee. If, for example, the trustee does not wish to have any courtesy delay or courtesy message, he/she may delete both. In such case, the timer used for transmitter timeout timer will reset immediately upon the user dropping his carrier. *Figure 2* represents the *Transmitter Tail Sequence*.



**Figure 2**

---



---

## Select Courtesy Delay

Programs the Courtesy Delay time.

- The *Courtesy Delay* time is the delay from COR drop to when the *Transmitter Timeout Timer* resets and the courtesy message begins. See *Figure 2* on page 17-2.
  - Enter two digits, from 00 to 50, representing a delay time from 0.0 to 5.0 seconds.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Courtesy Delay	(PW) 32 xx *	(00–50) = (0.0–5.0) seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Courtesy Delay is 0.5 seconds

### Examples:

A generous amount of courtesy delay forces repeater users to delay their transmissions, thus allowing other stations to break into the conversation. This is something referred to as an *anti-tailgating* measure. A station that ignores the courtesy message (indicating that the transmitter timeout timer has been reset) runs the risk of *timing out* the repeater. That station will have to repeat the portion of its transmission which was lost. To program the courtesy delay for 1.4 seconds, for example, enter this command:

```
(PW) 32 14 *
```

Some repeater groups prefer no courtesy time; that is, the transmitter timeout timer resets as soon as the COR drops. The courtesy message may also be erased.

To program the courtesy delay for zero delay, enter this command:

```
(PW) 32 00 *
```

---



---

## Select Dropout Delay

Sets the Dropout Delay time.

- The *Dropout Delay* time is the interval from the end of the *Courtesy Delay/Courtesy Message* (and *Reset Transmitter Timeout Timer*) to the moment the transmitter is unkeyed. See *Figure 2* on page 17-2.
- Enter the two digits, from 00 to 50, representing a delay from 0.0 to 5.0 seconds.

---



---

### Command Form:

Command	Form	Data Digit
Select Dropout Delay	(PW) 30 xx *	(00–50) = (0.0–5.0) seconds

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Dropout Delay is 3.0 seconds

### Examples:

Owners of tube-type repeaters sometimes use long a dropout delay to lengthen the lives of tubes and relays. Fewer transmitter keying transitions will occur, since the users will keep the transmitter up for the duration of the conversation. Dropout time for solid-state repeaters is mostly up to personal preference. To program the dropout delay for 2.1 seconds, for example, enter this command:

```
(PW) 30 21 *
```

To program the dropout delay for maximum time, enter the following:

```
(PW) 30 00 *
```

---



---

## Select Transmitter Timeout Timer

Controls the maximum amount of time an input carrier signal may be present.

- The *Transmitter Timeout Timer* starts timing when the COR becomes active, and continues to run until reset.
- The timer is reset either by command (on page 17-7) or releasing the carrier signal until the *Courtesy Delay* time elapses. See *Figure 2* on page 17-2.
- Enter one, two, or three digits from 1 to 546 to set the transmitter timeout timer to 0.1 to 54.6 minutes.
- To disable the timer completely, enter three zeroes.

---



---

### Command Form:

Command	Form	Data Digit
Select Transmitter Timeout Timer	(PW) 40 xxx *	000 = infinity (001–546) = (0.1–54.6) minutes

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Transmitter Timeout Timer is 3.0 minutes

### Examples:

Some of the ways to program the transmitter timeout timer follow: To change the transmitter timeout timer from its existing value to 4.5 minutes, enter:

(PW) 40 45 \*

To change the transmitter timeout timer to 10.0 minutes, enter:

(PW) 40 100 \*

To set the timer for infinity (no timeout), enter:

(PW) 40 000 \*

---

**Note:** The amount of time entered is in minutes and tenths of minutes. Therefore, entering (PW) 40 3 \* will set the timer to 0.3 minutes (18 seconds). If you want 3.0 minutes, be sure to enter (PW) 40 30 \*.

Leading zeroes are permitted. Therefore, entering (PW) 40 30 \* would be the same as entering (PW) 40 030 \*.

---

---

---

## Reset Transmitter Timeout Timer

Resets the Transmitter Timeout Timer.

- If the transmitter timeout timer has been exceeded, this command will allow the transmitter to return to the air.

---

---

### Command Form:

Command	Form
Reset Transmitter Timeout Timer	(PW) 10 *

**Acknowledgment:** None

**Errors:** None

**Default:** None

### Examples:

If the transmitting station has caused a timeout to occur, the receiving station may be able to bring the transmitter back up. To do so would require the receiving station to be able to override the offending station at the repeater site. Entering the *Reset Transmitter Timeout Timer* command will reload the timer as well as return the repeater transmitter to the air.

---



---

## Enable/Disable Transmitter

Enables or disables the specified Transmitter (TX1 or TX2) while not affecting receiver functions.

- The receiver will still be able to send commands to the controller, but the transmitter will not be keyed upon receiving COR signals.
  - See the various *Key Transmitter* commands beginning on page 17-9.
- 
- 

### Command Form:

Command	Form	Data Digit
Enable/Disable Transmitter 1	(PW) 63 00 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Transmitter 2	(PW) 63 22 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** None

### Errors:

Error	Meaning
? err 1	wrong number of digits entered (disable only)
? err 2	illegal digit entered (disable only)

**Default Condition:** Both Transmitters TX1 and TX2 are ON (enabled)

---



---

## Key Transmitter (Timed)

Keys the specified Transmitter (TX1 or TX2) for a timed period.

- The specified transmitter will not key under this command if it has been disabled using the *Enable/Disable Transmitter* command on page 17-8.
  - Enter transmitter, 1 or 2.
  - Enter a 1-, 2-, or 3-digit number representing the amount of time the transmitter should key (in tenths of minutes).
  - Enter nothing (or 000) to cancel key request.
- 
- 

### Command Form:

Command	Form	Data Digit
Key Transmitter (Timed)	(PW) 00 x yyy *	x = transmitter = (1 or 2) yyy = (001–546) = (0.1–54.6) minutes or yyy = [ (nothing) , 0, 00, 000] = cancel key

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digits entered

**Default Condition:** Both Transmitters TX1 and TX2 are not requested to key

---



---

## Key Transmitter (Untimed)

Keys the specified transmitter (TX1 or TX2) until canceled.

- The specified transmitter will not key under these commands if it has been disabled using the *Enable/Disable Transmitter* command on page 17-8.
- Enter one digit, 0 for OFF (cancel), 1 for ON (key).
- The transmitter will remain keyed indefinitely, until canceled.

---



---

### Command Form:

Command	Form	Data Digit
Key Transmitter 1 (Untimed)	(PW) 63 41 x *	1 = key 0 = cancel key
Key Transmitter 2 (Untimed)	(PW) 63 42 x *	1 = key 0 = cancel key

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Conditions:** Both Transmitters TX1 and TX2 are not requested to key

---



---

## Enable/Disable Transmitter Minimum Unkey Delay

Enables or disables the transmitter minimum unkey delay.

- A *Minimum Unkey Delay* is normally observed on Transmitter #1 to prevent it from unkeying between software keying requests. If this delay is disabled, the transmitter may drop out between messages or other activities that require keying.
- The delay may be disabled in special applications (such as half-duplex linking) where fast unkeying is desired.

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable TX1 Minimum Unkey Delay	(PW) 63 31 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable TX2 Minimum Unkey Delay	(PW) 63 32 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Conditions:** *Minimum Unkey Delay* for TX1 is ON (enabled);  
for TX2 is OFF (disabled)

---



---

## Select Transmitter Minimum Unkey Delay

Programs the minimum amount of time for a transmitter to unkey.

- A Transmitter 1 Minimum Unkey Delay can be programmed from 0 to 655.3 seconds.
- A Transmitter 2 Minimum Unkey Delay can be programmed from 0 to 655.3 seconds.
- Enter the timeout value as 1, 2, 3, or 4 digits, leading zeroes are not required.
- A programmed Minimum Unkey Delay will not be present unless it is enabled using the *Enable/Disable Transmitter Minimum Unkey Delay* command (see page 17-11).

---



---

### Command Form:

Command	Form	Data Digit
Select Tx1 Minimum Unkey Delay	(PW) 49 98 xxxx *	from table below
Select Tx2 Minimum Unkey Delay	(PW) 49 99 xxxx *	from table below

Data Digit	Explanation
xxxx = 0000-6553	seconds in 0.1 second increments from 0.0 to 655.3 seconds as 1, 2, 3, or 4 digits

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	invalid timer or seconds parameter

**Default Condition:** None.

### Example:

To set the Transmitter 1 Minimum Unkey Delay to 0.4 second, enter the command:

```
(PW) 49 98 4 *
```

To set the Transmitter 2 Minimum Unkey Delay to 5.0 seconds, enter the command:

```
(PW) 49 99 50 *
```

---



---

## Select Receiver-to-Transmitter-Triggered Macros

Allows the programmer to execute macros based on receiver-to-transmitter activity.

- Macros can be executed based on receiver-to-transmitter activity.
  - Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
  - If the macro name has fewer than 4 digits, enter leading zeros.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Assign Macro to Any-Receiver-Active to Tx1	(PW) 26 11 (macro name) *
Assign Macro to All-Receivers-Inactive to Tx1	(PW) 26 09 (macro name) *
Assign Macro to Any-Receiver-Active to Tx2	(PW) 26 73 (macro name) *
Assign Macro to All-Receivers-Inactive to Tx2	(PW) 26 74 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.

---



---

## Select Transmitter PTT-Triggered Macros

Allows the programmer to execute macros based on transmitter keying.

- Each transmitter has its own *PTT Inactive-to-Active Macro*, *PTT Active-to-Inactive Before Unkey Delay Macro*, and *PTT Active-to-Inactive Macro*.
  - Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
  - If the macro name has fewer than 4 digits, enter leading zeros.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

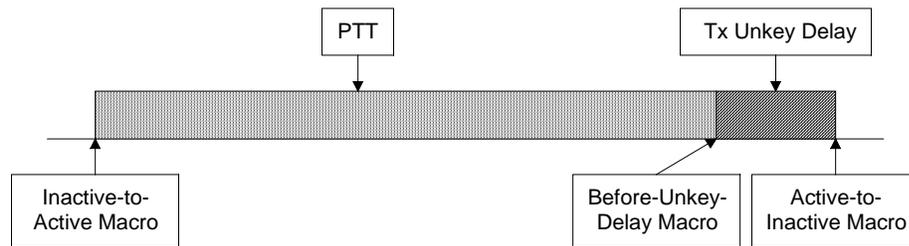
Command	Form
Assign Macro to Tx1 PTT Inactive-to-Active	(PW) 26 82 (macro name) *
Assign Macro to Tx1 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 83 (macro name) *
Assign Macro to Tx1 PTT Active-to-Inactive	(PW) 26 84 (macro name) *
Assign Macro to Tx2 PTT Inactive-to-Active	(PW) 26 85 (macro name) *
Assign Macro to Tx2 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 86 (macro name) *
Assign Macro to Tx2 PTT Active-to-Inactive	(PW) 26 87 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.



**Example 1:**

PTT-triggered macros provide a way to generate messages, control logic outputs, start timers, etc., for functions that need to be synchronized to a transmitter’s operation. The Inactive-to-Active macro is executed when the transmitter is keyed. The Active-to-Inactive macro is executed when the transmitter is unkeyed. The Active-to-Inactive Before Unkey Delay macro is executed a programmable amount of time before the transmitter is actually unkeyed.

As an example, let’s say that you have a CTCSS encoder on your repeater transmitter and your repeater users program their radios to only open their receivers when a CTCSS tone is present. If the CTCSS tone is always present on your transmitter, then, when the transmitter unkeys, a squelch burst is heard in your users’ receivers. To prevent the squelch burst, you could disable the CTCSS tone on your transmitter a small amount of time before the transmitter is unkeyed so that the users’ receivers would close before the squelch burst could occur.

To control a CTCSS encoder, you would write two macros and assign them to the Inactive-to-Active and Active-to-Inactive Before Unkey Delay-triggered macros to enable and disable the CTCSS encoder using a Logic Output.

To create a macro that turns on Logic Output 7 to enable the CTCSS encoder, enter the following:

```
(PW) 20 9107 (PW) 70 7 *
```

To create a macro that turns off Logic Output 7 to disable the CTCSS encoder, enter the following:

```
(PW) 20 9108 (PW) 71 7 *
```

To assign these macros to the PTT-triggered events, enter the following:

```
(PW) 26 82 9107 *
(PW) 26 83 9108 *
```

To adjust the amount of time that the transmitter stays keyed after the tone encoder is disabled, set the Transmitter Minimum Unkey Delay (see page 17-15). For example, to set the Tx1 Minimum Unkey Delay to 0.4 seconds, enter the following:

```
(PW) 49 98 4 *
```

---

**Note:** an alternate way to control a CTCSS tone on Transmitter 1 is to use the controller's dedicated CTCSS audio gate (see page 10-2). When enabled, this audio gate opens to pass audio when Transmitter 1 is keyed and closes at the beginning of the Tx1 Minimum Unkey Delay. You would use the Select Tx1 Minimum Unkey Delay command as in the example above to adjust the amount of time the transmitter stays keyed after the CTCSS encoder is disabled. This method does not require the use of PTT-triggered macros.

---

**Example 2:**

The PTT-triggered macros can be used with the User Timers to control external equipment that should operate for a time after a transmitter is unkeyed. See page 20-7 for an example of controlling a fan.

---

## *Chapter 18*

# Repeater Functions

---

The commands in this chapter relate to the repeater, which we define as the Receiver 1 and Transmitter 1 combination. Receivers 2 and 3, and Transmitter 2, are generally viewed as link devices, and are described in other chapters (see *Receiver Functions* on page 16-1, *Transmitter Functions* on page 17-1, and *Links* on page 13-1).

---



---

## Select Repeater Access Mode (Path 1)

Selects one of seven possible Access Modes for Path 1.

- Enter one digit from the *Repeater Access Mode Table* below.

---



---

### Command Form:

Command	Form	Data Digit (Mode)
Select Repeater Access Mode (Path 1)	(PW) 57 00 x *	Repeater Access Mode Table (below)

Mode	Repeater Access	Explanation
0	No Access	Activity on the COR and PL inputs is ignored.
1	Carrier Access	Activity on the COR input will key the transmitter; activity on the PL input is ignored.
2	PL Access	Activity on the PL input will key the transmitter; activity on the COR input is ignored.
3	And-PL Access	Activity on both the COR and PL inputs simultaneously will key the transmitter.
4	Or-PL Access	Activity on either the COR or PL inputs will key the transmitter.
5	Anti-PL Access	Activity on the COR input simultaneously with no activity on the PL input will key the transmitter.
6	Always Access	Activity on the COR and PL inputs is ignored. The path is always enabled.

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Access Mode for Path 1 is Mode 1 (Carrier Access)

---

**Note:** Repeater access mode may be made different from DTMF decoder access mode, if desired. (See page 11-5.)

---

**Examples:**

Assume that the repeater is in carrier access mode, and that PL access is desired. The proper command would be:

```
(PW) 57 00 2 *
```

A better mode for many repeater installations is mode 3, And-PL access. This mode has better rejection of adjacent-channel interference than mode 2, since noise falsing from unsquelched audio is eliminated. Also, COR drops out more quickly than PL, allowing a quick dropout result. Enter this command:

```
(PW) 57 00 3 *
```

Mode 4 allows both carrier access and PL operation. Since PL is more easily detected, PL users will find increased range. Carrier access users are unaffected. The squelch may be tightened to suppress band opening problems. Anti-PL is used when the repeater is co-channel with another, PL-accessed repeater. Users of the second system are kept out of the Anti-PL system.

If you broadcast *Newsline Report*, the no access mode (mode 0) means that transmissions on the repeater input are ignored and can't interfere with the broadcast.

If you need to control the system on its input, place the DTMF decoder in a PL mode.

## Select Repeater Activity-Triggered Macros

### Select Repeater Activity Counter/Timer

Allows the programmer to execute macros based on the activity of the repeater.

Sets the *Repeater Activity Counter/Timer* (both the Event Count and the Duration).

- No data digits are required for the macros.
- Select the *Repeater Activity Counter/Timer (Event Count)* using 1-digit, 0–9. Setting the counter to 0 (zero) means that the *Post-Activity Macro* will execute each activity cycle. Setting the counter to 1 means that the post-activity macro will execute every other activity cycle, and so on. Setting the counter to 9, therefore, means that the post-activity macro will execute every 10th cycle.
- Select the *Repeater Activity Counter/Timer (Duration)* using 2 digits representing the delay. (00–99) equals (0.0–9.9) minute delay.

#### Command Form:

Command	Form	Data Digit
Select Repeater Start-of-Activity Macro	(PW) 26 14 (macro name) *	not applicable
Select Repeater Post-Activity Macro	(PW) 26 15 (macro name) *	not applicable
Select Repeater Activity Counter/Timer	(PW) 45 x yy*	x = (event count) = (0–9) y = (duration) = (00–99) = (0.0–9.9) minute delay

**Acknowledgment:** Sends OK

#### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default:** No Macros are assigned; Event Count is 0; Duration is 1.0 minutes

**Example:**

Applications for this feature include tape recording all repeater conversations, in which case, the activity count would be set to zero. However, if a taped message is to be played every 5th usage of the repeater, set the activity counter/timer to 4.

The three related *Select Repeater Activity-Triggered Macros* commands allow the programmer to execute macros based on repeater activity. For example, a bulletin may be sent a few minutes after the last activity of the repeater. Since the repeater was recently used, it is likely an audience still exists to hear the message. Of course, the bulletin would be too repetitious to send every time the repeater is used. In this light, the activity counter/ timer allows the programmer to select how often to execute the macro.

The *Repeater Start-of-Activity Macro* is executed when a fresh key-up occurs. This event starts an “activity cycle” which ends a certain time after the tail finishes. If activity occurs before the activity counter/timer expires, the activity cycle is simply extended. When the activity counter/timer finally expires, the *Repeater Post-Activity Macro* is executed. The activity counter/timer, which watches the number of activity cycles, is programmable in duration from 0–9.9 minutes and from 0–9 events.

Once the activity cycle has been completed, the start-of-activity macro is again “armed” and ready to execute at the next key-up activity. This is true regardless of whether the last repeater post-activity macro was actually executed (it may have been waiting for the proper activity count).

---

**Note:** The *Repeater Activity Counter/Timer* starts when the dropout message is sent.

---

---



---

## Select Anti-Kerchunker Parameters

Programs the “Anti-Kerchunk” *Key-up Delay* and *Re-Arm Delay* for the repeater.

- Users must key for the selected length of time before the repeater transmitter keys.
  - Once the *Key-Up Delay* is exceeded, the feature is disabled.
  - The anti-kerchunker is *Re-Armed* if no activity is present for a selected length of time after the repeater transmitter drops.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Key-Up Delay	(PW) 80 xx *	xx = duration = (00–99) = (0.0–9.9) seconds
Select Re-Arm Delay	(PW) 99 10 xx *	xx = duration = (00–99) = (0.0–9.9) minutes

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Key-Up Delay is 0 seconds; Re-Arm Delay is to 0 minutes

**Examples:**

If you want to require a one-half second key-up delay, enter:

```
(PW) 80 05 *
```

Unless changed, the anti-kerchunker will re-arm as soon as the repeater transmitter drops. If you want a 1.5 minute delay in re-arming, enter:

```
(PW) 99 10 15 *
```

To disable the anti-kerchunker, set the key-up delay to 0:

```
(PW) 80 00 *
```

---

---

## Select Anti-Kerchunk No Hangtime Mode

Allows the programmer to modify the operation of the Anti-Kerchunker.

- By default and when disabled, the Anti-Kerchunker does not key the transmitter during the Key-Up Delay.
  - By enabling the No Hangtime Mode, the transmitter is keyed during the Key-Up Delay.
  - Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).
- 
- 

### Command Form:

Command	Form	Data Digit
Select Anti-Kerchunk No Hangtime Mode	(PW) 63 30 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Disabled.

## Select (Review) Courtesy Messages

Program unique Courtesy Messages for each receiver.

- Enter the password, the 4-digit root number, the desired message, and a (\*).
- Any message may be any combination of message types including CW, beeps, page tones, speech, etc.
- The maximum size of any message is 50 bytes (50 2-digit codes).
- You must count the control character. Therefore, any message could have 46 CW characters, 23 synthesized speech words, and so on.
- To delete a message, enter the password, the 4-digit root number, and the (\*). Do not enter any message.

### Command Form:

Command	Form
Select Courtesy Message for Rx1	(PW) 31 10 (message) *
Select Courtesy Message for Rx2	(PW) 31 11 (message) *
Select Courtesy Message for Rx3	(PW) 31 12 (message) *
Review Courtesy Message for Rx1	(PW) 34 10 *
Review Courtesy Message for Rx2	(PW) 34 11 *
Review Courtesy Message for Rx3	(PW) 34 12 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

### Default Condition:

Command	Default Condition
Select Courtesy Message for Rx1	60mS 440 Hz beep (9910 74 09)
Select Courtesy Message for Rx2	60mS 660 Hz beep (9910 74 16)
Select Courtesy Message for Rx3	60mS 880 Hz beep (9910 74 21)

**Example:**

Suppose we want to change the courtesy message for Receiver 1 to a burst of 2 beeps. We want the two beeps to be 25 and 21, we want them to be 40mS in duration, and we want no gap between them.

Looking up this information in the *Beep Character Set Tables* beginning on page A-5, we find: 55 turns the automatic beep gap OFF; 73 changes the beep duration to 40mS; and, the control character for a beep message is 9910.

Therefore, the complete command to change the courtesy message is:

```
(PW) 31 10 9910 55 73 25 21 *
```

---



---

## Select Repeater Action-Triggered Macros

Allows the programmer to execute macros based on repeater activity.

- Macros can be executed based on receiver activity, receiver inactivity and when a courtesy message is sent.
- Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
- If the macro name has fewer than 4 digits, enter leading zeros.
- If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).

---



---

### Command Form:

Command	Form
Assign Macro to Any-Receiver-Active	(PW) 26 11 (macro name) *
Assign Macro to All-Receivers-Inactive	(PW) 26 09 (macro name) *
Assign Macro to Courtesy Message	(PW) 26 10 (macro name) *
Assign Macro to Dropout Message	(PW) 26 08 (macro name) *
Assign Macro to Repeater Timeout	(PW) 26 18 (macro name) *
Assign Macro to Return-From-Repeater-Timeout	(PW) 26 19 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.



---

## *Chapter 19*

# Base Station Functions

---

The controller includes features that allow commercial customers to operate *Base Stations* from standard dial-up phone lines or microwave links. The base station is connected to the Receiver 1 and Transmitter 1 ports in place of a repeater. The commands described in this chapter would *not* normally be used if you are controlling a repeater instead of a base station.

Unlike a repeater, a base station operates *half duplex*—you must alternate between transmitting and receiving. Therefore, commands are needed to place the controller into half-duplex mode and to allow talkout from the phone line to the transmitter.

---



---

## Enable/Disable Star/Pound Talkout

Turns ON or OFF the Star/Pound (\*/#) Talkout feature.

- This feature is used when controlling a *Half-Duplex Base Station* from a standard dial-up phone line.
- When enabled, the phone line party has control of the DTMF decoder.
- Receiver #1 audio is fed to the phone line as soon as the feature is enabled.
- The (\*) button keys transmitter 1 and feeds phone line audio to the transmitter. The (#) button unkeys transmitter 1 and feeds receiver 1 audio to the phone line. You have 40 seconds from the time this feature is enabled until the (\*) must be entered. Otherwise, the controller will go on-hook.
- This command must be entered each time a call is placed to the controller.
- Do not enable the *Pound Down (# Dump)* command on page 7-8 if you are using *Star/ Pound Talkout*, since the (#) character will then terminate the call.
- See the *Select Talkout Transmitter Mode* command on page 19-4.

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable Star/Pound Talkout	(PW) 63 13 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Star/Pound Talkout is OFF (disabled)

**Examples:**

Dial the base station telephone number. When it answers, enter:

(PW) 63 13 1 \*

This puts the controller into star/pound talkout mode. To exit the mode, enter:

(PW) 63 13 0 \*.

---

**Note:** Be sure you have selected *Base Station Mode* with the *Select Talkout Transmitter Mode* command on page 19-4.

---

---



---

## Select Talkout Transmitter Mode

Selects either Repeater Mode or Base Station Mode for phone line talkout applications.

- In *Repeater Mode*, transmitter #1 stays keyed during the entire conversation. This is the usual mode for all repeater autopatch applications.
  - In *Base Station Mode*, transmitter #1 is keyed and unkeyed by the (\*) and (#) characters sent by the phone line party.
  - This command works only when the *Enable/Disable Star/Pound Talkout* command is enabled (page 19-2).
  - The selected mode does not change when the call is terminated.
- 
- 

### Command Form:

Command	Form	Data Digit
Select Talkout Transmitter Mode	(PW) 63 14 x *	0 = Repeater Mode 1 = Base Station Mode

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Repeater Mode is selected

---



---

## Enable/Disable Command Execution on Interdigit Timer

Selects whether DTMF Interdigit Timer serves to cancel a partial command or execute a command that is not terminated.

- Used by those commercial customers owning radios that lack the (\*) and (#) characters.
- Although commands can be executed on End-of-Transmission, that feature cannot operate if a stuck mic exists in the system.
- Enter one digit, 0 for OFF (disabled), 1 for ON (enabled).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable Command Execution on Interdigit Timer for RX1	(PW) 63 60 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Execution on Interdigit Timer for RX2	(PW)•63 61 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Execution on Interdigit Timer for RX3	(PW) 63 62 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Execution on Interdigit Timer for Phone Line	(PW) 63 63 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Command Execution on Interdigit Timer is OFF (disabled) for all receivers

### Examples:

Recall that the DTMF Interdigit Timer measures the time delay between DTMF characters. Normally, the command buffer is cleared if this timer expires. However, the command described here changes the meaning of the timer: If the timer expires, the command is executed rather than cleared. The user would enter his command, then wait for execution.



---

## Chapter 20

# User Timers

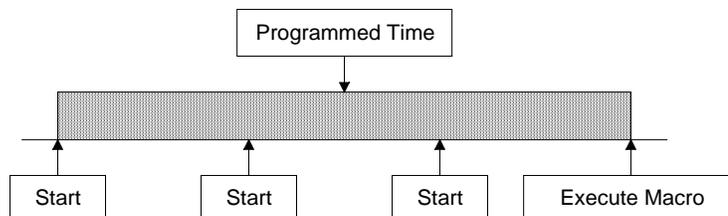
---

The Controller features ten *User Timers*. These timers can be used to implement timed operations not otherwise implemented by the controller.

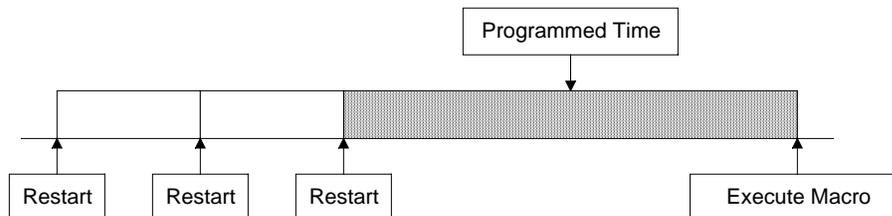
The *User Timers* can be set in 0.1-second increments to 655.3 seconds (slightly less than 11 minutes). When a timer times out, an event macro is executed to perform a user-defined operation.

The *User Timers* can be operated as “one-shot” timers or as “retriggerable” timers.

- *One-shot timers* are timers that are started and will time to completion. Even if the start command is executed again, the duration of the timer will be measured from the first start request:



- *Retriggerable* timers are timers that are started and can be restarted during their programmed time. When retriggerable timers do time out, the time period will be the full programmed time from the last restart command:



---



---

## Select Timeout Value

Programs the duration of a *User Timer*.

- The range of a one-shot or a retriggerable timer is from 0.1 second to 655.3 seconds.
  - Enter the 2-digit number to select a timer. Use a leading zero.
  - Enter the timeout value as 1, 2, 3, or 4 digits, leading zeroes are not required.
  - If the timer is running when this command is executed, the timer continues to run until this new timeout value is reached. But, if the new timeout value is less than the time already expired on the timer the new timeout value is set, the timer is stopped, and the macro assigned to the timer is executed.
- 
- 

### Command Form:

Command	Form	Data Digit
Set Timer Timeout Value	(PW) 49 (timer) 03 (seconds) *	from table below

Data Digit	Explanation
Timer, 00-09	select one of 10 timers, 2 digits are required
Seconds, 0001-6553	seconds in 0.1 second increments from 0.1 to 655.3 seconds as 1, 2, 3, or 4 digits

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	invalid timer or seconds parameter

**Default Condition:** None.

### Example:

To set the timeout duration of timer 00 to 27.0 seconds, enter the command:

```
(PW) 49 00 03 270 *
```

To set the timeout duration of timer 07 to 8 minutes (480 seconds), enter the command:

```
(PW) 49 07 03 4800 *
```

---



---

## Select Timer Event Macro

Assigns the macro to be triggered when the one-shot or retriggerable timer times out.

- Enter the 2-digit timer number and 4-digit macro name to be called upon timeout of the timer. Use leading zeros if required.
- To remove the assignment to the macro, enter the command with no macro name.
- If the timer is running when this command is executed, the timer will continue to run. The last macro entered by this command will be executed at the end of the timer period.

---



---

### Command Form:

Command	Form	Data Digit
Assign Timer Event Macro	(PW) 49 (timer) 02 (macro name) *	from table below
Unassign Timer Event Macro	(PW) 49 (timer) 02 *	from table below

Data Digit	Explanation
timer, 00-09	select one of 10 timers, 2 digits are required
macro name	the name of the macro to be triggered

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macro assigned.

### Example:

To assign macro 9101 to timer 00, enter the command:

```
(PW) 49 00 02 9101 *
```

To assign macro 9 to timer 04, enter the command:

```
(PW) 49 04 02 0009 *
```

---



---

## Stop Timer

Stops the one-shot or retriggerable timer.

- Enter the 2-digit timer number. Use a leading zero.
  - If the timer is running, it is stopped without triggering the macro.
  - If the timer is stopped or has timed out, this command has no effect.
- 
- 

### Command Form:

Command	Form	Data Digit
Stop Timer	(PW) 49 (timer) 00 *	from table below

Data Digit	Explanation
timer, 00-09	select one of 10 timers, 2 digits are required

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To stop timer 00, enter the command:

(PW) 49 00 00 \*

To stop timer 09, enter the command:

(PW) 49 09 00 \*

---



---

## Start Timer (Retriggerable)

Starts the selected timer as a retriggerable timer.

- Enter the 2-digit timer number. Use a leading zero.
  - If the timer is stopped, the timer is reset to zero time expired and started.
  - If the timer is running, the timer is reset to zero time expired and continues.
- 
- 

### Command Form:

Command	Form	Data Digit
Start/Restart Timer (Retriggerable)	(PW) 49 (timer) 01 *	from table below

Data Digit	Explanation
timer, 00-09	select one of 10 timers, 2 digits are required

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To start retriggerable timer 00 or retrigger it, enter the command:

```
(PW) 49 00 01 *
```

To start retriggerable timer 02 or retrigger it, enter the command:

```
(PW) 49 02 01 *
```

---



---

## Start Timer (One-Shot)

Starts the selected timer as a one-shot timer.

- Enter the 2-digit timer number. Use a leading zero.
  - If the timer is stopped, the timer is set to zero time expired and started.
  - If the timer is running, the command is ignored.
- 
- 

### Command Form:

Command	Form	Data Digit
Start Timer (One-Shot)	(PW) 49 (timer) 04 *	from table below

Data Digit	Explanation
timer, 00-09	select one of 10 timers, 2 digits are required

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To start one-shot timer 00, enter the command:

(PW) 49 00 04 \*

To start one-shot timer 08, enter the command:

(PW) 49 08 04 \*

**Example: Fan Control**

Installing a fan to cool a repeater or link transmitter is always a good idea. It can extend the life of the transmitter significantly. But, leaving the fan running all the time will shorten the life of the fan.

To extend the life of the fan, the fan can be operated whenever the transmitter is keyed and for a couple of minutes after. A *User Timer* can be used to control the amount of time the fan stays on after the transmitter unkeys.

Three macros will be required to implement the fan control: one is triggered when the transmitter is keyed, a second is triggered when the transmitter is unkeyed, and a third is triggered when the timer times out. To control the fan, a *Logic Output* will be used to power the fan through a switching device, e.g. a relay or HexFET.

For this example, we'll create macros 8701, 8702, and 8703. We'll use timer #9 and logic output #1.

First, setup the timer and assign the macros.

```
; Setup
(PW) 49 09 03 1200 * ; Set Timer 120.0 seconds
(PW) 49 09 02 8703 * ; Set Timer Macro
(PW) 26 82 8701 * ; Set Tx1 Active Macro
(PW) 26 84 8702 * ; Set Tx1 Inactive Macro
```

Enter the macro that is triggered when the transmitter is keyed. This macro stops the timer and enables the logic output to activate the fan for the entire time that the transmitter is keyed.

```
; Macro: Tx1 Active: Stop Timer, Logic Out On
(PW) 20 8701 (PW) 49 09 00 * ; stop timer
(PW) 29 8701 (PW) 70 1 * ; Logic Out 1 ON
```

Enter the macro that is triggered when the transmitter is unkeyed. This macro starts the timer and leaves the fan on.

```
; Macro: Tx1 Inactive
(PW) 20 8702 (PW) 49 09 01 * ; start timer
```

Enter the macro that is triggered when the timer times out. This macro turns off the fan.

```
; Macro: Timer Timeout
(PW) 20 8703 (PW) 71 1 * ; Logic Out 1 OFF
```

**Example: An Activity Timer**

The repeater and each receiver input has an activity timer available to cause a macro to be triggered after activity on the repeater has ceased. But, sometimes one activity timer is not enough. A *User Timer* can be used to implement one or more additional activity timers.

Three macros will be required to implement the activity timer: one is triggered when the repeater is activated by a receiver, a second is triggered when all receivers are inactive, and a third is triggered when the timer times out. Our example triggers a macro that speaks a message, but any commands can be executed at that time.

For this example, we'll create macros 8711, 8712, and 8713. We'll use timer #8.

First, setup the timer and assign the macros.

```
; Setup
(PW) 49 08 03 3000 * ; Set Timer 300.0 seconds
(PW) 49 08 02 8713 * ; Set Timer Macro
(PW) 26 11 8711 * ; Set Any-Rx-Active Macro
(PW) 26 09 8712 * ; Set All-Rx-Inactive Macro
```

Enter the macro that is triggered when any receiver is active. This macro stops the timer.

```
; Macro: Any-Rx-Active: Stop Timer
(PW) 20 8711 (PW) 49 08 00 * ; stop timer
```

Enter the macro that is triggered when all receivers are inactive. This macro starts the timer.

```
; Macro: All-Rx-Inactive
(PW) 20 8712 (PW) 49 08 01 * ; start timer
```

Enter the macro that is triggered when the timer times out. This macro can perform any operation, but in our example it speaks a message.

```
; Macro: Timer Timeout, speak 1-second-pause + "Net"
(PW) 20 8713 (PW) 15 9960 0000 0331 *
```

---

## *Chapter 21*

# Remote Base Interface

---

Your controller has many features that allow you to customize the operation of the controller when connected to a *Doug Hall Electronics RBI-1 Remote Base Interface*. All of the capabilities of the *RBI-1* are supported.

The 7K Remote Base Interface has the following features:

- All remote base user functions use a password that is different from the *Master*, *Control Operator*, or *Autopatch Passwords* defined within the controller. Because of this, users do not need to know these passwords to use the remote base functions.
- User functions are optimized to minimize the number of keystrokes users must enter to perform common functions.
- Macros can be used to define memory channels.
- Direct frequency entry allows easy frequency and transmitter offset changes.
- The time-of-day scheduler can be used to control when the remote base functions are available.
- The controller can speak the current radio configuration.
- Eight additional logic outputs on the *RBI-1* are available for controlling external devices.

## Remote Base Setup and Configuration

### Wiring

You will need to wire the *RBI-1* to the controller using the connections shown in the table, below. The first three wires allow the controller to send commands to the *RBI-1*. The rest of the wires connect the *RBI-1* to the controller's Receiver 2 and Transmitter 2 connections.

<i>7K</i>	<i>RBI-1</i>	Purpose
J3 Pin 16	J2 Pin 1	<i>RBI-1</i> Reset
J3 Pin 17	J2 Pin 4	<i>RBI-1</i> Clock
J3 Pin 18	J2 Pin 3	<i>RBI-1</i> Data
J3 Pin 25	J2 Pin 9	Ground
J2 Pin 8	J2 Pin 6	Rx2 Audio In
J2 Pin 22		Shield
J2 Pin 15	J2 Pin 5	Tx2 Audio Out
J2 Pin 19		Shield
J2 Pin 3	J2 Pin 7	Rx2 COR
J2 Pin 11	J2 Pin 8	Tx2 PTT

### Switch Setting

DIP Switch #2 is used to invert the Receiver 2 COR signal from the *RBI-1*. Set the dip switch as follows:

DIP Switch #2 = OFF. This inverts COR #2 for Rx2.

### Software Configuration

The radios connected to the *RBI-1* only operate half-duplex -- they cannot transmit and receive at the same time. The *Link Paths* of the controller define which receivers are connected to which transmitters. By default, Receiver 2 is connected to Transmitter 2. This link path must be disabled for proper operation of the remote base interface.

```
(PW) 63 85 0 * ;Disable Path 5 (Rx2 to Tx2)
```

By default, the controller will send an identifier message to Transmitter 2. Delete this message if you don't want to send an ID message.

```
(PW) 31 33 * ;Delete Initial ID Message for Tx2  
(PW) 31 34 * ;Delete Normal ID Message for Tx2
```

By default, the *7K* will mute all DTMF tones from Receiver 1 to Transmitter 2. If you wish to pass tones to Transmitter 2, enter the following command:

```
(PW) 63 53 0 * ;Disable Rx1-Tx2 DTMF Mute
```

By default, the remote base is disabled. To enable it for use, enter the following command:

```
(PW) 63 71 1 * ;Enable Remote Base
```

## Event Triggered Macros

The system owner **must** create two macros that are triggered by user function access to the remote base interface. These *Event-Triggered Macros* allow the users to enter simple user function commands to access the remote base to make use of it, and to dump the remote base when they are done with it.

Below are the recommended macros to use for this function. They can be modified or enhanced as necessary.

Define a *Remote Base Access-Triggered Macro* to allow a user to access the remote base interface. This macro is invoked automatically by the *User Function: Access Remote Base* command. This macro enables the link paths from the repeater receiver and transmitter and the remote base receiver and transmitter. In addition, a message is sent to the user as an acknowledgment that the remote base is now available.

```
(PW) 20 9000 (PW) 63 82 1 * ;Enable Path 2 (RX2 to TX1)
(PW) 29 9000 (PW) 63 84 1 * ;Enable Path 4 (RX1 to TX2)
;Send "Remote Up" Tones
(PW) 29 9000 (PW) 15 9910 54 48 49 50 *
```

Assign this macro to the *Remote Base Access-Triggered Macro* by entering the following command:

```
(PW) 26 91 9000 *
```

Define a *Remote Base Dump-Triggered Macro* to allow a user to terminate access to the remote base interface. This macro is invoked automatically by the *User Function: Dump Remote Base* command. This macro disables the link paths between the repeater receiver and transmitter and the remote base receiver and transmitter. In addition, a message is sent to the user as an acknowledgment that the remote base is no longer available.

```
(PW) 20 9001 (PW) 63 82 0 * ;Disable RX2 to TX1
(PW) 29 9001 (PW) 63 84 0 * ;Disable RX1 to TX2
; Send "Remote Down" Tones
(PW) 29 9001 (PW) 15 9910 54 50 49 48 *
```

Assign this macro to the *Remote Base Dump-Triggered Macro* by entering the following command:

```
(PW) 26 90 9001 *
```

---

---

## Assign Remote Base Password

Assigns a new password for remote base users.

- The new *Remote Base Password* may be 2, 4, or 6 digits in length.
  - The new *Remote Base Password* may be any combination of the numbers 0-9 and the letters A-D.
- 
- 

### Command Form:

Command	Form
Assign Remote Base Password	(PW) 39 02 (new remote base password) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** *Remote Base Password* defaults to 98.

### Example:

To change the remote base password to 22, enter the following:

```
(PW) 39 02 22 *
```

---



---

## Select Remote Base Access- and Dump-Triggered Macros

Assigns macros to be executed upon accessing or dumping the remote base.

- Enter the password, the 4-digit root number, and the 4-digit name of the macro you wish to have executed at the transition, and the (\*).
  - If the macro name has fewer than 4 digits, enter leading zeros.
  - If you wish to prevent a macro from being executed that was previously assigned, enter just the password, the 4-digit root number, and the (\*).
- 
- 

### Command Form:

Command	Form
Select Remote Base Access-Triggered Macro	(PW) 26 91 (macro name) *
Select Remote Base Dump-Triggered Macro	(PW) 26 90 (macro name) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** No macros assigned.

### Example:

These commands make the remote base interface much more flexible. For example, when a user enters the *Access Remote Base* command, a macro can be executed to enable the controller link paths, power up a remote base radio, set the frequency, select an antenna, and rotate the antenna to point in a particular direction; when a user enters the *Dump Remote Base* command, a macro can be executed to disable the controller link paths and turn off the power to the remote base radio.

---



---

## Select (Review) Remote Base Off Message

This message is sent over the repeater transmitter when the remote base is off.

- The *Remote Base Off Message* is sent when a User Function command has been executed and the remote base has not been enabled (see page 21-7).
- The message may be a combination of message types including CW, beeps, page tones, speech, etc.
- The maximum size of the message is 50 bytes (50 2-digit codes). You must count the control characters. Therefore, any message could have 46 CW characters, 23 synthesized speech words, etc.
- To delete a message, enter the password, the 4-digit root number, and the (\*); do not enter any message.
- If this message is not programmed, the default CW message will be sent only when *Command Responses* are enabled.

---



---

### Command Form:

Command	Form	Default
Select Remote Base Off Message	(PW) 31 60 (message) *	OFF in CW
Review Remote Base Off Message	(PW) 34 60 *	none

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The default CW message is sent only if *Command Responses* are enabled.

### Example:

To program the Remote Base Off Message to say “Remote Base Off”, enter the command:

```
(PW) 31 60 9960 0000 0418 0049 0355 *
```

---



---

## Reset RBI-1

Perform a hardware reset of the *RBI-1* and the attached remote base radios.

- This command performs a reset of the *RBI-1* and attached remote base radios.
  - The *RBI-1* Reset output (7K J3-16) is pulsed to hard-reset the *RBI-1*.
  - After the Reset occurs, the previous radio settings are sent to the *RBI-1*.
  - This command may take several seconds to complete.
- 

### Command Form:

Command	Form
Reset <i>RBI-1</i>	(PW) 39 91 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** None.

### Example:

To reset the *RBI-1* and attached radios, enter the following:

(PW) 39 91 \*

---



---

## Enable/Disable Access to the Remote Base

A flexible control scheme controls access to the remote base.

- Turns ON or OFF the remote base interface.
- Enter 1 digit: 0 for OFF (disabled), 1 for ON (enabled).
- *Remote Base Enable #1* is intended to be used by the *Control Operator* as a master enable/disable of the remote base interface.
- *Remote Base Enable #2* is intended to be used by the *Time-of-Day Scheduler* to control the times when the remote base interface may be used.
- *Remote Base Enable #3* is intended to be used by the *Control Operator* to override the *Time-of-Day Scheduler* to activate the remote base interface at a time of day when the interface would be normally disabled.
- If the *Time-of-Day Scheduler* is not going to be utilized, *only Remote Base Enable #1* needs to be manipulated by the *Control Operator*.
- Programmer's note: the remote base is enabled when the following equation evaluates to TRUE: EN1 AND (EN2 OR EN3).

---



---

### Command Form:

Command	Form	Data Digit
Enable/Disable Remote Base Enable #1	(PW) 63 71 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Remote Base Enable #2	(PW) 63 72 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Remote Base Enable #3	(PW) 63 73 x *	0 = OFF (disabled) 1 = ON (enabled)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
? err 1	wrong number of digits entered

**Default Condition:** Enable #1 is OFF; Enable #2 is ON; Enable #3 is OFF.

**Example:**

The *Control Operator* can enable the remote base interface by entering:

```
(PW) 63 71 1 *
```

The *Control Operator* can disable the remote base interface by entering:

```
(PW) 63 71 0 *
```

To have the *Scheduler* control remote base access, define *Scheduler* setpoints to disable the remote base interface during afternoon drive times (4:00 P.M. through 6:30 P.M.) Monday through Friday. This requires macros to be executed by the *Scheduler*.

First, define macros containing the commands to enable and disable the remote base interface using Enable #2:

```
(PW) 20 9002 (PW) 63 72 0 * ; disable remote base  
(PW) 20 9003 (PW) 63 72 1 * ; enable remote base
```

Then, define *Scheduler* setpoints to execute these macros:

```
(PW) 28 00 9002 99 32 16 00 * ; disable at 4 PM  
(PW) 28 01 9003 99 32 18 30 * ; enable at 6:30 PM
```

## User Functions: Controlling the Radios

Users will operate the remote base radios using the *User Functions* commands described on the following pages. These commands allow users to turn on and off the remote base interface, change VFO frequency or memory channel, transmitter offset and power, and change the operation of the CTCSS encoder and decoder.

---

Note: not all features are available in all remote base radios. See the *Doug Hall Electronics RBI-1 Manual* for availability of features in the radios that you are using.

---

As the *User Function* commands are entered, they are immediately sent to the *RBI-1* and on to the radio, with only a small processing delay.

---

Note: *User Function* commands are preceded by the *Remote Base Password* (shown as RBPW in the following pages) instead of the *Master Password* or *Control Operator Password* (shown as PW where required).

---

Normally, the remote base interface is off. When a user wants to use the remote base interface, he will enter the *User Function: Access Remote Base* command. This causes the *Remote Base Access-Triggered Macro* to be executed setting everything to initial settings that you defined.

The user can then specify a frequency or memory channel to monitor.

**Direct Frequency Entry** -- A user can directly enter a frequency to monitor or operate. The transmitter can be initially disabled or it can be enabled with an offset.

**Radio Memory Channels** -- A user can select a preprogrammed radio memory channel. The memory channels can contain the frequency, offset, and CTCSS information so that information does not need to be entered.

The user can change radio parameters as required to change frequency, transmit power, CTCSS frequency, etc.

When done with the remote base interface, the user would enter the *User Function: Dump Remote Base*. This causes the *Remote Base Dump-Triggered Macro* to be executed disabling the interface.

## Defining Memory Channels using Macros

The macros of the 7K controller can be used to predefine memory channels for easy selection of the most-used frequencies and radio configurations. Because macros can hold complicated controller commands, changing channels can be easily done using a short macro name.

The *User Function* commands described above cause each command to be sent to the *RBI-1* and remote base radio immediately. Since a macro can contain many radio commands, many data transfers may have to take place to setup the radio causing an unacceptable processing delay. The *Macro Function* commands are queued in controller memory until the *Macro Function: Send Queued Settings* command is executed. This causes all radio changes to be sent in only one data transfer for minimum processing delay.

Here is an example of defining a memory channel using a controller macro. The macro name we will define is 52. Let's say that you want the macro to select 146.520 MHz simplex, low power, and a CTCSS Frequency of 110.9 Hz. To define the macro, you would enter:

```
(PW) 20 0052 (RBPW) 21 146520 2 * ;Freq and Offset
(PW) 29 0052 (RBPW) 23 1 * ;Tx Low Power
(PW) 29 0052 (RBPW) 27 15 * ;CTCSS Frequency
(PW) 29 0052 (RBPW) 39 * ;Send Queued Settings
; Pause, then say "Five-Two"
(PW) 29 0052 (PW) 15 9960 0000 0166 0538 *
```

To execute the macro, enter:

```
52 *
```

---

---

## User Function: Access Remote Base

Access the remote base.

- Enter the *Remote Base Password* followed by a 1 and the star (\*).
  - Entering this command causes the *Remote Base Access-Triggered Macro* to be executed.
  - Note: if no *Remote Base Access-Triggered Macro* has been assigned, this command will have no effect.
- 
- 

### Command Form:

Command	Form
Access Remote Base	(RBPW) 1 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The remote base interface is initially off.

### Example:

To access the remote base, enter the following

(RBPW) 1 \*

---



---

## User Function: Dump Remote Base

Dump the remote base.

- Enter the *Remote Base Password* followed by a 0 and the star (\*).
  - Entering this command causes the *Remote Base Dump-Triggered Macro* to be executed.
  - Note: if no *Remote Base Dump-Triggered Macro* has been assigned, this command will have no effect.
- 
- 

### Command Form:

Command	Form
Dump Remote Base	(RBPW) 0 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The remote base interface is initially off.

### Example:

To dump the remote base, enter the following

(RBPW) 0 \*

---



---

## User Function: Speak Radio Configuration

Speak the current remote base radio configuration.

- The current radio settings can be spoken by the controller in one of several formats.
  - Both abbreviated and detailed information is available.
  - The controller will speak the Frequency or Memory Channel and whether the Transmitter is On or Off. If On, it will speak the Transmitter Offset.
  - The controller will speak the CTCSS frequency and whether it is enabled for encode, decode, or both.
- 
- 

### Command Form:

Command	Form
Speak Frequency and Offset	(RBPW) 19 *
Speak Frequency and Offset	(RBPW) 19 0 *
Speak CTCSS Frequency	(RBPW) 19 1 *
Speak All	(RBPW) 19 2 *
Speak Abbreviated Frequency and Offset	(RBPW) 19 3 *
Speak Abbreviated CTCSS Frequency	(RBPW) 19 4 *
Speak Abbreviated All	(RBPW) 19 5 *

### Acknowledgment for Detailed Responses:

- When the VFO of the remote base radio is selected, the actual frequency is spoken.
  - When a memory channel of the remote base radio is selected, the memory channel number is spoken.
  - If the transmitter is disabled, the controller says “Transmit Off”.
  - If the transmitter is enabled, the controller speaks the currently selected offset: “Offset Minus”, “No Offset”, or “Offset Plus”. Special offsets are supported. On the 1200 band, the controller may say “Offset Minus Twenty”. On the 440 band, the controller may say “Offset Minus Minus”. (See your radio manual for when this offset may be selected.)
  - If no CTCSS tone is selected for encode or decode, the controller says “CTCSS Off”.
  - If a tone is selected for either encode or decode, the controllers says “CTCSS” and the frequency. For example, for a CTCSS frequency of 123.0 Hz, it says “C T C S S one two three point zero hertz”.
  - If a tone is selected for encode, the controller says “Transmit”.
  - If a tone is selected for decode, the controller says “Receive”.
  - If a tone is selected for encode and decode, the controller says “Transmit And Receive”.
-

**Acknowledgment for Abbreviated Responses:**

- When the VFO of the remote base radio is selected, an abbreviated version of the actual frequency is spoken. For example, “545” is spoken for “145.450” or “445.450”.
- When a memory channel of the remote base radio is selected, the memory channel number is spoken.
- If the transmitter is enabled, the controller speaks the currently selected offset: “Minus” or “Plus” or nothing for simplex.
- If no CTCSS tone is selected for encode or decode, there is no response.
- If a tone is selected for either encode or decode, the controller says just the CTCSS frequency. For example, for a CTCSS frequency of 123.0 Hz, “one two three zero” is spoken.

**Errors:**

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

**Examples:**

To have the controller speak just the frequency and transmitter status of the remote base radio currently selected, enter the following:

(RBPW) 19 \*

or:

(RBPW) 19 0 \*

To verify the current CTCSS frequency and whether the radio is configured for encode or decode, enter:

(RBPW) 19 1 \*

To hear the complete status of the radio, enter:

(RBPW) 19 2 \*

To hear an abbreviated status of the radio, enter:

(RBPW) 19 5 \*

---



---

## User Function: Select Memory Channel and Band

Selects a specific remote base radio and memory channel.

- The *RBI-1* supports four bands: 144, 222, 440, and 1200.
  - Memory channels range from 1 to the maximum number available in the selected radio.
  - If the remote base radio was powered off, this command turns it on and enables the receiver.
  - The remote base radio transmitter is disabled when this command is entered. To enable the transmitter, see the *User Function: Enable/Disable Transmitter* command.
  - The CTCSS encoder and decoder frequency and enable/disable are set in the memory channel of the radio. If not set in the radio, they can be controlled by *User Function* commands.
  - **Note:** this command only works on some of the radios that can be connected to the *RBI-1*. See the *RBI-1* manual for details.
- 
- 

### Command Form:

Command	Form
Select A Memory Channel and Band	(RBPW) 40 (band) (channel) * <i>band =</i> 1 = 144 2 = 220 4 = 440 8 = 1200 <i>channel =</i> 1 thru the maximum supported by the radio
Macro: Select A Memory Channel and Band (Stored until (RBPW) 39 sent.)	(RBPW) 20 (band) (channel) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To select memory channel 1 in the 144 MHz radio, enter the following

(RBPW) 40 1 1 \*

To select memory channel 12 in the 440 MHz radio, enter the following

(RBPW) 40 4 12 \*

---

---



---

## User Function: Select VFO Frequency and Offset

Selects a specific remote base radio and enters a VFO frequency and offset.

- Enter the frequency that you want the receiver of the remote base radio to be set to.
  - Optionally, enter the transmitter offset to be used. Transmitter offsets of minus, simplex, plus, and special offsets can be selected.
  - If the remote base radio was powered off, this command turns it on and enables the receiver..
  - If no transmitter offset is specified, the remote base transmitter is disabled. To set a transmitter offset and enable the transmitter, use the *User Function: Select Transmitter Offset* command.
  - The CTCSS encoder and decoder are disabled.
  - The transmitter power level remains at its previous setting.
- 
- 

### Command Form:

Command	Form
Select VFO Frequency and Offset	(RBPW) 41 (frequency) (offset) * <i>frequency =</i> 140.000-149.995 MHz, 6 digits 220.000-229.995 MHz, 6 digits 420.000-449.995 MHz, 6 digits 1240.000-1299.995 MHz, 7 digits Note: the 1kHz digit can be only 5 or 0. The ranges are subject to the limitations of the radios in use. <i>offset =</i> 1 = Minus 2 = Simplex 3 = Plus 0 = Special: On 1200, Minus 20; On 420-440, special offset subject to limitations of radio in use.
Macro: Select VFO Frequency and Offset (Stored until (RBPW) 39 sent.)	(RBPW) 21 (frequency) (offset) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

---

**Default Condition:** None.

**Example:**

To set the VFO frequency on the 440 MHz radio to 446.000 MHz with the transmitter disabled, enter the following

```
(RBPW) 41 446000 *
```

To set the VFO frequency on the 144 MHz radio to 146.940 MHz with a minus offset, enter the following

```
(RBPW) 41 146940 1 *
```

To set the VFO frequency on the 144 MHz radio to 146.520 MHz simplex, enter the following

```
(RBPW) 41 146520 2 *
```

---



---

## User Function: Select Transmitter Offset

Selects a transmitter offset on the currently active remote base radio.

- Transmitter offsets of minus, simplex, plus, and special can be selected.
  - This command has no effect when a memory channel is currently selected.
  - If the remote base radio transmitter is disabled, it will be enabled.
- 
- 

### Command Form:

Command	Form
Select Transmitter Offset	(RBPW) 42 (offset) * offset = 1 = Minus 2 = Simplex 3 = Plus 0 = Special: On 1200, Minus 20; On 420-440, special offset subject to limitations of radio in use.
Macro: Select Transmitter Offset (Stored until (RBPW) 39 sent.)	(RBPW) 22 (offset) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The remote base interface is initially off.

### Example:

To enable the transmitter and set the transmitter offset on the currently selected radio to minus, enter the following:

```
(RBPW) 42 1 *
```

To enable the transmitter and set the transmitter offset on the currently selected radio to simplex, enter the following:

```
(RBPW) 42 2 *
```

---



---

## User Function: Enable/Disable Transmitter

Enables or disables the transmitter on the currently active remote base radio.

- The transmitter can be enabled or disabled.
- 
- 

### Command Form:

Command	Form
Enable/Disable Transmitter	(RBPW) 45 x * 0 = OFF (disable) 1 = ON (enable)
Macro: Select Enable/Disable Transmitter (Stored until (RBPW) 39 sent.)	(RBPW) 25 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The transmitter is disabled when the *Select VFO Frequency and Offset* is entered without an offset. The transmitter is disabled when a memory channel is selected.

### Example:

To enable the transmitter, enter the following:

(RBPW) 45 1 \*

To disable the transmitter, enter the following:

(RBPW) 45 0 \*

---



---

## User Function: Enable/Disable Receiver

Enables or disables the receiver on the currently active remote base radio.

- The receiver can be enabled or disabled.
- 
- 

### Command Form:

Command	Form
Enable/Disable Receiver	(RBPW) 44 x * 0 = OFF (disable) 1 = ON (enable)
Macro: Select Enable/Disable Receiver (Stored until (RBPW) 39 sent.)	(RBPW) 24 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The receiver is enabled when a VFO frequency or memory channel is selected.

### Example:

To enable the receiver, enter the following:

(RBPW) 44 1 \*

To disable the receiver, enter the following:

(RBPW) 44 0 \*

---



---

## User Function: Enable/Disable Radio Power

Enables or disables the power to the currently active remote base radio.

- The radio power can be enabled or disabled.
  - **Note:** not all radios that can be connected to the *RBI-1* can have their power controlled. See the *RBI-1* manual for details.
- 
- 

### Command Form:

Command	Form
Enable/Disable Radio Power	(RBPW) 46 x * 0 = OFF (disable) 1 = ON (enable)
Macro: Select Enable/Disable Radio Power (Stored until (RBPW) 39 sent.)	(RBPW) 26 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** Radio power is enabled when a VFO frequency or memory channel is selected.

### Example:

To turn the power on to the selected radio, enter the following:

(RBPW) 46 1 \*

To turn the power off to the selected radio, enter the following:

(RBPW) 46 0 \*

---



---

## User Function: Select Transmitter Power Output

Selects the transmitter power output level of the currently active remote base radio.

- The transmitter power output level can be set to low, medium, or high.
  - **Note:** not all radios that can be connected to the *RBI-1* can have their transmitter power output level controlled. See the *RBI-1* manual for details.
- 
- 

### Command Form:

Command	Form
Select Transmitter Power Output	(RBPW) 43 x * 1 = Low 2 = Medium 3 = High
Macro: Select Transmitter Power Output (Stored until (RBPW) 39 sent.)	(RBPW) 23 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The current transmitter power output level is the power output level that was last set. (The controller does not change the level in response to any other commands.)

### Example:

To set the transmitter power output level on the currently selected radio to medium, enter the following:

(RBPW) 43 2 \*

---



---

## User Function: Select Frequency of CTCSS

Selects the frequency of the CTCSS Encoder and Decoder of the currently active remote base radio.

- The CTCSS frequency is entered as a *Tone Code* that is looked up in a table. See page 10-5 for frequencies from 67.0 through 203.5.
  - Entering this command causes the CTCSS Encoder to be enabled and the CTCSS Decoder to be disabled.
  - This command has no effect if a memory channel of the currently active radio is selected and the memory channel sets the CTCSS frequency.
  - **Note:** not all radios that can be connected to the *RBI-1* can have their CTCSS frequency controlled. See the *RBI-1* manual for details.
- 
- 

### Command Form:

Command	Form
Select CTCSS Frequency	(RBPW) 47 (tone code) * <i>tone code =</i> (01-32, see page 10-5) 33 = 210.7 Hz 34 = 218.1 Hz 35 = 225.7 Hz 36 = 233.6 Hz 37 = 241.8 Hz 38 = 250.3 Hz
Macro: Select CTCSS Frequency (Stored until (RBPW) 39 sent.)	(RBPW) 27 (tone code) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To set the CTCSS frequency to 82.5 Hz, lookup the *Tone Code* in the *TS-32 Programming Table* on page 10-5 and enter the following:

(RBPW) 47 6 \*

To set the CTCSS frequency to 110.9 Hz, enter the following:

(RBPW) 47 15 \*

---

---



---

## User Function: Enable/Disable CTCSS Encoder

Enables or disables the CTCSS Encoder on the currently active remote base radio.

- The CTCSS Encoder can be enabled or disabled.
  - This command has no effect if a memory channel of the currently active radio is selected and the memory channel enables the CTCSS Encoder.
- 
- 

### Command Form:

Command	Form
Enable/Disable CTCSS Encoder	(RBPW) 48 x * 0 = OFF (disable) 1 = ON (enable)
Macro: Select Enable/Disable CTCSS Encoder (Stored until (RBPW) 39 sent.)	(RBPW) 28 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The CTCSS Encoder is enabled when a CTCSS frequency is selected. The CTCSS Encoder is disabled when a VFO frequency is selected.

### Example:

To enable the CTCSS Encoder in the selected radio, enter the following:

(RBPW) 48 1 \*

To disable the CTCSS Encoder in the selected radio, enter the following:

(RBPW) 48 0 \*

---



---

## User Function: Enable/Disable CTCSS Decoder

Enables or disables the CTCSS Decoder on the currently active remote base radio.

- The CTCSS Decoder can be enabled or disabled.
- This command has no effect if a memory channel of the currently active radio is selected and the memory channel enables the CTCSS Encoder or Decoder.

---



---

### Command Form:

Command	Form
Enable/Disable CTCSS Decoder	(RBPW) 49 x * 0 = OFF (disable) 1 = ON (enable)
Macro: Select Enable/Disable CTCSS Decoder (Stored until (RBPW) 39 sent.)	(RBPW) 29 x *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** The CTCSS Decoder is disabled when a CTCSS frequency is selected. The CTCSS Decoder is also disabled when a VFO frequency is selected.

### Example:

To enable the CTCSS Decoder in the selected radio, enter the following:

(RBPW) 49 1 \*

To disable the CTCSS Decoder in the selected radio, enter the following:

(RBPW) 49 0 \*

---



---

## Macro Function: Send Queued Settings

Transfers the queued *Macro* settings to the remote base radio.

- The settings entered from the *Macro* commands are stored in the controller memory until this command is executed.
  - Settings are queued using *Macro* commands 20-29.
- 
- 

### Command Form:

Command	Form
Send Queued Settings	(RBPW) 39 *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** None.

### Example:

To send the queued settings stored in the controller memory to the remote base radio, enter the following:

(RBPW) 39 \*

## RBI-1 User Function Outputs

The eight *RBI-1 User Function Outputs* are available for your use in operating auxiliary devices at the repeater site. These outputs can be latched ON or OFF. The outputs can be controlled individually or as a group.

“ON” refers to the state of an output when it is sinking current to ground; “OFF” refers to the state of an output when it is open (floating).

Following a power failure or controller reset, the outputs are set to the state that they were before the power failure or reset.

A number of the *User Function Outputs* can be grouped for control using decimal numbers from 0 to 255. This type of command could be used to enter rotator azimuths for control of an antenna rotator. Since not all outputs may need to be used for rotator control, the number of outputs can be specified so that the remaining outputs can be used for control of other auxiliary devices.

Here is an example of the use of the *User Function Outputs*. Suppose you needed to control a rotator that needed six control lines to specify the azimuth in which to point the antenna. You would connect the rotator controller to the *User Function Outputs* starting from *UF-1* as follows:

<i>RBI-1 Pin</i>	Function	<i>RBI-1 Pin</i>	Function
UF-1	Rotator Control Line #0	UF-4	Rotator Control Line #3
UF-2	Rotator Control Line #1	UF-5	Rotator Control Line #4
UF-3	Rotator Control Line #2	UF-6	Rotator Control Line #5

You would then issue the *Select RBI-1 Number of User Function Outputs* command:

**(PW) 39 90 6 \***

to specify that only the first six *User Function Outputs* are to be controlled by the *Enter RBI-1 User Function Output Group*. The rotator would then be controlled by entering values in the range of zero (0) through sixty-three (63).

The remaining *User Function Outputs*, seven and eight, would be available for auxiliary control.

The range of decimal numbers that may be entered in the group depends on the number of *User Function Outputs* included in the group. The following table defines the ranges. The group always starts with *UF-1*:

Group	Valid Decimal Numbers	Group	Valid Decimal Numbers
0	none available	5	0 thru 31
1	0 or 1	6	0 thru 63
2	0 thru 3	7	0 thru 127
3	0 thru 7	8	0 thru 255
4	0 thru 15		

---



---

## Select *RBI-1* Number of User Function Outputs

Selects the number of *RBI-1* User Function Outputs to be included in the group.

- Enter a number from 0 to 8 to define how many outputs are to be controlled as a group.
  - The group always starts at *UF-1*.
  - Programmer's note: *UF-8* is the Most Significant Bit (MSB); *UF-1* is the Least Significant Bit (LSB).
- 
- 

### Command Form:

Command	Form
Select <i>RBI-1</i> Number of User Function Outputs	(PW) 39 90 (number of outputs) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** All 8 outputs are included in the group.

### Example:

To set the number of outputs in the group to 6, enter the following:

(PW) 39 90 6 \*

---



---

## Select Individual *RBI-1* User Function Outputs

Control one or more *RBI-1* User Function Outputs.

- Each output in a list of outputs may be latched ON or OFF.
  - List the outputs to be controlled by entering any combination of digits 1 through 8.
- 
- 

### Command Form:

Command	Form
Select User Function Outputs Latched OFF	(RBPW) 12 (list the outputs) *
Select User Function Outputs Latched ON	(RBPW) 11 (list the outputs) *

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** After a 7K cold reset, the outputs are off. After a power failure, the outputs will be set to the state they were in before the power failure.

### Example:

To turn ON user function output 1, enter the following:

```
(RBPW) 11 1 *
```

To turn OFF user function output 2, enter the following:

```
(RBPW) 12 2 *
```

To turn ON user function outputs 7 and 8, enter the following:

```
(RBPW) 11 7 8 *
```

---



---

## Enter *RBI-1* User Function Output Group

Control a group of *RBI-1* User Function Outputs.

- Enter a decimal number to control a group of outputs.
  - The largest decimal number is determined by the number of outputs selected by the *Select Number Of User Function Outputs* command
  - Programmer's Note: *UF-8* is the Most Significant Bit (MSB); *UF-1* is the Least Significant Bit (LSB).
- 
- 

### Command Form:

Command	Form
Select User Function Output Group	(RBPW) 10 (decimal number) * <i>decimal number =</i> (See table on page 26.)

**Acknowledgment:** Sends OK

### Errors:

Error	Meaning
OFF	remote base is disabled
? err 1	wrong number of digits entered
? err 2	illegal digit entered

**Default Condition:** After a 7K cold reset, the outputs are off. After a power failure, the outputs will be set to the state they were in before the power failure.

### Example:

To output a value of 30 to the group of outputs, enter the following:

```
(RBPW) 10 30 *
```



---

## *Appendix A*

# Programming Tables

---

The tables in this section are used to program the controller. Additionally, the *Command Quick Reference* on page A-25 contains a summary of each command.

## CW Character Set Tables

<b>CW Alphanumeric Characters</b>			
Control Character 9900			
<b>Character</b>	<b>Code</b>	<b>Character</b>	<b>Code</b>
0	00	I	18
1	01	J	19
2	02	K	20
3	03	L	21
4	04	M	22
5	05	N	23
6	06	O	24
7	07	P	25
8	08	Q	26
9	09	R	27
A	10	S	28
B	11	T	29
C	12	U	30
D	13	V	31
E	14	W	32
F	15	X	33
G	16	Y	34
H	17	Z	35

<b>CW Punctuation and Related Characters</b>		
Control Character 9900		
Character/Parameter	Symbol	Code
period	.	36
comma	,	37
fraction	/	38
Question	?	39
word space	space	40
end-of-message	(AR)	41
wait	(AS)	42
break	(BK)	43
double dash	(BT)	44
end-of-work	(SK)	45
hyphen	-	46
colon	:	47
semicolon	;	48
parenthesis	( )	49
apostrophe	'	50
exclamation	!	51
quotation	"	52
understood	(SN)	53
1.0 second pre-message delay		54

<b>CW Frequency and Speed Changes</b>	
Control Character 9900	
Change	Code
frequency	59xxxx ( <i>xxxx = tone code</i> )
speed to 5 WPM	60
speed to 7 WPM	61
speed to 10 WPM	62
speed to 13 WPM	63
speed to 15 WPM	64
speed to 17 WPM	65
speed to 20 WPM	66
speed to 24 WPM	67
speed to 30 WPM	68
speed to 40 WPM	69

## Beep Character Set Tables

<b>Factory-Fixed Frequency Beeps</b>								
Control Character 9910								
Freq	Note	Beep	Freq	Note	Beep	Freq	Note	Beep
262Hz	C3	00	659Hz	E4	16	1661Hz	G#5	32
277Hz	C#3	01	698Hz	F4	17	1760Hz	A5	33
294Hz	D3	02	740Hz	F#4	18	1865Hz	A#5	34
311Hz	D#3	03	784Hz	G4	19	1976Hz	B5	35
330Hz	E3	04	831Hz	G#4	20	2093Hz	C6	36
349Hz	F3	05	880Hz	A4	21	2217Hz	C#6	37
370Hz	F#3	06	932Hz	A#4	22	2349Hz	D6	38
392Hz	G3	07	988Hz	B4	23	2489Hz	D#6	39
415Hz	G#3	08	1046Hz	C5	24	2637Hz	E6	40
440Hz	A3	09	1109Hz	C#5	25	2794Hz	F6	41
466Hz	A#3	10	1175Hz	D5	26	2960Hz	F#6	42
494Hz	B3	11	1244Hz	D#5	27	3136Hz	G6	43
523Hz	C4	12	1319Hz	E5	28	3322Hz	G#6	44
554Hz	C#4	13	1397Hz	F5	29	3520Hz	A6	45
587Hz	D4	14	1480Hz	F#5	30	3729Hz	A#6	46
622Hz	D#4	15	1568Hz	G5	31	3951Hz	B6	47

<b>Owner-Fixed Frequency Beeps</b>		
Control Character 9910		
Beep	Owner-Fixed Frequency (Fill-In)	Default Condition
48		500Hz
49		750Hz
50		1000Hz
51		1250Hz
52		1500Hz
53		1750Hz

<b>Beep Duration Change Characters</b>	
Control Character 9910	
<b>Beep Duration Change</b>	<b>Code</b>
10mS	70
20mS	71
30mS	72
40mS	73
60mS	74
80mS	75
120mS	76
160mS	77
240mS	78
320mS	79

<b>Beep Gap Change Characters</b>	
Control Character 9910	
<b>Beep Gap Change</b>	<b>Code</b>
10mS	60
20mS	61
30mS	62
40mS	63
60mS	64
80mS	65
120mS	66
160mS	67
240mS	68
320mS	69

## Beep Parameters (General)

Control Character 9910

Beep Parameter	Code
custom beep	57xxxxyy
custom beep delay	58xx
1 second pre-message delay	54
automatic beep gap OFF	55
automatic beep gap ON	56

## DTMF Character Set Tables

<b>DTMF Characters</b>			
Control Character 9950			
<b>DTMF Character</b>	<b>Code</b>	<b>DTMF Character</b>	<b>Code</b>
0	00	8	08
1	01	9	09
2	02	A	10
3	03	B	11
4	04	C	12
5	05	D	13
6	06	*	14
7	07	#	15

<b>DTMF Duration Change Characters</b>	
Control Character 9950	
<b>DTMF Duration Change</b>	<b>Code</b>
30mS	20
40mS	21
50mS	22
60mS	23
70mS	24
80mS	25
90mS	26
100mS	27
150mS	28
200mS	29

## DTMF Gap Change Characters

Control Character 9950

DTMF Gap Change	Code
20mS	30
30mS	31
40mS	32
50mS	33
60mS	34
70mS	35
80mS	36
90mS	37
100mS	38
150mS	39

## DTMF Pause Characters

Control Character 9950

DTMF Pause	Code
100mS	40
200mS	41
300mS	42
400mS	43
500mS	44
600mS	45
700mS	46
800mS	47
900mS	48
1000mS	49

## DTMF Custom Changes (Duration Gap Pause)

Control Character 9950

DTMF Custom Change	Code	Data Digit
custom DTMF duration change (10990mS)	50xx	0199 x 10mS
custom DTMF duration change (1009900mS)	51xx	0199 x 100mS
custom DTMF gap change (10990mS)	52xx	0199 x 10mS
custom DTMF gap change (1009900mS)	53xx	0199 x 100mS
custom DTMF pause (10990mS)	54xx	0199 x 10mS
custom DTMF pause (1009900mS)	55xx	0199 x 100mS
to ignore each custom DTMF change code		enter 00 for xx in any of above codes

<b>Synthesized Speech Vocabulary (Male Voice)</b>					
Control Character 9960					
<b>Word</b>	<b>Code</b>	<b>Word</b>	<b>Code</b>	<b>Word</b>	<b>Code</b>
<b>A</b>	0001	area	0035	calling	0068
abeam	0002	arrival	0036	calm	0069
abort	0003	as	0037	cancel	0070
about	0004	association	0038	caution	0071
above	0005	at	0039	ceiling	0072
accelerated	0006	atis	0040	Celsius	0073
acknowledge	0007	August	0041	center	0074
action	0008	auto-	0042	change	0075
adjust	0009	automatic	0043	Charlie	0076
advise	0010	autopilot	0044	check	0077
aerial	0011	auxiliary	0045	circuit	0078
affirmative	0012	<b>B</b>	0046	clear	0079
afternoon	0013	band	0047	clearance	0080
air	0014	bank	0048	clearance delay	0081
air brakes	0015	base	0049	climb	0082
aircraft	0016	battery	0050	clock	0083
airport	0017	below	0051	closed	0084
airspeed	0018	between	0052	club	0085
alert	0019	big	0053	code	0086
all	0020	blowing	0054	come	0087
aloft	0021	boost	0055	complete	0088
alpha	0022	brake	0056	connect	0089
alternate	0023	braking	0057	contact	0090
altimeter	0024	bravo	0058	control	0091
altitude	0025	break	0059	converging	0092
amateur	0027	broken	0060	course	0093
amps	0028	busy	0061	cowl	0094
and	0029	button	0062	crane	0095
answer	0030	by	0063	crosswind	0096
approach	0031	<b>C</b>	0064	crystals	0097
approaches	0032	cabin	0065	current	0098
April	0033	calibrate	0066	cycle	0099
A.P.U.	0034	call	0067	cylinder	0100
<b>D</b>	0101	eleven	0135	flaps	0169
danger	0102	emergency	0136	flight1	0170
date	0103	engine	0137	flight2	0171

day	0104	enter	0138	flight watch	0172
days	0105	equal	0139	flow	0173
December	0106	-er	0140	fog	0174
decrease	0107	error	0141	for-	0175
decreasing	0108	estimated	0142	forty	0176
degree	0109	E.T.A.	0143	four	0177
degrees	0110	evacuate	0144	fourteen	0178
delta	0111	evacuation	0145	fourth	0179
departure1	0112	evening	0146	foxtrot	0180
departure2	0113	exit	0147	freedom	0181
device	0114	expect	0148	freezing	0182
dialing	0115	<b>F</b>	0149	frequency	0183
dinner	0116	Fahrenheit	0150	Friday	0184
direction	0117	fail	0151	from	0185
display	0118	failure	0152	front	0186
divided	0119	farad	0153	F.S.S.	0187
door	0120	fast	0154	fuel	0188
doors	0121	February	0155	full	0189
down	0122	feet	0156	<b>G</b>	0190
downwind	0123	field	0157	galley	0191
drizzle	0124	fif-	0158	gallons	0192
dust	0125	fifteen	0159	gate	0193
<b>E</b>	0126	fifth	0160	gauge	0194
east	0127	fifty	0161	gear	0195
echo	0128	filed	0162	get	0196
eight	0129	final	0163	glide	0197
eighteen	0130	fire	0164	go	0198
eighth	0131	first	0165	golf	0199
eighty	0132	five	0166	good bye	0200
electrician	0133	flameout	0167	grain	0201
elevation	0134	flap load	0168	green	0202
Greenwich	0203	immediately	0237	leg	0271
ground	0204	in	0238	less than	0272
gundish	0205	inbound	0239	level1	0273
gusting to	0206	inch	0240	level2	0274
<b>H</b>	0207	increase	0241	level off	0275
hail	0208	increasing	0242	light	0276
half	0209	increasing to	0243	lights	0277
ham	0210	India	0244	Lima	0278
hamfest	0211	indicated	0245	line	0279
have	0212	inflight	0246	link	0280
haze	0213	information	0247	list	0281
heading	0214	-ing	0248	localizer	0282

heavy	0215	inner	0249	long	0283
hello	0216	inspector	0250	low	0284
help	0217	instruments	0251	lower	0285
Henry	0218	intruder	0252	lunch	0286
hertz	0219	is	0253	<b>M</b>	0287
high	0220	it	0254	machine	0288
hold	0221	<b>J</b>	0255	magnetos	0289
home	0222	January	0256	maintain	0290
hotel	0233	Juliet	0257	man	0291
hour	0234	July	0258	manual	0292
hours	0225	June	0259	March	0293
hundred	0226	<b>K</b>	0260	marker	0294
<b>I</b>	0227	key	0261	May	0295
ice	0228	kilo	0262	mayday	0296
icing	0229	knots	0263	me	0297
identify	0230	<b>L</b>	0264	mean	0298
idle	0231	land	0265	measure	0299
if	0232	landing	0266	meet	0300
I.F.R.	0233	landing gear	0267	meeting	0301
ignite	0234	launch	0268	mega	0302
ignition	0235	lean	0269	messages	0303
I.L.S.	0236	left	0270	meter	0304
micro	0305	ninth	0339	pass	0373
middle	0306	no	0340	passed	0374
midpoints	0307	noon	0341	patch	0375
mig	0308	north	0342	path	0376
mike	0309	northeast	0343	(pause)	0377
miles	0310	northwest	0344	pellets	0378
mill	0311	not	0345	per	0379
milli	0312	notam	0346	percent	0380
million	0313	no turn	0347	phone	0381
minus	0314	November	0348	pico	0382
minutes	0315	number	0349	plan	0383
mist	0316	<b>O</b>	0350	please	0384
mixture	0317	obscured	0351	plus	0385
mobile	0318	o'clock	0352	P.M.	0386
moderate	0319	October	0353	point	0387
monday	0320	of	0354	police	0388
month	0321	off	0355	position	0389
more than	0322	ohm	0356	power	0390
morning	0323	oil	0357	press	0391
motor	0324	on	0358	pressure	0392
move	0325	one	0359	priority	0393

moving	0326	open	0360	probe	0394
much	0327	operator	0361	props	0395
<b>N</b>	0328	oscar	0362	pull	0396
near	0329	other	0363	pumps	0397
negative	0330	out	0364	push	0398
net	0331	outer	0365	<b>Q</b>	0399
new	0332	over	0366	Quebec	0400
next	0333	overcast	0367	<b>R</b>	0401
night	0334	overspeed	0368	radar	0402
nine	0335	<b>P</b>	0369	radial	0403
niner	0336	page	0370	radio	0404
nineteen	0337	papa	0371	radios	0405
ninety	0338	partially	0372	rain	0406
raise	0407	select	0441	squawking	0475
range	0408	September	0442	stabilizer	0476
rate1	0409	sequence	0443	stall	0477
rate2	0410	service	0444	start	0478
ready	0411	set	0445	stop	0479
rear	0412	seven	0446	storm	0480
receive	0413	seventeen	0447	street	0481
red	0414	seventh	0448	Sunday	0482
refueling	0415	seventy	0449	switch	0483
release	0416	severe	0450	system	0484
remark	0417	short	0451	<b>T</b>	0485
remote	0418	showers	0452	tacan	0486
repair	0419	shut	0453	tango	0487
repeat	0420	side	0454	tank	0488
repeater	0421	sierra	0455	target1	0489
rich	0422	sigmet	0456	target2	0490
right	0423	six	0457	taxi	0491
R nav	0424	sixteen	0458	-teen	0492
road	0425	sixteenth	0459	telephone	0493
Roger	0426	sixth	0460	temperature	0494
rollout	0427	sixty	0461	ten	0495
Romeo	0428	sleet	0462	tenth	0496
runway	0429	slope	0463	terminal	0497
R.V.R.s	0430	slow1	0464	test	0498
<b>S</b>	0431	slow2	0465	-th	0499
/S/ sound	0432	smoke	0466	the	0500
safe	0433	snow	0467	thee	0501
sand	0434	south	0468	thin	0502
Saturday	0435	southeast	0469	thinly	0503
scattered	0436	southwest	0470	thir-	0504

second	0437	speed	0471	third	0505
seconds	0438	spoilers	0472	thirteen	0506
security	0439	spray	0473	thirty	0507
selcal	0440	squawk	0474	this	0508
this is	0509	-ty	0539	watch	0569
thousand	0510	<b>U</b>	0540	watts	0570
three	0511	under	0541	way	0571
thunderstorms	0512	undercarriage	0542	we	0572
Thursday	0513	unicom	0543	weather	0573
time	0514	uniform	0544	Wednesday	0574
timer	0515	unit	0545	week	0575
times	0516	unlimited	0546	welcome	0576
to-	0517	until	0547	west	0577
today	0518	up	0548	whiskey	0578
tommorow	0519	use1 (noun)	0549	white	0579
tonight	0520	use2 (verb)	0550	will	0580
tool	0521	<b>V</b>	0551	wind	0581
too low	0522	vacuum	0552	windows	0582
tornado	0523	valley	0553	with	0583
touchdown	0524	valve	0554	wrong	0584
tower	0525	variable	0555	<b>X</b>	0585
traffic	0526	vectors	0556	X-ray	0586
transmit	0527	verify	0557	<b>Y</b>	0587
trim	0528	V.F.R.	0558	yankee	0588
true	0529	V.H.E.	0559	yellow	0589
Tuesday	0530	Victor	0560	yesterday	0590
turbulence	0531	visibility	0561	you	0591
turn1	0532	volts	0562	your	0592
turn2	0533	V.O.R.	0563	you've	0593
twelfth	0534	vortac	0564	<b>Z</b>	0594
twelve	0535	<b>W</b>	0565	zero	0595
twentieth	0536	wait	0566	zone	0596
twenty	0537	wake	0567	Zulu	0597
two	0538	warning	0568		

<p style="text-align: center;"><b>Synthesized Speech Vocabulary (Female Voice and Sound Effects)</b></p> <p style="text-align: center;">Control Character 9960</p>					
Word	Code	Word	Code	Word	Code
afternoon	4097	ten	4122	laugh 2	4146
A.M.	4098	the	4123	laugh- diabolic	4147
eight	4099	thirteen	4124	music	4148
eighteen	4100	thirty	4125	Superman	4149
eleven	4101	three	4126	tic	4150
evening	4102	time	4127	TI first (football)	4151
fifteen	4103	twelve	4128	TI second (football)	4152
fifty	4104	twenty	4129	toc	4153
five	4105	two	4130	tone 1	4154
forty	4106	<b>Sound Effect</b>	<b>Code</b>	tone 2	4155
four	4107	ball caught	4131	tone 3	4156
fourteen	4108	bat hitting ball	4132	tone 4	4157
good	4109	bugle call	4133	tone 5	4158
is	4110	chime 1	4134	tone A	4159
morning	4111	chime 2	4135	tone B	4160
nine	4112	chime 3	4136	tone D	4161
nineteen	4113	chime 4	4137	tone G	4162
o'clock	4114	crowd noise	4138	tone low B	4163
oh	4115	def-in-pos (f'tball)	4139	tone low C	4164
one	4116	explosion-long	4140	tone low G	4165
P.M.	4117	explosion-short	4141	tune 1	4166
seven	4118	Georgia Brown	4142	tune 2	4167
seventeen	4119	gunshot	4143	whistle	4168
six	4120	laser	4144	whistle - falling	4169
sixteen	4121	laugh 1	4145	whistle - rising	4170

<b>Message Run-Time Variables</b>		
<b>Run-Time Variable</b>	<b>Meaning</b>	<b>Example</b>
9810	hour & minute, 12-hr format CW	2 45 in CW
9811	AM/PM, CW	PM in CW
9812	hour & minute, 24-hr format, CW	14 45 in CW
9813	day-of-week, CW	WED in CW
9814	month, CW	1 in CW
9815	day-of-month, CW	1 in CW
9816	seconds, CW	27 in CW
9820	hour & minute, 12-hr format, male voice	two forty-five (male)
9821	AM/PM, male voice	PM (male)
9822	hour & minute, 12-hr format, female voice	two forty-five (female)
9823	AM/PM, female voice	PM (female)
9824	hour & minute, 24-hr format, male voice	14 hours, 45 minutes (male)
9825	same as 9824 without "hours" & "minutes"	fourteen forty-five (male)
9826	day-of-week, male voice	Wednesday (male)
9827	cardinal day-of-month, male voice	one (male)
9828	ordinal day-of-month, male voice	first (male)
9829	month, male voice	January (male)
9830	"good morning/good afternoon/good evening", female voice	good afternoon (female)
9831	"morning/afternoon/evening", male voice	afternoon (male)
9832	seconds, male voice	twenty-seven (male)
9896	Call Count, CW	105 in CW
9897	Call Count, male voice	one zero five (male)
9898	Software Version, CW	203 in CW
9899	Software Version, male voice	two point zero three (male)

<b>Message Control Characters</b>	
<b>Control Character</b>	<b>Definition</b>
9900	CW characters follow
9910	beep characters follow
9920	single-tone page follows
9930	two-tone page follows
9940	5/6-tone page follows
9950	DTMF characters follow
9960	synthesized speech characters follow
9981	route this message to transmitter #1 mixed with other audio
9982	route this message to transmitter #1 not mixed with other audio
9983	route this message to transmitter #2 mixed with other audio
9984	route this message to transmitter #2 not mixed with other audio
9985	route this message to phone line mixed with Rx audio
9986	route this message to phone line not mixed with Rx audio
9987	do not route remaining message audio to transmitter #1
9988	do not route remaining message audio to transmitter #2
9989	do not route remaining message audio to phone line
9990	save current routing settings
9991	restore saved routing settings
9999 xxxx	execute macro xxxx after prior message audio has been sent

<b>Scheduler Day Code Table</b>			
<b>Day Code</b>	<b>Explanation</b>	<b>Day Code</b>	<b>Explanation</b>
01-31	calendar day-of-month	54	2nd Saturday of month
32	weekdays (Mon-Fri)	55	3rd Sunday of month
33	weekends (Sat-Sun)	56	3rd Monday of month
34	Sundays	57	3rd Tuesday of month
35	Mondays	58	3rd Wednesday of month
36	Tuesdays	59	3rd Thursday of month
37	Wednesdays	60	3rd Friday of month
38	Thursdays	61	3rd Saturday of month
39	Fridays	62	4th Sunday of month
40	Saturdays	63	4th Monday of month
41	1st Sunday of month	64	4th Tuesday of month
42	1st Monday of month	65	4th Wednesday of month
43	1st Tuesday of month	66	4th Thursday of month
44	1st Wednesday of month	67	4th Friday of month
45	1st Thursday of month	68	4th Saturday of month
46	1st Friday of month	69	5th Sunday of month
47	1st Saturday of month	70	5th Monday of month
48	2nd Sunday of month	71	5th Tuesday of month
49	2nd Monday of month	72	5th Wednesday of month
50	2nd Tuesday of month	73	5th Thursday of month
51	2nd Wednesday of month	74	5th Friday of month
52	2nd Thursday of month	75	5th Saturday of month
53	2nd Friday of month	99	every day ( <i>wild card</i> )

<b>Tone Code Table</b>									
All Frequencies in Hz									
<b>Freq</b>	<b>Code</b>	<b>Freq</b>	<b>Code</b>	<b>Freq</b>	<b>Code</b>	<b>Freq</b>	<b>Code</b>	<b>Freq</b>	<b>Code</b>
100	9999	225	4444	350	2857	475	2105	600	1666
105	9523	230	4347	355	2816	480	2083	605	1652
110	9090	235	4255	360	2777	485	2061	610	1639
115	8695	240	4166	365	2739	490	2040	615	1626
120	8333	245	4081	370	2702	495	2020	620	1612
125	8000	250	4000	375	2666	500	2000	625	1600
130	7692	255	3921	380	2631	505	1980	630	1587
135	7407	260	3846	385	2597	510	1960	635	1574
140	7142	265	3773	390	2564	515	1941	640	1562
145	6896	270	3703	395	2531	520	1923	645	1550
150	6666	275	3636	400	2500	525	1904	650	1538
155	6451	280	3571	405	2469	530	1886	655	1526
160	6250	285	3508	410	2439	535	1869	660	1515
165	6060	290	3448	415	2409	540	1851	665	1503
170	5882	295	3389	420	2380	545	1834	670	1492
175	5714	300	3333	425	2352	550	1818	675	1481
180	5555	305	3278	430	2325	555	1801	680	1470
185	5405	310	3225	435	2298	560	1785	685	1459
190	5263	315	3174	440	2272	565	1769	690	1449
195	5128	320	3125	445	2247	570	1754	695	1438
200	5000	325	3076	450	2222	575	1739	700	1428
205	4878	330	3030	455	2197	580	1724	705	1418
210	4761	335	2985	460	2173	585	1709	710	1408
215	4651	340	2941	465	2150	590	1694	715	1398
220	4545	345	2898	470	2127	595	1680	720	1388
725	1379	850	1176	975	1025	1100	0909	1225	0816
730	1369	855	1169	980	1020	1105	0904	1230	0813
735	1360	860	1162	985	1015	1110	0900	1235	0809
740	1351	865	1156	990	1010	1115	0896	1240	0806
745	1342	870	1149	995	1005	1120	0892	1245	0803
750	1333	875	1142	1000	1000	1125	0888	1250	0800
755	1324	880	1136	1005	0995	1130	0884	1255	0796
760	1315	885	1129	1010	0990	1135	0881	1260	0793
765	1307	890	1123	1015	0985	1140	0877	1265	0790
770	1298	895	1117	1020	0980	1145	0873	1270	0787
775	1290	900	1111	1025	0975	1150	0869	1275	0784
780	1282	905	1104	1030	0970	1155	0865	1280	0781
785	1273	910	1098	1035	0966	1160	0862	1285	0778
790	1265	915	1092	1040	0961	1165	0858	1290	0775
795	1257	920	1086	1045	0956	1170	0854	1295	0772

800	1250	925	1081	1050	0952	1175	0851	1300	0769
805	1242	930	1075	1055	0947	1180	0847	1305	0766
810	1234	935	1069	1060	0943	1185	0843	1310	0763
815	1226	940	1063	1065	0938	1190	0840	1315	0760
820	1219	945	1058	1070	0934	1195	0836	1320	0757
825	1212	950	1052	1075	0930	1200	0833	1325	0754
830	1204	955	1047	1080	0925	1205	0829	1330	0751
835	1197	960	1041	1085	0921	1210	0826	1335	0749
840	1190	965	1036	1090	0917	1215	0823	1340	0746
845	1183	970	1030	1095	0913	1220	0819	1345	0743
1350	0740	1475	0677	1600	0625	1725	0579	1850	0540
1355	0738	1480	0675	1605	0623	1730	0578	1855	0539
1360	0735	1485	0673	1610	0621	1735	0576	1860	0537
1365	0732	1490	0671	1615	0619	1740	0574	1865	0536
1370	0729	1495	0668	1620	0617	1745	0573	1870	0534
1375	0727	1500	0666	1625	0615	1750	0571	1875	0533
1380	0724	1505	0664	1630	0613	1755	0569	1880	0531
1385	0722	1510	0662	1635	0611	1760	0568	1885	0530
1390	0719	1515	0660	1640	0609	1765	0566	1890	0529
1395	0716	1520	0657	1645	0607	1770	0564	1895	0527
1400	0714	1525	0655	1650	0606	1775	0563	1900	0526
1405	0711	1530	0653	1655	0604	1780	0561	1905	0524
1410	0709	1535	0651	1660	0602	1785	0560	1910	0523
1415	0706	1540	0649	1665	0600	1790	0558	1915	0522
1420	0704	1545	0647	1670	0598	1795	0557	1920	0520
1425	0701	1550	0645	1675	0597	1800	0555	1925	0519
1430	0699	1555	0643	1680	0595	1805	0554	1930	0518
1435	0696	1560	0641	1685	0593	1810	0552	1935	0516
1440	0694	1565	0638	1690	0591	1815	0550	1940	0515
1445	0692	1570	0636	1695	0589	1820	0549	1945	0514
1450	0689	1575	0634	1700	0588	1825	0547	1950	0512
1455	0687	1580	0632	1705	0586	1830	0546	1955	0511
1460	0684	1585	0630	1710	0584	1835	0544	1960	0510
1465	0682	1590	0628	1715	0583	1840	0543	1965	0508
1470	0680	1595	0626	1720	0581	1845	0542	1970	0507
1975	0506	2100	0476	2225	0449	2350	0425	2475	0404
1980	0505	2105	0475	2230	0448	2355	0424	2480	0403
1985	0503	2110	0473	2235	0447	2360	0423	2485	0402
1990	0502	2115	0472	2240	0446	2365	0422	2490	0401
1995	0501	2120	0471	2245	0445	2370	0421	2495	0400
2000	0500	2125	0470	2250	0444	2375	0421	2500	0400
2005	0498	2130	0469	2255	0443	2380	0420	2505	0399
2010	0497	2135	0468	2260	0442	2385	0419	2510	0398

2015	0496	2140	0467	2265	0441	2390	0418	2515	0397
2020	0495	2145	0466	2270	0440	2395	0417	2520	0396
2025	0493	2150	0465	2275	0439	2400	0416	2525	0396
2030	0492	2155	0464	2280	0438	2405	0415	2530	0395
2035	0491	2160	0462	2285	0437	2410	0414	2535	0394
2040	0490	2165	0461	2290	0436	2415	0414	2540	0393
2045	0488	2170	0460	2295	0435	2420	0413	2545	0392
2050	0487	2175	0459	2300	0434	2425	0412	2550	0392
2055	0486	2180	0458	2305	0433	2430	0411	2555	0391
2060	0485	2185	0457	2310	0432	2435	0410	2560	0390
2065	0484	2190	0456	2315	0431	2440	0409	2565	0389
2070	0483	2195	0455	2320	0431	2445	0408	2570	0389
2075	0481	2200	0454	2325	0430	2450	0408	2575	0388
2080	0480	2205	0453	2330	0429	2455	0407	2580	0387
2085	0479	2210	0452	2335	0428	2460	0406	2585	0386
2090	0478	2215	0451	2340	0427	2465	0405	2590	0386
2095	0477	2220	0450	2345	0426	2470	0404	2595	0385
2600	0384	2725	0366	2850	0350	2975	0336		
2605	0383	2730	0366	2855	0350	2980	0335		
2610	0383	2735	0365	2860	0349	2985	0335		
2615	0382	2740	0364	2865	0349	2990	0334		
2620	0381	2745	0364	2870	0348	2995	0333		
2625	0380	2755	0362	2875	0347	3000	0333		
2630	0380	2760	0362	2880	0347				
2635	0379	2765	0361	2885	0346				
2640	0378	2770	0361	2890	0346				
2645	0378	2775	0360	2895	0345				
2650	0377	2780	0359	2900	0344				
2655	0376	2785	0359	2905	0344				
2660	0375	2790	0358	2910	0343				
2665	0375	2795	0357	2915	0343				
2670	0374	2755	0362	2920	0342				
2675	0373	2800	0357	2925	0341				
2680	0373	2805	0356	2930	0341				
2685	0372	2810	0355	2935	0340				
2690	0371	2815	0355	2940	0340				
2695	0371	2820	0354	2945	0339				
2700	0370	2825	0353	2950	0338				
2705	0369	2830	0353	2955	0338				
2710	0369	2835	0352	2960	0337				
2715	0368	2840	0352	2965	0337				
2720	0367	2845	0351	2970	0336				

<b>Root Numbers (Commands) by Number</b>		
<b>Page</b>	<b>Number</b>	<b>Description</b>
17-9	00	Key Transmitter (Timed)
10-2	02	Enable/Disable CTCSS Encoder
10-3	03	Select Frequency of CTCSS
4-12 4-19	06	Select Frequency of CW/Beep
17-7	10	Reset Transmitter Timeout Timer
4-13	11	Send Next CW Message Slowly
4-14	12	Select Normal CW Speed
4-14	13	Select Slow CW Speed
4-42	15	Send Message
6-5	20	Create New Macro
6-11	21	Erase Macro
6-12	22	Erase All Macros
7-32	23	Change Autopatch Access Password
8-2	25	Set Clock and Calendar
A-24	26	Set Event-Triggered Macro ( <i>See table page A-24.</i> )
6-13	27	Rename Macro
9-2 9-6	28	Create Scheduler Setpoint
6-7	29	Append to Macro
17-4	30	Select Transmitter Dropout Delay
A-27	31	Select Message ( <i>See table page A-27.</i> )
17-3	32	Select Transmitter Courtesy Delay
6-9	33	List Macro in CW
A-27	34	Review Message ( <i>See table page A-27.</i> )
6-9	35	List Macro in Speech
21-4	39 02	Assign Remote Base Password
21-29	39 90	Select <i>RBI-1</i> Number of User Function Outputs in Group
21-7	39 91	Reset <i>RBI-1</i>
17-5	40	Select Transmitter Timeout Timer
18-4	45	Select Repeater Activity Counter/Timer
16-4	47	Select COR Pulse Parameters
8-4 8-6	48	Adjust Daylight Savings Time
20-1 A-29	49	User Timers Set xxx.x Seconds Timers ( <i>See table page A-29.</i> )
12-10	50	Select ID Tail Message
12-5	51	Select ID Message Interval
12-7	54	Reset Initial ID Message to Normal ID Message for Tx1

<b>Root Numbers (Commands) by Number</b>		
12-8	55	Send Initial ID Message for Tx1
A-29	57	Select Access Mode <i>(See table page A-29.)</i>
7-36	60	Select Autopatch Call Types
7-6	61	Select Autopatch Dialing Mode
A-30	63	Enable/Disable Software Switches <i>(See page A-30.)</i>
7-53	64	Select Phone Line Answer Mode
7-25	65	Select Autopatch Timeout Timer
7-42	67	Enter/Clear Autopatch Reject Number Table
7-40	68	Enter/Clear Autopatch Accepted Number Table
7-48	69	Clear Autopatch Call Counter
15-2	70	Select Logic Outputs Latched ON
15-2	71	Select Logic Outputs Latched OFF
15-2	72	Select Logic Outputs Momentary ON
15-2	73	Select Logic Outputs Momentary OFF
7-57	79	Select Phone Line Off-Hook Timer
18-6	80	Select Repeater Anti-Kerchunk Key-Up Delay
7-26	81	Reset Autopatch Timeout Timer
11-7	82	Select DTMF Decoder Interdigit Timer
7-15	83	Dump Autopatch Using A Code
7-23	83 1	Landline Hookflash
7-34	83 2	Autopatch Go Off-Hook
7-34	83 3	Autopatch Go Off-Hook, Ignore Busy Logic Input
7-13	83 10	Select/Delete Autopatch Dialing Prefix
7-45	84	Autopatch Redial Last Number
7-46	85	Clear Autopatch Redialer
7-49	86	Send Autopatch Call Count in CW
7-60	87	Trigger Reverse Patch
7-61	88	Answer Reverse Patch
11-3	89	Select DTMF Priority/Scan
13-3	90	Select Audio Routing Priorities
7-68	91	Select Autopatch Command Response Message Routing
5-2	92	Assign Control Operator Password
5-3	93	Assign Master Password
5-4 5-5	94	Assign Control Operator Privilege level
11-8	96	Select DTMF Decoder Mute Delay
6-15	98	Pause Command Execution
A-29	99	Select xx.x Minute Timers <i>(See table page A-29.)</i>

<b>Event Macros by Number</b>		
Assign with (PW) 26 (number) (macro) *		
Erase with (PW) 26 (number) *		
<b>Page</b>	<b>Number</b>	<b>Description</b>
6-16	00	Power-On Reset Macro
12-4	03	Initial ID Macro for Tx1
12-4	04	Normal ID Macro for Tx1
12-4	05	Impolite ID Macro for Tx1
7-22	06	Any-Receiver-Active-to-Autopatch-Triggered Macro
7-22	07	All-Receivers-Inactive-to-Autopatch-Triggered Macro
18-11	08	Dropout Message-Triggered Macro
18-11 17-13	09	All-Receivers-Inactive-to-Tx1-Triggered Macro
18-11	10	Courtesy Message-Triggered Macro
18-11 17-13	11	Any-Receiver-Active-to-Tx1-Triggered Macro
7-16	12	Autopatch Access-Triggered Macro
7-16	13	Autopatch Dump-Triggered Macro
18-4	14	Repeater Start-of-Activity Macro
18-4	15	Repeater Post-Activity Macro
7-55	16	Phone Line Answer Macro
16-4	17	COR Pulse-Triggered Macro
18-11	18	Repeater Timeout Macro
18-11	19	Repeater Return-From-Timeout Macro
14-2	20	Logic Input 1 Hi-to-Lo Macro
14-2	21	Logic Input 1 Lo-to-Hi Macro
14-2	22	Logic Input 2 Hi-to-Lo Macro
14-2	23	Logic Input 2 Lo-to-Hi Macro
14-2	24	Logic Input 3 Hi-to-Lo Macro
14-2	25	Logic Input 3 Lo-to-Hi Macro
14-2	26	Logic Input 4 Hi-to-Lo Macro
14-2	27	Logic Input 4 Lo-to-Hi Macro
14-2	28	Logic Input 5 Hi-to-Lo Macro
14-2	29	Logic Input 5 Lo-to-Hi Macro
14-2	30	Logic Input 6 Hi-to-Lo Macro
14-2	31	Logic Input 6 Lo-to-Hi Macro
14-2	32	Phone Line Busy Input Hi-to-Lo Macro
14-2	33	Phone Line Busy Input Lo-to-Hi Macro
14-2	34	COR Input 1 Hi-to-Lo Macro
14-2	35	COR Input 1 Lo-to-Hi Macro
14-2	36	COR Input 2 Hi-to-Lo Macro

<h2 style="text-align: center;">Event Macros by Number</h2> <p style="text-align: center;">Assign with (PW) 26 (number) (macro) * Erase with (PW) 26 (number) *</p>		
14-2	37	COR Input 2 Lo-to-Hi Macro
14-2	38	COR Input 3 Hi-to-Lo Macro
14-2	39	COR Input 3 Lo-to-Hi Macro
14-2	40	PL Input 1 Hi-to-Lo Macro
14-2	41	PL Input 1 Lo-to-Hi Macro
14-2	42	PL Input 2 Hi-to-Lo Macro
14-2	43	PL Input 2 Lo-to-Hi Macro
14-2	44	PL Input 3 Hi-to-Lo Macro
14-2	45	PL Input 3 Lo-to-Hi Macro
12-4	46	Initial ID Macro for Tx2
12-4	47	Normal ID Macro for Tx2
12-4	48	Impolite ID Macro for Tx2
11-12	49	DTMF Digit Decoded-Triggered Macro
11-11	50	Long-Tone Zero Macro
11-11	51	Long-Tone One Macro
11-11	52	Long-Tone Two Macro
11-11	53	Long-Tone Three Macro
11-11	54	Long-Tone Four Macro
11-11	55	Long-Tone Five Macro
11-11	56	Long-Tone Six Macro
11-11	57	Long-Tone Seven Macro
11-11	58	Long-Tone Eight Macro
11-11	59	Long-Tone Nine Macro
11-11	60	Long-Tone A Macro
11-11	61	Long-Tone B Macro
11-11	62	Long-Tone C Macro
11-11	63	Long-Tone D Macro
11-11	64	Long-Tone Star (*) Macro
11-11	65	Long-Tone Pound (#) Macro
16-2	67	Rx1 Start-of-Activity Macro
16-2	68	Rx1 Post-Activity Macro
16-2	69	Rx2 Start-of-Activity Macro
16-2	70	Rx2 Post-Activity Macro
16-2	71	Rx3 Start-of-Activity Macro
16-2	72	Rx3 Post-Activity Macro
17-13	73	Any-Receiver-Active-to-Tx2-Triggered Macro
17-13	74	All-Receivers-Inactive-to-Tx2-Triggered Macro
7-67	75	Autopatch Access-From-Rx1-Triggered Macro
7-67	76	Autopatch Access-From-Rx2-Triggered Macro
7-67	77	Autopatch Access-From-Rx3-Triggered Macro

**Event Macros by Number**

Assign with (PW) 26 (number) (macro) \*

Erase with (PW) 26 (number) \*

7-63	80	Reverse Patch Ring-Triggered Macro
7-56	81	Control Line Dump Macro
17-14	82	Tx1 Inactive-to-Active Macro
17-14	83	Tx1 Active-to-Inactive Before Unkey Delay Macro
17-14	84	Tx1 Active-to-Inactive Macro
17-14	85	Tx2 Inactive-to-Active Macro
17-14	86	Tx2 Active-to-Inactive Before Unkey Delay Macro
17-14	87	Tx2 Active-to-Inactive Macro
21-5	90	Remote Base Access-Triggered Macro
21-5	91	Remote Base Dump-Triggered Macro

<p style="text-align: center;"><b>Messages by Number</b>                      Program with (PW) 31 (number) (message) *                      Review with (PW) 34 (number) *</p>			
Page	Number	Description	Default
4-45	00	Warm Reset Message	?RES in CW
4-44	01	OK Command Response Message	OK in CW
4-44	02	Error 1 Command Response Message	?ERR1 in CW
4-44	03	Error 2 Command Response Message	?ERR2 in CW
18-9	10	Courtesy Message for Rx1	60 mS 440 Hz (74 09)
18-9	11	Courtesy Message for Rx2	60 mS 660 Hz (74 16)
18-9	12	Courtesy Message for Rx3	60 mS 880 Hz (74 21)
4-37	13	Dropout Message	none
4-37	16	Pre-Timeout Message	TO in CW
4-37	19	Post-Timeout Message	TO in CW
12-9	28	Initial ID Programmable Tail Message for Tx1	none
12-9	29	Normal ID Programmable Tail Message for Tx1	none
12-3	30	Initial ID Message for Tx1	ID in CW
12-3	31	Normal ID Message for Tx1	ID in CW
12-3	32	Impolite ID Message for Tx1	none
12-3	33	Initial ID Message for Tx2	9983 ID in CW
12-3	34	Normal ID Message for Tx2	9983 ID in CW
12-3	35	Impolite ID Message for Tx2	none
7-7	40	Autopatch Dialing Message	AS in CW
7-27	41	Autopatch Timeout Warning Message	AR in CW
7-8	42	Landline Busy Message	BZ in CW
7-9	43	Autopatch Dump Message	none
7-8	44	Autopatch Off Message	OFF in CW
7-8	45	Autopatch Error Message (Invalid phone number)	?ERR in CW
7-8	46	Autopatch Reject Message (Match in Reject Table)	?REJ in CW
7-8	47	Autopatch No-Redial-Number Message	CLR in CW
7-54	50	Phone Line Answer Message	3 beeps (74 09 21 33)
7-62	51	Reverse Patch Ringout Message	55 in CW

## Messages by Number

Program with (PW) 31 (number) (message) \*

Review with (PW) 34 (number) \*

Page	Number	Description	Default
21-6	60	Remote Base Off Message	OFF in CW
4-41	70	User Message 1	none
4-41	71	User Message 2	none
4-41	72	User Message 3	none
4-41	73	User Message 4	none

## Tenth-Second Timers by Number

User Timers: (PW) 49 (number) (function) (value) \*  
Other Timers: (PW) 49 (number) (value) \*

Page	Number	Description
20-1	00-09	User Timers
7-11	96	Autopatch Pause ("B") Digit Time
12-6	97	Select ID Pending Interval for Tx1 and Tx2
17-12	98	Select Tx1 Unkey Delay
17-12	99	Select Tx2 Unkey Delay

## Tenth-Minute Timers by Number

(PW) 99 (number) (value) \*

Page	Number	Description
16-2	00	Rx1 Post-Activity Timer
16-2	01	Rx2 Post-Activity Timer
16-2	02	Rx3 Post-Activity Timer
18-6	10	Repeater Anti-Kerchunk Re-Arm Delay

## Path Access Mode by Number

(PW) 57 (number) (mode) \*

Page	Number	Description
13-4 18-2	00	Rx1-to-Tx1 Access Mode (Path1)
13-4 18-2	01	Rx2-to-Tx1 Access Mode (Path2)
13-4 18-2	02	Rx3-to-Tx1 Access Mode (Path3)
13-4 18-2	03	Rx1-to-Tx2 Access Mode (Path4)
13-4 18-2	04	Rx2-to-Tx2 Access Mode (Path5)
13-4 18-2	05	Rx3-to-Tx2 Access Mode (Path6)
11-5	06	Rx1-to-DTMF Decoder Access Mode
11-5	07	Rx2-to-DTMF Decoder Access Mode
11-5	08	Rx3-to-DTMF Decoder Access Mode

## Software Switches by Number

(PW) 63 (number) (enable/disable) \*

Page	Number	Description
17-8	00	Enable/Disable Transmitter 1
4-11	01	Enable/Disable CW
11-2	02	Enable/Disable Command Responses
7-10	04	Enable/Disable Autopatch Dialing Mixed-Mode
7-12	05	Enable/Disable Autopatch Pound Down (# Dump)
7-18	06	Enable/Disable Autopatch Privacy
7-17	07	Enable/Disable Autopatch Full-Duplex Mode
7-19	08	Enable/Disable Autopatch Repeater-to-Phone DTMF Mute
7-20	09	Enable/Disable ID During Autopatch
7-21	10	Require Autopatch Dump Before Next Call
7-33	11	Enable/Disable Autopatch Access Without Password
19-2	13	Enable/Disable Base Station Star/Pound Talkout
19-4	14	Select Base Station Talkout Transmitter Mode
9-7	15	Enable/Disable Scheduler
17-8	22	Enable/Disable Transmitter 2
7-58	23	Monitor Repeater Receiver #1 (Rx1)
7-58	24	Monitor Repeater Receiver #2 (Rx2)
7-58	25	Monitor Repeater Receiver #3 (Rx3)
7-58	26	Talk Out Transmitter #1 (Tx1)
7-58	27	Talk Out Transmitter #2 (Tx2)
18-8	30	Select Anti-Kerchunk No Hangtime Mode
17-11	31	Enable/Disable Tx1 Minimum Unkey Delay
17-11	32	Enable/Disable Tx2 Minimum Unkey Delay
17-10	41	Key Transmitter 1 (Untimed)
17-10	42	Key Transmitter 2 (Untimed)
11-9	50	Enable/Disable Rx1-Tx1 DTMF Mute
11-9	51	Enable/Disable Rx2-Tx1 DTMF Mute
11-9	52	Enable/Disable Rx3-Tx1 DTMF Mute
11-9	53	Enable/Disable Rx1-Tx2 DTMF Mute
11-9	54	Enable/Disable Rx2-Tx2 DTMF Mute
11-9	55	Enable/Disable Rx3-Tx2 DTMF Mute
16-6	57	Enable/Disable End-of-Transmission Command Execution for Rx1
16-6	58	Enable/Disable End-of-Transmission Command Execution for Rx2
16-6	59	Enable/Disable End-of-Transmission Command Execution for Rx3
19-5	60	Enable/Disable Command Execution on Interdigit Timer for Rx1
19-5	61	Enable/Disable Command Execution on Interdigit Timer for Rx2
19-5	62	Enable/Disable Command Execution on Interdigit Timer for Rx3

<h2 style="text-align: center;">Software Switches by Number</h2> <p style="text-align: center;">(PW) 63 (number) (enable/disable) *</p>		
19-5	63	Enable/Disable Command Execution on Interdigit Timer for Phone Line
16-8	64	Enable/Disable From-Start-of-Transmission Timer for Rx1
16-8	65	Enable/Disable From-Start-of-Transmission Timer for Rx2
16-8	66	Enable/Disable From-Start-of-Transmission Timer for Rx3
11-10	68	Enable/Disable DTMF Long Tones
21-8	70	Enable/Disable Remote Base -- Control Operator
21-8	71	Enable/Disable Remote Base -- Scheduler
21-8	72	Enable/Disable Remote Base -- Control Op Scheduler Override
13-2	81	Enable/Disable Path 1 (Rx1 to Tx1)
13-2	82	Enable/Disable Path 2 (Rx2 to Tx1)
13-2	83	Enable/Disable Path 3 (Rx3 to Tx1)
13-2	84	Enable/Disable Path 4 (Rx1 to Tx2)
13-2	85	Enable/Disable Path 5 (Rx2 to Tx2)
13-2	86	Enable/Disable Path 6 (Rx3 to Tx2)
13-2	87	Enable/Disable Path 7 (Rx1 to LL)
13-2	88	Enable/Disable Path 8 (Rx2 to LL)
13-2	89	Enable/Disable Path 9 (Rx3 to LL)
13-2	90	Enable/Disable Path 10 (LL to Tx1)
13-2	91	Enable/Disable Path 11 (LL to Tx2)
5-6	99	Enable/Disable Front Panel

## **Command Quick Reference**

This section of the manual may be copied by the registered owner and distributed freely to users of the repeater controller. It may *not* be copied for any other purpose.

*No other portion of the manual may be copied.*

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
4-1	<b>Messages</b>			
4-11	Enable/Disable CW	(PW) 63 01 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
4-12	Select Frequency of CW	(PW) 06 00 (tone code) * <i>See Tone Code Table on page A-20.</i>	1500 Hz	
4-13	Send Next CW Message Slowly	(PW) 11 *	normal rate	
4-14	Select Normal CW Speed	(PW) 12 x * 0 = 5 WPM      5 = 17 WPM 1 = 7 WPM      6 = 20 WPM 2 = 10 WPM     7 = 24 WPM 3 = 13 WPM     8 = 30 WPM 4 = 15 WPM     9 = 40 WPM	20 WPM	
4-14	Select Slow CW Speed	(PW) 13 x * 0 = 5 WPM      5 = 17 WPM 1 = 7 WPM      6 = 20 WPM 2 = 10 WPM     7 = 24 WPM 3 = 13 WPM     8 = 30 WPM 4 = 15 WPM     9 = 40 WPM	15 WPM	
4-19	Select Frequency of Beep 48	(PW) 06 01 (tone code) * <i>See Tone Code Table on page A-20.</i>	500 Hz	
4-19	Select Frequency of Beep 49	(PW) 06 02 (tone code) * <i>See Tone Code Table on page A-20.</i>	750 Hz	
4-19	Select Frequency of Beep 50	(PW) 06 03 (tone code) * <i>See Tone Code Table on page A-20.</i>	1000 Hz	
4-19	Select Frequency of Beep 51	(PW) 06 04 (tone code) * <i>See Tone Code Table on page A-20.</i>	1250 Hz	
4-19	Select Frequency of Beep 52	(PW) 06 05 (tone code) * <i>See Tone Code Table on page A-20.</i>	1500 Hz	
4-19	Select Frequency of Beep 53	(PW) 06 06 (tone code) * <i>See Tone Code Table on page A-20.</i>	1750 Hz	
4-37	Select Courtesy Message	(PW) 31 10 (message) *	60 mS 440 Hz beep (74 09)	
4-37	Select Dropout Message	(PW) 31 13 (message) *	none	
4-37	Select Pre-Timeout Message	(PW) 31 16 (message) *	TO in CW	
4-37	Select Post-Timeout Message	(PW) 31 19 (message) *	TO in CW	
4-37	Select Initial ID Message for Tx1	(PW) 31 30 (message) *	ID in CW	
4-37	Select Initial ID Message for Tx2	(PW) 31 33 (message) *	9983 ID in CW	
4-37	Select Normal ID Message for Tx1	(PW) 31 31 (message) *	ID in CW	
4-37	Select Normal ID Message for Tx2	(PW) 31 34 (message) *	9983 ID in CW	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
4-37	Select Autopatch Dialing Message	(PW) 31 40 (message) *	AS in CW	
4-37	Select Autopatch Timeout Warning Message	(PW) 31 41 (message) *	AR in CW	
4-37	Select Phone Line Answer Message	(PW) 31 50 (message) *	3 beeps (74 09 21 33 )	
4-37	Select Reverse Patch Ringout Message	(PW) 31 51 (message) *	55 in CW	
4-40	Review Courtesy Message	(PW) 34 10 (message) *	none	
4-40	Review Dropout Message	(PW) 34 13 (message) *	none	
4-40	Review Pre-Timeout Message	(PW) 34 16 (message) *	none	
4-40	Review Post-Timeout Message	(PW) 34 19 (message) *	none	
4-40	Review Initial ID Message for Tx1	(PW) 34 30 (message) *	none	
4-40	Review Initial ID Message for Tx2	(PW) 34 33 (message) *	9983 ID in CW	
4-40	Review Normal ID Message for Tx1	(PW) 34 31 (message) *	none	
4-40	Review Normal ID Message for Tx2	(PW) 34 34 (message) *	9983 ID in CW	
4-40	Review Autopatch Dialing Message	(PW) 34 40 (message) *	AS in CW	
4-40	Review Autopatch Timeout Warning Message	(PW) 34 41 (message) *	none	
4-40	Review Phone Line Answer Message	(PW) 34 50 (message) *	none	
4-40	Review Reverse Patch Ringout Message	(PW) 34 51 (message) *	none	
4-41	Select User Messages	(PW) 31 xx (message) * xx = 70, 71, 72, or 73	none	
4-41	Review User Messages	(PW) 34 xx * xx = 70, 71, 72, or 73	none	
4-42	Send Message	(PW) 15 (message) *	none	
4-44	Select OK Command Response Message	(PW) 31 01 (message) *	OK in CW	
4-44	Review OK Command Response Message	(PW) 34 01 *	none	
4-44	Select Keystroke Error Command Response Message	(PW) 31 02 (message) *	?ERR1 in CW	
4-44	Review Keystroke Error Command Response Message	(PW) 34 02 *	none	
4-44	Select Data Error Command Response Message	(PW) 31 03 (message) *	?ERR2 in CW	
4-44	Review Data Error Command Response Message	(PW) 34 03 *	none	
4-45	Select Warm Reset Message	(PW) 31 00 (message) *	?RES in CW	
4-45	Review Warm Reset Message	(PW) 34 00 *	none	
<b>5-1</b>	<b>Security</b>			
5-2	Assign Control Operator Password	(PW) 92 (new control operator PW) *	no password	
5-3	Assign Master Password	(PW) 93 (new master PW) *	99	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
5-4	Assign Control Operator Privilege Level	(PW) 94 (root number, x) * 0 = master and control operator 1 = master only	all commands accessible	
5-5	Assign Control Operator Privilege Level to a Range of Commands	(PW) 94 (first root number, last root number, x) * 0 = master and control operator 1 = master only	all commands accessible	
5-6	Enable/Disable Front Panel Display	(PW) 63 99 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
<b>6-1</b>	<b>Macros</b>			
6-5	Create New Macro	(PW) 20 (macro name, command) *	no macros	
6-7	Append to Macro	(PW) 29 (macro name, command) *	none	
6-9	List Macro in CW	(PW) 33 (macro name) *	none	
6-9	List Macro in Speech	(PW) 35 (macro name) *	none	
6-11	Erase Macro	(PW) 21 (macro name) *	none	
6-12	Erase All Macros	(PW) 22 00 *	none	
6-13	Rename Macro	(PW) 27 (old, new) *	none	
6-15	Pause	(PW) 98 xxx * (1-255) seconds	none	
6-16	Select Power ON-Triggered Macro	(PW) 26 00 (macro name) *	none	
<b>7-3</b>	<b>Autopatch Setup and Configuration</b>			
7-6	Select Autopatch Dialing Mode	(PW) 61 x * 1 = 10 PPS rotary 2 = 20 PPS rotary 3 = 5 PPS DTMF	10 PPS rotary	
7-7	Select Autopatch Dialing Message	(PW) 31 40 (message) *	AS in CW	
7-7	Review Autopatch Dialing Message	(PW) 34 40 *	AS in CW	
7-8	Select Landline Busy Message	(PW) 31 42 (message) *	BZ in CW	
7-8	Select Autopatch Off Message	(PW) 31 44 (message) *	OFF in CW	
7-8	Select Autopatch Error Message (Invalid phone number)	(PW) 31 45 (message) *	?ERR in CW	
7-8	Select Autopatch Reject Message (Match in Reject Table)	(PW) 31 46 (message) *	?REJ in CW	
7-8	Select Autopatch No-Redial-Number Message	(PW) 31 47 (message) *	CLR in CW	
7-8	Review Autopatch Error Message	(PW) 34 45 *	?ERR in CW	
7-8	Review Autopatch No-Redial-Number Message	(PW) 34 47 *	CLR in CW	
7-8	Review Autopatch Off Message	(PW) 34 44 *	OFF in CW	
7-8	Review Autopatch Reject Message	(PW) 34 46 *	?REJ in CW	
7-8	Review Landline Busy Message	(PW) 34 42 *	BZ in CW	
7-9	Select Autopatch Dump Message	(PW) 31 43 (message) *	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
7-9	Review Autopatch Dump Message	(PW) 34 43 *	none	
7-10	Enable/Disable Autopatch Dialing Mixed-Mode	(PW) 63 04 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-11	Autopatch Pause ("B") Digit Time  (Note: does <b>not</b> affect the pause in an Autopatch Dialing Prefix.)	(PW) 49 96 xxx * (001-100)=0.1-10.0 seconds 010 = 1.0 seconds 020 = 2.0 seconds 100 = 10.0 seconds	5.0 seconds	
7-12	Enable/Disable Pound Down (# Dump)	(PW) 63 05 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-13	Select Autopatch Dialing Prefix	(PW) 83 10 (prefix) * Up to 16-digits. 00=0, 01=1, 02=2, 03=3, 04=4, 05=5, 06=6, 07=7, 08=8, 09=9, 10=A, 11=B, 12=C, 13=D, 14=*, 15=#, 16=1-Second Pause, 17=2-Second Pause, 18=5-Second Pause, 19 = 10-Second Pause, 20=Rotary, 21=DTMF	none	
7-13	Delete Autopatch Dialing Prefix	(PW) 83 10 *	none	
7-15	Dump Autopatch Using a Code	(PW) 83 *	none	
7-16	Select Autopatch Access-Triggered Macro, Default	(PW) 26 12 (macro name) *	none	
7-16	Select Autopatch Dump-Triggered Macro	(PW) 26 13 (macro name) *	none	
7-17	Enable/Disable Full-Duplex Mode	(PW) 63 07 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-18	Enable/Disable Autopatch Privacy	(PW) 63 06 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-19	Enable/Disable Repeater-to-Phone DTMF Mute	(PW) 63 08 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-20	Enable/Disable ID During Autopatch	(PW) 63 09 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-21	Require Dump Before Next Call	(PW) 63 10 x * 0 = OFF (not required) 1 = ON (required)	OFF not required	
7-22	Assign Macro to Any-Rx-Active to AP	(PW) 26 06 (macro name) *	none	
7-22	Assign Macro to All-Rx-Inactive to AP	(PW) 26 07 (macro name) *	none	
7-23	Landline Hookflash	(PW) 83 1 *	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
<b>7-24</b>	<b>Autopatch Timeout Timer</b>			
7-25	Select Autopatch Timeout Timer	(PW) 65 xxx * (000-546) = 0.0-54.6 minutes 000 = infinity 001 = 0.1 minute 030 = 3.0 minutes 546 = 54.6 minutes ... etc.	3.0 minutes	
7-26	Reset Autopatch Timeout Timer	(PW) 81 *	none	
7-27	Select Autopatch Timeout Warning Message	(PW) 31 41 (message) *	AR in CW	
7-27	Review Autopatch Timeout Warning Message	(PW) 34 41 *	none	
<b>7-28</b>	<b>Autopatch Access and Passwords</b>			
7-29	Access Autopatch With Password	(AP access pswd) (phone number) *	PW is 10	
7-30	Access Autopatch Without Password	(phone number) *	OFF (disabled)	
7-32	Change Autopatch Access Password	(PW) 23 (new AP access password) *	PW is 10	
7-33	Enable/Disable Autopatch Access Without Password	(PW) 63 11 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-34	Autopatch Go Off-Hook	(PW) 83 2 *	none	
7-34	Autopatch Go Off-Hook, Ignore Busy Logic Input	(PW) 83 3 *	none	
<b>7-35</b>	<b>Autopatch Call Types</b>			
7-36	Select Autopatch Call Types	(PW) 60 x * none = OFF (disabled) 0 = accepted numbers only 1 = operator (0) 2 = xxx-xxxx 3 = 0-xxx-xxxx 4 = 1-xxx-xxxx 5 = 0-xxx-xxx-xxxx 6 = 1-xxx-xxx-xxxx 7 = 1-800-xxx-xxxx, 1-888-xxx-xxxx 8 = xxx-xxx-xxxx	OFF disabled	
<b>7-38</b>	<b>Autopatch Restrictions</b>			
7-40	Clear All Accepted Numbers From Table	(PW) 68 *	table empty	
7-40	Enter Accepted Number Into Table	(PW) 68 (phone number) *	table empty	
7-42	Clear All Rejected Numbers From Table	(PW) 67 *	table empty	
7-42	Enter Rejected Number Into Table	(PW) 67 (phone number) *	table empty	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
<b>7-44</b>	<b>Autopatch Redialer</b>			
7-45	Redial Last Number	(PW) 84 *	memory cleared	
7-46	Clear Autopatch Redialer	(PW) 85 *	memory cleared	
<b>7-47</b>	<b>Autopatch Call Counter</b>			
7-48	Clear Autopatch Call Counter	(PW) 69 *	counter 000	
7-49 4-35	Send Autopatch Call Count in CW	(PW) 86 *	counter 000	
4-35	Send Autopatch Call Count in Speech	(PW) 15 9897 *	counter 000	
<b>7-50</b>	<b>Phone Line Control Mode</b>			
7-53	Select Phone Line Answer Mode, Do Not Answer	(PW) 64 0 *	<i>(see next command)</i>	
7-53	Select Phone Line Answer Mode	(PW) 64 x yy zz * x = mode (1-4) (See page 7-38) y = ring-in delay (00-99) rings z = ringout limit (00-99) rings	mode 3, ring-in delay 2, ringout limit 1	
7-54	Select Phone Line Answer Message	(PW) 31 50 (message) *	3 beeps (74 09 21 33)	
7-54	Review Phone Line Answer Message	(PW) 34 50 *	none	
7-55	Select Phone Line Answer Macro	(PW) 26 16 (macro name) *	none	
7-56	Select Control Mode Dump-Triggered Macro	(PW) 26 81 (macro name) *	none	
7-57	Select Phone Line Off-Hook Timer	(PW) 79 xxx * (000-546)=0.1-54.6 minutes 000 = infinity 001 = 0.1 minute 030 = 3.0 minutes 546 = 54.6 minutes ... etc.	none	
7-58	Monitor Repeater Receiver (Rx1)	(PW) 63 23 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-58	Monitor Repeater Receiver (Rx2)	(PW) 63 24 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-58	Monitor Repeater Receiver (Rx3)	(PW) 63 25 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-58	Talk Out Tx1	(PW) 63 26 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
7-58	Talk Out Tx2	(PW) 63 27 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
<b>7-59</b>	<b>Reverse Patch</b>			
7-60	Trigger Reverse Patch	(PW) 87 *	none	
7-61	Answer Reverse Patch	(PW) 88 *	none	
7-62	Select Reverse Patch Ringout Message	(PW) 31 51 (message) *	55 in CW	
7-62	Review Reverse Patch Ringout Message	(PW) 34 51 *	none	
7-63	Select Ring-Triggered Macro	(PW) 26 80 (macro name) * Note: executes on each ring.	none	
<b>7-64</b>	<b>Autopatch Multiple Port Access</b>			
7-67	Select Autopatch Access-Triggered Macro from Rx1	(PW) 26 75 (macro name) *	none	
7-67	Select Autopatch Access-Triggered Macro from Rx2	(PW) 26 76 (macro name) *	none	
7-67	Select Autopatch Access-Triggered Macro from Rx3	(PW) 26 77 (macro name) *	none	
7-68	Select Rx1 Autopatch Command Response Message Routing	(PW) 91 00 x x * 1 = Tx1, 2 = Tx2	1 (Tx1)	
7-68	Select Rx2 Autopatch Command Response Message Routing	(PW) 91 01 x x * 1 = Tx1, 2 = Tx2	1 (Tx1)	
7-68	Select Rx3 Autopatch Command Response Message Routing	(PW) 91 02 x x * 1 = Tx1, 2 = Tx2	1 (Tx1)	
<b>8-1</b>	<b>Clock and Calendar</b>			
8-2	Set Clock and Calendar	(PW) 25 (year, month, day-of-month, day-of-week, hour, minute) * year = 00-99 month = 01-12 (Jan is 01) day-of-month = 01-31 day-of-week = 0-6 (Sun is 0) hour = 00-23 minute = 00-59	00:00:00, Wed, Jan 1, 1992	
8-4	Adjust Daylight Savings Time	(PW) 48 x * 0 = <i>fall back</i> (subtract 1 from hours) 1 = <i>spring ahead</i> (add 1 to hours) 2 = <i>fall back</i> (subtract 1 from hours, inhibited for 61 minutes.)	none	
8-6	Reset Clock Seconds	(PW) 48 3 *	none	
8-7	Add Clock Seconds	(PW) 48 4 (seconds) * seconds = 01-30	none	
8-7	Subtract Clock Seconds	(PW) 48 5 (seconds) * seconds = 01-30	none	
8-7	Subtract Clock Seconds, Inhibited for 2 Minutes	(PW) 48 6 (seconds) * seconds = 01-30 (Inhibited for 2 minutes)	none	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
9-1	<b>Scheduler</b>			
9-2	Create Setpoint	(PW) 28 (setpoint, macro, month, day, hour, minute) * setpoint = 00-99, 2 digits macro = 4 digits month = 01-12 or 99, 2 digits day = 01-75 or 99, 2 digits (See Day Code Table page A-46.) hour = 00-23 or 99, 2 digits minute = 00-59 or 99, 2 digits (Note: 99 is the <i>wild card</i> )	no setpoints	
9-6	Delete One Setpoint	(PW) 28 (setpoint) * setpoint = 00-99, 2 digits	none	
9-6	Delete Range of Setpoints	(PW) 28 (first setpoint) (last setpoint) * setpoint = 00-99, 2 digits	none	
9-7	Enable/Disable Scheduler	(PW) 63 15 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
10-1	<b>CTCSS Functions</b>			
10-2	Enable/Disable CTCSS Encoder	(PW) 02 x * 0 = disabled      5 = 5 seconds 1 = continuous    6 = 6 seconds 2 = 2 seconds    7 = 7 seconds 3 = 3 seconds    8 = 8 seconds 4 = 4 seconds    9 = 9 seconds	0 disabled	
10-3	Select Frequency of CTCSS	(PW) 03 xx * (00-63) See TS-32 Programming, page 10-5.	all outputs open	
11-1	<b>DTMF Decoder</b>			
11-2	Enable/Disable Command Response Messages	(PW) 63 02 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-3	Select DTMF Priority/Scan	(PW) 89 (Rx1, Rx2, Rx3, PH) * 0 = no access to DTMF decoder 1 = Priority 1 (highest priority) 2 = Priority 2 3 = Priority 3 4 = Priority 4 5 = Scan this device	Priorities: Rx1 = 3 Rx2 = 4 Rx3 = 1 PH = 2	
11-5	Select Rx1-to-DTMF Decoder Access Mode	(PW) 57 06 x * 0 = no access 1 = carrier access 2 = PL access 3 = And-PL access 4 = Or-PL access 5 = Anti-PL access	1 carrier access	
11-5	Select Rx2-to-DTMF Decoder Access Mode	(PW) 57 07 x * Same as above	1 carrier access	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
11-5	Select Rx3-to-DTMF Decoder Access Mode	(PW) 57 08 x * Same as above	1 carrier access	
11-7	Select DTMF Decoder Interdigit Timer	(PW) 82 xx * (01-99) = 0.1-9.9 seconds 01 = 0.1 seconds 05 = 0.5 seconds 10 = 1.0 seconds 99 = 9.9 seconds ... etc.	5.0 seconds	
11-8	Select DTMF Decoder Mute Delay	(PW) 96 x * (0-9) = 0.0-0.9 seconds 0 = 0 seconds 1 = 0.1 seconds 2 = 0.2 seconds ... etc.	0.5 seconds	
11-9	Enable/Disable Rx1-Tx1 DTMF Mute	(PW) 63 50 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-9	Enable/Disable Rx2-Tx1 DTMF Mute	(PW) 63 51 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-9	Enable/Disable Rx3-Tx1 DTMF Mute	(PW) 63 52 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-9	Enable/Disable Rx1-Tx2 DTMF Mute	(PW) 63 53 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-9	Enable/Disable Rx2-Tx2 DTMF Mute	(PW) 63 54 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-9	Enable/Disable Rx3-Tx2 DTMF Mute	(PW) 63 55 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
11-10	Enable/Disable DTMF Long Tones	(PW) 63 68 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
11-11	Assign Macro to Long Tone Zero	(PW) 26 50 (macro name) *	none	
11-11	Assign Macro to Long Tone One	(PW) 26 51 (macro name) *	none	
11-11	Assign Macro to Long Tone Two	(PW) 26 52 (macro name) *	none	
11-11	Assign Macro to Long Tone Three	(PW) 26 53 (macro name) *	none	
11-11	Assign Macro to Long Tone Four	(PW) 26 54 (macro name) *	none	
11-11	Assign Macro to Long Tone Five	(PW) 26 55 (macro name) *	none	
11-11	Assign Macro to Long Tone Six	(PW) 26 56 (macro name) *	none	
11-11	Assign Macro to Long Tone Seven	(PW) 26 57 (macro name) *	none	
11-11	Assign Macro to Long Tone Eight	(PW) 26 58 (macro name) *	none	
11-11	Assign Macro to Long Tone Nine	(PW) 26 59 (macro name) *	none	
11-11	Assign Macro to Long Tone A	(PW) 26 60 (macro name) *	none	
11-11	Assign Macro to Long Tone B	(PW) 26 61 (macro name) *	none	
11-11	Assign Macro to Long Tone C	(PW) 26 62 (macro name) *	none	
11-11	Assign Macro to Long Tone D	(PW) 26 63 (macro name) *	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
11-11	Assign Macro to Long Tone Star (*)	(PW) 26 64 (macro name) *	none	
11-11	Assign Macro to Long Tone Pound (#)	(PW) 26 65 (macro name) *	none	
11-12	Assign Macro to DTMF Digit Decoded	(PW) 26 49 (macro name) *	none	
<b>12-1</b>	<b>Identifier</b>			
12-3	Select Initial ID Message for Tx1	(PW) 31 30 (message) *	ID in CW	
12-3	Select Initial ID Message for Tx2	(PW) 31 33 (message) *	9983 ID in CW	
12-3	Select Normal ID Message for Tx1	(PW) 31 31 (message) *	ID in CW	
12-3	Select Normal ID Message for Tx2	(PW) 31 34 (message) *	9983 ID in CW	
12-3	Select Impolite ID Message for Tx1	(PW) 31 32 (message) *	none	
12-3	Select Impolite ID Message for Tx2	(PW) 31 35 (message) *	none	
12-3	Review Initial ID Message for Tx1	(PW) 34 30 *	none	
12-3	Review Initial ID Message for Tx2	(PW) 34 33 *	none	
12-3	Review Normal ID Message for Tx1	(PW) 34 31 *	none	
12-3	Review Normal ID Message for Tx2	(PW) 34 34 *	none	
12-3	Review Impolite ID Message for Tx1	(PW) 34 32 *	none	
12-3	Review Impolite ID Message for Tx2	(PW) 34 35 *	none	
12-4	Select Impolite ID Macro for Tx1	(PW) 26 05 (macro name) *	none	
12-4	Select Impolite ID Macro for Tx2	(PW) 26 48 (macro name) *	none	
12-4	Select Initial ID Macro for Tx1	(PW) 26 03 (macro name) *	none	
12-4	Select Initial ID Macro for Tx2	(PW) 26 46 (macro name) *	none	
12-4	Select Polite ID Macro for Tx1	(PW) 26 04 (macro name) *	none	
12-4	Select Polite ID Macro for Tx2	(PW) 26 47 (macro name) *	none	
12-5	Select ID Message Interval for Tx1 and Tx2	(PW) 51 xxx * (005-300) = 0.5-30.0 minutes 005 = 0.5 minutes 060 = 6.0 minute 099 = 9.9 minutes 300 = 30.0 minutes ... etc.	3.0 minutes	
12-6	Select ID Pending Interval for Tx1 and Tx2	(PW) 49 97 xxxx * (0300-1800) = 30.0-180.0 seconds 0300 = 30.0 seconds 0600 = 60.0 seconds 1200 = 120.0 seconds 1800 = 180.0 seconds ... etc.	30.0 seconds	
12-7	Reset Initial ID Message to Normal ID Message for Tx1	(PW) 54 *	none	
12-8	Send Initial ID Message for Tx1	(PW) 55 *	none	
12-9	Select Initial ID Programmable Tail Message for Tx1	(PW) 31 28 (message) *	none	
12-9	Select Normal ID Programmable Tail Message for Tx1	(PW) 31 29 (message) *	none	
12-9	Review Initial ID Programmable Tail Message for Tx1	(PW) 34 28 *	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
12-9	Review Normal ID Programmable Tail Message for Tx1	(PW) 34 29 *	none	
12-10	Select Initial ID Tail Message for Tx1	(PW) 50 0 xx * xx = tail number 0-15 and 98 0 = (none)      9 = WARN 1 = FEST        10 = RACES 2 = DUES        11 = TGIF 3 = MEET        12 = /R 4 = NET         13 = LINK 5 = HI           14 = RMT (remote) 6 = WX          15 = BAT 7 = ALERT       98 = programmable 8 = WATCH      (none) = no msg	none	
12-10	Select Normal ID Tail Message for Tx1	(PW) 50 1 xx * xx = tail number 0-15 and 98 0 = (none)      9 = WARN 1 = FEST        10 = RACES 2 = DUES        11 = TGIF 3 = MEET        12 = /R 4 = NET         13 = LINK 5 = HI           14 = RMT (remote) 6 = WX          15 = BAT 7 = ALERT       98 = programmable 8 = WATCH      (none) = no msg	none	
12-10	Review Initial ID Tail Message for Tx1	(PW) 50 0 99 *	none	
12-10	Review Normal ID Tail Message for Tx1	(PW) 50 1 99 *	none	
12-11	Enable/Disable ID During Autopatch	(PW) 63 09 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
<b>13-1</b>	<b>Links</b>			
13-2	Enable/Disable Path 1 (Rx1 to Tx1)	(PW) 63 81 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 2 (Rx2 to Tx1)	(PW) 63 82 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 3 (Rx3 to Tx1)	(PW) 63 83 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 4 (Rx1 to Tx2)	(PW) 63 84 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 5 (Rx2 to Tx2)	(PW) 63 85 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 6 (Rx3 to Tx2)	(PW) 63 86 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
13-2	Enable/Disable Path 7 (Rx1 to AP)	(PW) 63 87 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 8 (Rx2 to AP)	(PW) 63 88 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
13-2	Enable/Disable Path 9 (Rx3 to AP)	(PW) 63 89 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
13-2	Enable/Disable Path 10 (AP to Tx1)	(PW) 63 90 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
13-2	Enable/Disable Path 11 (AP to Tx2)	(PW) 63 91 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
13-3	Select Receiver-to-Tx1 Audio Routing Priority	(PW) 90 00 x x x * x = 1, 2, 3 1 = Rx1, 2 = Rx2, 3 = Rx3	Routing Priorities: Rx1, Rx2, Rx3	
13-3	Select Receiver-to-Tx2 Audio Routing Priority	(PW) 90 01 x x x * x = 1, 2, 3 1 = Rx1, 2 = Rx2, 3 = Rx3	Routing Priorities: Rx1, Rx2, Rx3	
13-3	Select Receiver-to-Autopatch Audio Routing Priority	(PW) 90 02 x x x * x = 1, 2, 3 1 = Rx1, 2 = Rx2, 3 = Rx3	Routing Priorities: Rx1, Rx2, Rx3	
13-3	Select Receiver-to-Phone Line Monitor Audio Routing Priority	(PW) 90 03 x x x * x = 1, 2, 3 1 = Rx1, 2 = Rx2, 3 = Rx3	Routing Priorities: Rx1, Rx2, Rx3	
13-4	Select Rx1-to-Tx1 Access Mode (Path 1)	(PW) 57 00 x * 0 = no access 1 = carrier access 2 = PL access 3 = And-PL access 4 = Or-PL access 5 = Anti-PL access 6 = Always access	1 carrier access	
13-4	Select Rx2-to-Tx1 Access Mode (Path 2)	(PW) 57 01 x * Same as above	1 carrier access	
13-4	Select Rx3-to-Tx1 Access Mode (Path 3)	(PW) 57 02 x * Same as above	1 carrier access	
13-4	Select Rx1-to-Tx2 Access Mode (Path 4)	(PW) 57 03 x * Same as above	1 carrier access	
13-4	Select Rx2-to-Tx2 Access Mode (Path 5)	(PW) 57 04 x * Same as above	1 carrier access	
13-4	Select Rx3-to-Tx2 Access Mode (Path 6)	(PW) 57 05 x * Same as above	1 carrier access	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
<b>14-1</b>	<b>Logic Inputs</b>			
14-2	Assign Macro to Logic Input 1 Hi-to-Lo	(PW) 26 20 (macro name) *	none	
14-2	Assign Macro to Logic Input 1 Lo-to-Hi	(PW) 26 21 (macro name) *	none	
14-2	Assign Macro to Logic Input 2 Hi-to-Lo	(PW) 26 22 (macro name) *	none	
14-2	Assign Macro to Logic Input 2 Lo-to-Hi	(PW) 26 23 (macro name) *	none	
14-2	Assign Macro to Logic Input 3 Hi-to-Lo	(PW) 26 24 (macro name) *	none	
14-2	Assign Macro to Logic Input 3 Lo-to-Hi	(PW) 26 25 (macro name) *	none	
14-2	Assign Macro to Logic Input 4 Hi-to-Lo	(PW) 26 26 (macro name) *	none	
14-2	Assign Macro to Logic Input 4 Lo-to-Hi	(PW) 26 27 (macro name) *	none	
14-2	Assign Macro to Logic Input 5 Hi-to-Lo	(PW) 26 28 (macro name) *	none	
14-2	Assign Macro to Logic Input 5 Lo-to-Hi	(PW) 26 29 (macro name) *	none	
14-2	Assign Macro to Logic Input 6 Hi-to-Lo	(PW) 26 30 (macro name) *	none	
14-2	Assign Macro to Logic Input 6 Lo-to-Hi	(PW) 26 31 (macro name) *	none	
14-2	Assign Macro to Phone Line Busy Input Hi-to-Lo	(PW) 26 32 (macro name) *	none	
14-2	Assign Macro to Phone Line Busy Input Lo-to-Hi	(PW) 26 33 (macro name) *	none	
14-2	Assign Macro to COR Input 1 Hi-to-Lo	(PW) 26 34 (macro name) *	none	
14-2	Assign Macro to COR Input 1 Lo-to-Hi	(PW) 26 35 (macro name) *	none	
14-2	Assign Macro to COR Input 2 Hi-to-Lo	(PW) 26 36 (macro name) *	none	
14-2	Assign Macro to COR Input 2 Lo-to-Hi	(PW) 26 37 (macro name) *	none	
14-2	Assign Macro to COR Input 3 Hi-to-Lo	(PW) 26 38 (macro name) *	none	
14-2	Assign Macro to COR Input 3 Lo-to-Hi	(PW) 26 39 (macro name) *	none	
14-2	Assign Macro to PL Input 1 Hi-to-Lo	(PW) 26 40 (macro name) *	none	
14-2	Assign Macro to PL Input 1 Lo-to-Hi	(PW) 26 41 (macro name) *	none	
14-2	Assign Macro to PL Input 2 Hi-to-Lo	(PW) 26 42 (macro name) *	none	
14-2	Assign Macro to PL Input 2 Lo-to-Hi	(PW) 26 43 (macro name) *	none	
14-2	Assign Macro to PL Input 3 Hi-to-Lo	(PW) 26 44 (macro name) *	none	
14-2	Assign Macro to PL Input 3 Lo-to-Hi	(PW) 26 45 (macro name) *	none	
<b>15-1</b>	<b>Logic Outputs</b>			
15-2	Select Logic Outputs Latched OFF	(PW) 71 (list of outputs 1-7) *	all OFF disabled	
15-2	Select Logic Outputs Latched ON	(PW) 70 (list of outputs 1-7) *	all OFF disabled	
15-2	Select Logic Outputs Momentary OFF	(PW) 73 (list of outputs 1-7) *	all OFF disabled	
15-2	Select Logic Outputs Momentary ON	(PW) 72 (list of outputs 1-7) *	all OFF disabled	
<b>16-1</b>	<b>Receiver Functions</b>			
16-2	Select Rx1 Start-of-Activity Macro	(PW) 26 67 (macro name) *	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
16-2	Select Rx1 Post-Activity Macro	(PW) 26 68 (macro name) *	none	
16-2	Select Rx2 Start-of-Activity Macro	(PW) 26 69 (macro name) *	none	
16-2	Select Rx2 Post-Activity Macro	(PW) 26 70 (macro name) *	none	
16-2	Select Rx3 Start-of-Activity Macro	(PW) 26 71 (macro name) *	none	
16-2	Select Rx3 Post-Activity Macro	(PW) 26 72 (macro name) *	none	
16-2	Select Rx1 Post-Activity Timer	(PW) 99 00 xx * (00-99) = 0.0-9.9 minutes.	1.0 minute	
16-2	Select Rx2 Post-Activity Timer	(PW) 99 01 xx * (00-99) = 0.0-9.9 minutes.	1.0 minute	
16-2	Select Rx3 Post-Activity Timer	(PW) 99 02 xx * (00-99) = 0.0-9.9 minutes.	1.0 minute	
16-4	Select COR Pulse-Triggered Macro	(PW) 26 17 (macro name) *	none	
16-4	Select COR Pulse Parameters	(PW) 47 0 x yyyy zzzz * x = <i>pulse count</i> (0-9) = 0-9 pulses 0 = 0 pulses 1 = 1 pulse 5 = 5 pulses ... etc. y = <i>minimum duration</i> (0001-9999) = 0.01-99.99 seconds 0001 = 0.01 seconds 0010 = 0.10 seconds 0100 = 1.00 seconds 1000 = 10.00 seconds 9999 = 99.99 seconds ... etc. z = <i>window time</i> Same as minimum duration	3 pulses, 0.5 second minimum duration, 5.0 second window time	
16-6	Enable/Disable End-of-Transmission Command Execution for Rx1	(PW) 63 57 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled (* required to terminate commands	
16-6	Enable/Disable End-of-Transmission Command Execution for Rx2	(PW) 63 58 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled (* required to terminate commands	
16-6	Enable/Disable End-of-Transmission Command Execution for Rx3	(PW) 63 59 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled (* required to terminate commands	
16-8	Enable/Disable From-Start-of-Transmission Timer for Rx1	(PW) 63 64 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
16-8	Enable/Disable From-Start-of-Transmission Timer for Rx2	(PW) 63 65 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
16-8	Enable/Disable From-Start-of-Transmission Timer for Rx3	(PW) 63 66 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
17-1	<b>Transmitter Functions</b>			
17-3	Select Courtesy Delay	(PW) 32 xx * (00-50) = 0.0-5.0 seconds 00 = 0.0 seconds 05 = 0.5 seconds 10 = 1.0 seconds 50 = 5.0 seconds ... etc.	0.0 seconds	
17-4	Select Dropout Delay	(PW) 30 xx * (00-50) = 0.0-5.0 seconds 00 = 0.0 seconds 05 = 0.5 seconds 10 = 1.0 seconds 50 = 5.0 seconds ... etc.	3.0 seconds	
17-5	Select Transmitter Timeout Timer	(PW) 40 xxx * (001-546) = 0.1-54.6 minutes 000 = infinity 001 = 0.1 minute 030 = 3.0 minutes 546 = 54.6 minutes ... etc.	3.0 minutes	
17-7	Reset Transmitter Timeout Timer	(PW) 10 *	none	
17-8	Enable/Disable Transmitter 1	(PW) 63 00 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
17-8	Enable/Disable Transmitter 2	(PW) 63 22 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
17-9	Key Transmitter (Timed)	(PW) 00 x yyy * <i>x = transmitter</i> 1 = Tx1 2 = Tx2 <i>y = duration</i> 000 = cancel tx key (001-546) = 0.1-54.6 minutes 001 = 0.1 minute 010 = 1.0 minute 100 = 10.0 minutes 546 = 54.6 minutes ... etc.	Tx1 and Tx2 not requested to key	
17-10	Key Transmitter 1 (Untimed)	(PW) 63 41 x * 0 = cancel tx key 1 = key tx	0 cancel tx key	
17-10	Key Transmitter 2 (Untimed)	(PW) 63 42 x * 0 = cancel tx key 1 = key tx	0 cancel tx key	
17-11	Enable/Disable Tx1 Minimum Unkey Delay	(PW) 63 31 x * 0 = OFF (disabled) 1 = ON (enabled)	ON enabled	
17-11	Enable/Disable Tx2 Minimum Unkey Delay	(PW) 63 32 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
17-12	Select Tx1 Minimum Unkey Delay	(PW) 49 98 xxxx * (00-6553) = 0-655.3 second 0000 = 0.0 second 0001 = 0.1 second 0010 = 1.0 second 6553 = 655.3 seconds ... etc.	0.1 second when enabled	
17-12	Select Tx2 Minimum Unkey Delay	(PW) 49 99 xxxx * (0000-6553) = 0-655.3 seconds 0000 = 0.0 second 0001 = 0.1 second 0010 = 1.0 second 0100 = 10.0 seconds 6553 = 655.3 seconds ... etc.	0.1 second when enabled	
17-13	Assign Macro to Any-Rx-Active to Tx1	(PW) 26 11 (macro name) *	none	
17-13	Assign Macro to All-Rx-Inactive to Tx1	(PW) 26 09 (macro name) *	none	
17-13	Assign Macro to Any-Rx-Active to Tx2	(PW) 26 73 (macro name) *	none	
17-13	Assign Macro to All-Rx-Inactive to Tx2	(PW) 26 74 (macro name) *	none	
17-14	Assign Macro to Tx1 PTT Inactive-to-Active	(PW) 26 82 (macro name) *	none	
17-14	Assign Macro to Tx1 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 83 (macro name) *	none	
17-14	Assign Macro to Tx1 PTT Active-to-Inactive After Unkey Delay	(PW) 26 84 (macro name) *	none	
17-14	Assign Macro to Tx2 PTT Inactive-to-Active	(PW) 26 85 (macro name) *	none	
17-14	Assign Macro to Tx2 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 86 (macro name) *	none	
17-14	Assign Macro to Tx2 PTT Active-to-Inactive After Unkey Delay	(PW) 26 87 (macro name) *	none	
<b>18-1</b>	<b>Repeater Functions</b>			
18-2	Select Repeater Access Mode (Path 1)	(PW) 57 00 x * 0 = no access 1 = carrier access 2 = PL access 3 = And-PL access 4 = Or-PL access 5 = Anti-PL access 6 = Always access	1 carrier access	
18-4	Select Repeater Start-of-Activity Macro	(PW) 26 14 (macro name) *	none	
18-4	Select Repeater Post-Activity Macro	(PW) 26 15 (macro name) *	none	
18-4	Select Repeater Activity Counter/Timer	(PW) 45 x yy * x = <i>event counter</i> 0-9 0 = each time 1 = every other time ... etc. y = <i>duration</i> (00-99) = 0.0-9.9 minutes	0 event count, 1.0 minute duration	
18-6	Select Anti-Kerchunk Key-Up Delay	(PW) 80 xx * (00-99) = 0.0-9.9 seconds	0 seconds (disabled)	
18-6	Select Anti-Kerchunk Re-Arm Delay	(PW) 99 10 xx * (00-99) = 0.0-9.9 minutes	0 minutes	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
18-8	Select Anti-Kerchunk No Hangtime Mode	(PW) 63 30 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
18-9	Select Courtesy Message for Rx1	(PW) 31 10 (message) *	60 mS 440 Hz beep (9910 74 09)	
18-9	Select Courtesy Message for Rx2	(PW) 31 11 (message) *	60 mS 660 Hz beep (9910 74 16)	
18-9	Select Courtesy Message for Rx3	(PW) 31 12 (message) *	60 mS 880 Hz beep (9910 74 21)	
18-9	Review Courtesy Message for Rx1	(PW) 34 10 *	none	
18-9	Review Courtesy Message for Rx2	(PW) 34 11 *	none	
18-9	Review Courtesy Message for Rx3	(PW) 34 12 *	none	
18-11	Assign Macro to Any-Rx-Active to Tx1	(PW) 26 11 (macro name) *	none	
18-11	Assign Macro to All-Rx-Inactive to Tx1	(PW) 26 09 (macro name) *	none	
18-11	Assign Macro to Courtesy Message	(PW) 26 10 (macro name) *	none	
18-11	Assign Macro to Dropout Message	(PW) 26 08 (macro name) *	none	
18-11	Assign Macro to Repeater Timeout	(PW) 26 18 (macro name) *	none	
18-11	Assign Macro to Return-From-Repeater-Timeout	(PW) 26 19 (macro name) *	none	
<b>19-1</b>	<b>Base Station Functions</b>			
19-2	Enable/Disable Star/Pound Talkout	(PW) 63 13 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
19-4	Select Talkout Transmitter Mode	(PW) 63 14 x * 0 = Repeater Mode 1 = Base Station Mode	0, Repeater Mode	
19-5	Enable/Disable Command Execution on Interdigit Timer for Rx1	(PW) 63 60 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
19-5	Enable/Disable Command Execution on Interdigit Timer for Rx2	(PW) 63 61 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
19-5	Enable/Disable Command Execution on Interdigit Timer for Rx3	(PW) 63 62 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	
19-5	Enable/Disable Command Execution on Interdigit Timer for Phone Line	(PW) 63 63 x * 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
20-1	<b>User Timers</b>			
20-2	Set Timer Timeout	(PW) 49 xx 03 yyyy * xx = timer number, 00-09 yyyy = timeout (0001-6553) = 0.1-655.3 seconds	1.0 second	
20-3	Assign Timer Event Macro	(PW) 49 xx 02 (macro name)* xx = timer number, 00-09	none	
20-3	Unassign Timer Event Macro	(PW) 49 xx 02 * xx = timer number, 00-09	none	
20-4	Stop Timer	(PW) 49 xx 00 * xx = timer number, 00-09	none	
20-5	Start/Restart Timer (Retriggerable)	(PW) 49 xx 01 * xx = timer number, 00-09	none	
20-6	Start Timer (One-Shot)	(PW) 49 xx 04 * xx = timer number, 00-09	none	
21-1	<b>Remote Base</b>			
21-2	<b>Remote Base Configuration</b>			
21-4	Assign Remote Base Password	(PW) 39 02 (new password)*	98	
21-5	Select Remote Base Access-Triggered Macro	(PW) 26 91 (macro name) * Note: invoked by <i>Access Remote Base</i> command.	none	
21-6	Select Remote Base Dump-Triggered Macro	(PW) 26 90 (macro name) * Note: invoked by <i>Dump Remote Base</i> command.	none	
21-6	Select Remote Base Off Message	(PW) 31 60 (message) *	OFF in CW	
21-6	Review Remote Base Off Message	(PW) 34 60 *	OFF in CW	
21-7	Reset RBI-1	(PW) 39 91 *	none	
21-8	Enable/Disable Remote Base -- Control Operator	(PW) 63 71 x * 0 = OFF (disabled) 1 = ON (enabled) Note: used by the Control Operator to enable/disable the remote base. Note: Remote Base enabled when (En71 AND (En72 OR En73)) = TRUE.	OFF disabled	
21-8	Enable/Disable Remote Base -- Scheduler	(PW) 63 72 x * 0 = OFF (disabled) 1 = ON (enabled) Note: used by the Scheduler to enable/disable the remote base. Note: Remote Base enabled when (En71 AND (En72 OR En73)) = TRUE.	ON enabled	
21-8	Enable/Disable Remote Base -- Control Operator Override Scheduler Disable	(PW) 63 73 x * 0 = OFF (disabled) 1 = ON (enabled) Note: used by the Control Operator to override a scheduler disable of the remote base. Note: Remote Base enabled when (En71 AND (En72 OR En73)) = TRUE.	OFF disabled	

<b>Command Quick Reference</b>				
Page	Command Name	Form and Data Digit	Default	User
21-10	<b>Remote Base User Commands</b>			
21-12	Access Remote Base	(RBPW) 1 *		
21-13	Dump Remote Base	(RBPW) 0 *		
21-14	Speak Radio Configuration	(RBPW) 19 x * 0 = Frequency and Offset 1 = CTCSS Frequency 2 = Both 3 = Abbreviated Freq and Offset 4 = Abbreviated CTCSS Frequency 5 = Abbreviated Both	0	
21-16	Select Memory Channel and Band	(RBPW) 40 (band, channel) * <i>band</i> = 1 = 144 2 = 222 4 = 440 8 = 1200 <i>channel</i> = 1 thru maximum supported	none	
21-16	Macro: Select Memory Channel and Band	(RBPW) 20 (band, channel) * <i>band</i> = 1 = 144 2 = 222 4 = 440 8 = 1200 <i>channel</i> = 1 thru maximum supported	none	
21-17	Select VFO Frequency and Offset	(RBPW) 41 (frequency, offset) * <i>frequency</i> 140.000 thru 149.995, 6-digits 220.000 thru 229.995, 6-digits 420.000 thru 449.995, 6-digits 1240.000 thru 1299.995, 7-digits The 1kHz digit can be only 0 or 5. <i>offset</i> 1 = Minus 2 = Simplex 3 = Plus 0 = On 1200, Minus 20. On 420-440, special offset depending on radio.	none	
21-17	Macro: Select VFO Frequency and Offset	(RBPW) 21 (frequency, offset) * <i>frequency</i> = 140.000 thru 149.995, 6-digits 220.000 thru 229.995, 6-digits 420.000 thru 449.995, 6-digits 1240.000 thru 1299.995, 7-digits The 1kHz digit can be only 0 or 5. <i>offset</i> = 1 = Minus 2 = Simplex 3 = Plus 0 = On 1200, Minus 20. On 420-440, special offset depending on radio.	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
21-19	Select Transmitter Offset	(RBPW) 42 (offset) * offset: 1 = Minus 2 = Simplex 3 = Plus 0 = On 1200, Minus 20. On 420-440, special offset depending on radio.	none	
21-19	Macro: Select Transmitter Offset	(RBPW) 22 (offset) * offset = 1 = Minus 2 = Simplex 3 = Plus 0 = On 1200, Minus 20. On 420-440, special offset depending on radio.	none	
21-20	Enable/Disable Transmitter	(RBPW) 45 x * 1 = Enable 0 = Disable	disabled	
21-20	Macro: Enable/Disable Transmitter	(RBPW) 25 x * 1 = Enable 0 = Disable	disabled	
21-21	Enable/Disable Receiver	(RBPW) 44 x * 1 = Enable 0 = Disable	enabled	
21-21	Macro: Enable/Disable Receiver	(RBPW) 24 x * 1 = Enable 0 = Disable	enabled	
21-22	Enable/Disable Radio Power	(RBPW) 46 x * 1 = Enable 0 = Disable	enabled	
21-22	Macro: Enable/Disable Radio Power	(RBPW) 26 x * 1 = Enable 0 = Disable	enabled	
21-23	Select Transmitter Power Output	(RBPW) 43 x * 1 = Low 2 = Medium 3 = High	none	
21-23	Macro: Select Transmitter Power Output	(RBPW) 23 x * 1 = Low 2 = Medium 3 = High	none	
21-24	Select Frequency of CTCSS	(RBPW) 47 (tone code) * See Page 10-5 for frequencies of 67.0 through 203.5. Above 203.5, use: 33 = 210.7 24 = 218.1 35 = 225.7 36 = 233.6 37 = 241.8 38 = 250.3	none	

<b>Command Quick Reference</b>				
<b>Page</b>	<b>Command Name</b>	<b>Form and Data Digit</b>	<b>Default</b>	<b>User</b>
21-24	Macro: Select Frequency of CTCSS	(RBPW) 27 (tone code) * See Page 10-5 for frequencies of 67.0 through 203.5. Above 203.5, use: 33 = 210.7 24 = 218.1 35 = 225.7 36 = 233.6 37 = 241.8 38 = 250.3	none	
21-25	Enable/Disable CTCSS Encoder	(RBPW) 48 x * 1 = Enable 0 = Disable	disabled	
21-25	Macro: Enable/Disable CTCSS Encoder	(RBPW) 28 x * 1 = Enable 0 = Disable	disabled	
21-26	Enable/Disable CTCSS Decoder	(RBPW) 49 x * 1 = Enable 0 = Disable	disabled	
21-26	Macro: Enable/Disable CTCSS Decoder	(RBPW) 29 x * 1 = Enable 0 = Disable	disabled	
21-27	Send Current Settings	(RBPW) 39 *	none	
<b>21-28</b>	<b>Remote Base User Function Outputs</b>			
21-29	Select <i>RBI-1</i> Number of User Function Outputs in Group	(PW) 39 90 (number in group) *	8	
21-30	Select Individual <i>RBI-1</i> User Function Outputs Latched ON	(RBPW) 11 (list of outputs 1-8) *	none	
21-30	Select Individual <i>RBI-1</i> User Function Outputs Latched OFF	(RBPW) 12 (list of outputs 1-8) *	none	
21-31	Enter <i>RBI-1</i> User Function Output Group	(RBPW) 10 (decimal number) * The decimal number can be set to 0 through the maximum set in the <i>Select Number of User Function Outputs</i> command. The following ranges are available by number of outputs: 0 = none available 1 = 0 or 1 2 = 0 thru 3 3 = 0 thru 7 4 = 0 thru 15 5 = 0 thru 31 6 = 0 thru 63 7 = 0 thru 127 8 = 0 thru 255	none	



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## Appendix B

# Application Notes

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### Using the 7K as a Beacon Controller

Several customers are using the 7K Repeater Controller as a *Beacon Controller*. The 7K does an excellent job at this, since the speed, pitch, and interval of the ID-er are remotely programmable; It can also be turned ON (enabled) and OFF (disabled) remotely. Here's how to do it:

- Set the *Transmitter Timeout Timer* for infinity (page 17-5).
- Program the *ID Message Interval* for the desired frequency of occurrence (perhaps 1.0 minute). See page 12-5.
- Either ground the COR input (*RX* switch is ON), or open the COR input (*RX* switch is OFF).

The transmitter will stay keyed indefinitely. The ID will be sent at the interval selected by command. If desired, the actual ID Message can be changed automatically by the 7K. This is accomplished by using the *ID-Triggered Macro* capability (page 12-4): when the controller wishes to ID, it executes a macro. The macro sends the CW ID, and also changes the ID-triggered-macro for the next ID.

For example, let's assume that we have defined 5 CW ID messages that we want the 7K to "rotate." How do we program the 7K to do the rotation?

- Delete the messages (callsigns) that have been stored in the ID-er, if any. See page 12-3.
- Create five macros. Let's call them 1000, 1001, 1002, 1003, and 1004.

Place two commands into each macro; the first one is a *Send Message* command (page 4-42) that has one of the desired callsigns in it, and the second one reprograms the impolite ID macro using the *Select Impolite ID Macro* command (page 12-4):

```
(PW) 20 1000 (PW) 15 (CW message #1) *
```

```
(PW) 29 1000 (PW) 26 05 1001 *
```

```
(PW) 20 1001 (PW) 15 (CW message #2) *
```

```
(PW) 29 1001 (PW) 26 05 1002 *
```

Continue building macros 1002, 1003, and 1004. At macro 1004 reprogram the *Select Impolite ID Macro* command back to 1000:

```
(PW) 20 1004 (PW) 15 (CW message #5) *
```

```
(PW) 29 1004 (PW) 26 05 1000 *
```

Don't forget to program the *Select Impolite ID Macro* command (page 12-4) to get the chain started:

```
(PW) 26 05 1000 *
```

You'll also want to suppress the *Enable/Disable Command Response Messages* command (see page 11-2) to keep from hearing *OK* each time a macro is executed.

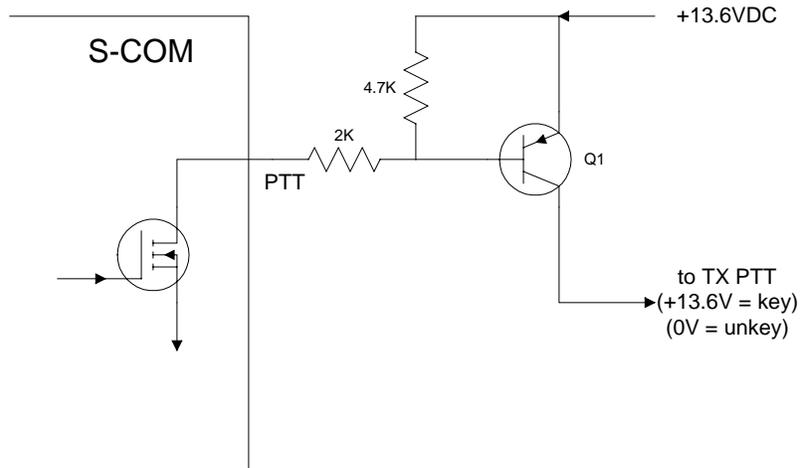
## Positive Voltage TX Keying Circuit

Some transmitters require a positive voltage to be sourced into their PTT inputs to key; removing the voltage unkeys the transmitter. This contrasts with the style of transmitter that requires the PTT line to be grounded to key, opened to unkey.

Transmitters that require positive voltage keying include models made by Hamtronics, Maggiore, and the RCA 500 and 700-series repeaters.

A simple outboard circuit can be placed between the 7K controller and the transmitter PTT. A PNP power transistor allows current to flow to the transmitter to key, and opens the current path to unkey. Be sure to use a sufficiently large PNP transistor for Q1, as these transmitters or exciters can draw considerable current. The TX DIP switch in the 7K controller should be ON.

Q1 can be a 2N2904 if the transmitter/exciter draws 500 mA or less; recommend TIP30 for loads of 1 A or less.





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# Appendix C

# Installation

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## Theory of Operation

Great care was taken in the design of the controller to make it *installer-friendly*. Audio and digital interfaces are universal in nature, so that a minimum of external hardware is needed to complete the installation. Although the controller's "engine" is a powerful microprocessor, the command language is designed to be flexible and easy to learn.

### Pre-Programming

The controller needs to know your repeater's callsign for its *Identifier*. You also must tell it your choice of *Courtesy Message*, *Transmitter Timeout Timer*, and so on. You can program the controller on your workbench, with an external DTMF pad and other devices to simulate the repeater, or you can program the controller after installation through one of the receiver ports.

### Default Information

To make the installation easier, the controller comes pre-programmed with certain default information stored in non-volatile memory. This is referred to as the *Default Condition* of the device.

When you have finished the installation, you may overwrite the pre-programmed default conditions by entering DTMF commands. Likewise, if it ever becomes necessary, you may also force the controller into its original default condition by using the *Initialize Push-Button* during a power-up sequence. This procedure is explained in the *Getting Started* chapter on page 2-1.

This initialize push-button procedure causes the controller to read the default condition information from the EPROM and write it over the old information stored in the non-volatile memory.

### Power Supply

The controller has a modest power requirement which can be supplied by the repeater's power supply in most cases. The controller requires 12VDC at approximately 125mA (*Main Board with Telephone Interface Module*). The

optional *Speech Synthesizer Module* requires approximately 180mA more. Power can be unregulated, since the controller contains internal regulators to create both a 10VDC audio supply and a 5VDC digital supply. A third supply of 4.5VDC is created from the audio supply, and is used as the audio section's bias voltage.

### Repeater Interfacing

In addition to the power supply, the controller requires a minimum of four connections to the repeater: *Receiver COR*, *Receiver Audio*, *Transmitter PTT*, and *Transmitter Audio*.

If you require subaudible tone operation, additional connections are provided for a *CTCSS Encoder/Decoder*.

---

**Note:** Paths around the controller should not exist for either the COR-to-PTT circuit or the RX audio-to-TX audio. Otherwise, the controller will not be able to fully take charge of the repeater control functions.

---

### Control Receiver Interfacing

If a control receiver is to be used, two additional connections are required: *Control Receiver COR* and *Control Receiver Audio*.

---

**Note:** Each *COR Input*, *CTCSS Decoder Input*, and *Transmitter PTT Output* has an associated DIP switch which is used to either invert—or not invert—the signal. Thus, signals which are *low-active* or *high-active* can be accommodated.

---

### External Device Interfacing

The controller can sense the states of up to six external devices. Seven logic-level power MOSFETS accomplish high-current switching (75mA).

### Audio Gating

The controller uses two ICs—both of which are under microprocessor control: An 8-by-12 *Analog Crosspoint Switch IC* for main audio gating, and a *Triple SPDT Analog Gate IC* for additional gating.

Extremely flexible system designs are possible since all audio sources (receivers, tone generators, phone line, etc.) are fed into the crosspoint switch, and all audio loads (transmitters, tone decoder, phone line) are driven from the crosspoint switch.

### Tone Generation

CW and paging tones are generated as square waves by an *HD6340 Programmable Timer IC*, then shaped by a *Transconductance Amplifier* to reduce CW *thumping*. (This thumping effect is caused by the DC component in the square wave pulse train). Tones are filtered by a *Sixth-Order Switched-Capacitor Lowpass Filter* to yield sine waves. The lowpass filter is under

microprocessor control and tracks the tone frequency, so that a constant-amplitude sine wave tone is created at any CW or paging tone frequency.

DTMF tones are generated by a *MT8880 DTMF Transceiver IC*.

## Memory Protection

The controller contains circuitry to protect the data stored in RAM and to maintain the clock and calendar even with no power applied to the controller.

A *Dallas Semiconductor DS1644 Timekeeping RAM IC* performs the following tasks: It monitors the 5V logic supply, disables the RAM's chip-enable input when an out-of-tolerance condition is detected, and switches the RAM's VCC pin from the logic supply to the lithium battery when the logic supply falls too low to maintain the data. The IC also contains the controller's Clock and Calendar.

The *Lithium Battery* contained within the IC has better than a 10-year life due to low (about 1  $\mu$ A) current drawn by the RAM under backup conditions.

## Cables

You will need to prepare either two or three *Cables* for the 7K controller.

- One cable is for DC power, using the *2.5mm plug* provided.
- One cable is for repeater connections, using the *DB25P* provided.
- A third cable is for auxiliary connections, and is not needed for simple installations. It uses the *DB25S* provided.

The following section of the manual describes the proper connection of the 7K's circuits to your equipment, and the audio adjustments required.

## Repeater Receiver COR

The controller requires a signal, generated by the repeater receiver, which becomes active when an incoming carrier is detected. This signal is usually called *COR (Carrier Operated Relay)* or *COS (Carrier Operated Switch)*, and is usually generated by the receiver's *Noise-Operated Squelch Circuit*. Some receivers don't have a COR or COS but have a *Channel Busy LED Indicator*, which works similarly. At this point, it is unimportant whether the COR signal is *low active* or *high active*, since the controller has sense-reversal DIP switches (discussed later). The COR from your receiver should be connected to Pin #2 of J2 (the female DB25S connector).

To get a better idea of how to interface your particular COR signal to the controller, let's examine the controller's *COR Input Circuit*. This circuit consists of an NPN transistor, Q1A, and three resistors. Q1 is actually a DIP package containing four 2n3904-type transistors. R10 is a DIP package containing seven 10K resistors. R11 is a SIP package containing seven 4.7K resistors with one common. One resistor from R10 and one resistor from R11 form a three-to-one voltage divider. Therefore, the COR input voltage threshold is 3 x 0.7V, or about 2V. Your receiver's COR driver must be capable of swinging

above and below this 2V threshold as the incoming carrier is applied and removed.

The third resistor mentioned above is R12 (4.7K), which is a “pullup” resistor connected between the input pin and the controller’s +5V supply. The purpose of the pullup resistor is to provide input current for the transistor in installations using dry contacts, or an open- collector transistor driver, to feed the COR input.

The purpose of the voltage divider mentioned above is to increase the threshold of voltage needed to switch the input ON and OFF. If the divider were not used, the input threshold would be only 0.7V, and some COR drivers would keep the input “high” permanently.

- If your receiver’s COR circuit provides a pair of relay contacts to indicate carrier detection, connect one contact to the COR input of the controller and the other contact to ground.
- If your COR circuit provides an open-collector transistor (or open-drain MOSFET), connect the signal to the COR input.
- If, however, your COR circuit sources a voltage (such as from a TTL logic gate or an op amp comparator circuit), you may need to disable the controller’s input.

**To check your installation:**

- Make the connection.
- Measure the voltage at the controller’s COR input pin with both the controller and receiver powered up.
- The voltage should swing above and below the 2V threshold as an incoming carrier is applied and removed.

Some COR drivers have low output impedances, and it is not necessary to clip the pullup resistor. However, if the pullup resistor interferes with the operation of your COR driver, you should clip one lead and lift the resistor to prevent it making contact.

Finally, determine the “sense” of your receiver’s COR signal. That is, does the COR signal go *low* or *high* when an incoming carrier is detected?

- If the COR goes low when a carrier is applied and returns high when the carrier is removed, place DIP Switch #1 (part of S2) in the ON (closed) position.
- If, however, the COR goes high when a carrier is applied and returns to low when the carrier is removed, place DIP Switch #1 in the OFF (open) position.

---

## Repeater Transmitter PTT

Your transmitter will require a *PTT (Push-To-Talk) Signal* from the controller. When this signal becomes active, the transmitter will *Key (Transmit)*. At this point, it is unimportant whether your transmitter's PTT input is *low active* or *high active* since the controller has sense-reversal DIP switches (discussed later). The PTT input from your transmitter should be connected to Pin #10 of J2 (the female DB25S connector).

To get a better idea of how to interface your particular PTT input to the controller, let's examine the controller's PTT output circuit. This circuit consists of a power MOSFET connected as an open-drain driver, plus a transient suppressor connected between the output and ground. The suppressor removes transients above about 40V, thereby protecting the MOSFET. The MOSFET is a large (8 Amp) device in a TO-220 package, but it was not selected for its high current capability. Rather, it was used because of its low ON resistance (less than 1  $\Omega$ ), making it a nearly perfect switch. The MOSFET's drain is connected to the PTT output, and its source is grounded. When turned ON, the MOSFET appears to be a very low resistance between the output and ground. When turned OFF, the MOSFET appears to be a very high impedance, isolating the output from ground. Because of these characteristics, the PTT circuit can control transmitters with a variety of PTT inputs, from TLL-logic-compatible to large DC relay coils.

Some transmitters, including models made by Hamtronics, MELCO (Maggiore Electronic Laboratory), and RCA (500-and 700-series), use a powered PTT input arrangement, and cannot be keyed by an open-drain driver. These transmitters require a positive voltage to be sourced into their PTT inputs to key; removing the voltage unkeys the transmitter. The current requirement can be substantial.

A simple outboard circuit can be placed between the controller's PTT output and the transmitter's PTT input to satisfy these requirements. (See schematic on page B-3.)

- Connect a large PNP transistor so that its emitter goes to the transmitter's +12V supply, its collector goes to the transmitter's PTT input, and its base goes to the controller's PTT output *through a 2K resistor (important)*.
- Connect a 4.7K resistor across the PNP transistor's base and emitter.
- If the transmitter draws little current through its PTT (500mA or less), you can use a 2N2904.
- If the transmitter draws 1 Amp or less, use a TIP30.
- When using this outboard circuit, place DIP Switch #7 (part of S2) in the ON (closed) position.
- You may then skip to the *Repeater Receiver Audio* section which follows.

Unless you have used the outboard circuit described above, you must determine the *sense* of your transmitter's PTT input.

- Does the transmitter key when the PTT input is driven *low* or *high*? (The majority of transmitters key when the PTT input is driven low.)
- If the transmitter keys when the PTT input is driven low and unkeys when the PTT input is opened, place DIP Switch #7 (part of S2) in the ON (closed) position.

- If the transmitter keys when the PTT input is opened and unkeys when the PTT input is driven low, place DIP Switch #7 in the OFF (open) position.

## Repeater Receiver Audio

The controller requires audio from the repeater receiver. Connect the audio from the repeater receiver to Pin #1 of J2 (the female DB25S connector).

To get a better idea of how to interface your particular receiver's audio output to the controller, let's examine the controller's repeater receiver audio input. This circuit consists of an op amp connected as an AC-coupled inverting amplifier, with two feedback resistors and one feedback capacitor. A 50K pot, R97, is connected between the audio input and ground, and serves as an adjustment for the audio going into the op amp. The input impedance of the controller depends upon the pot setting, but will be 14K $\Omega$  or greater. The best place to get receiver audio is the output of the receiver's first audio preamplifier stage (usually right after the discriminator). This point is often available at the *high* end of the volume control pot. The preamplifier stage provides flat audio from a low-impedance driver, often an op amp or an emitter-follower stage.

---

**Note:** Do not tap into the wiper of the volume control, or use the speaker driver as the audio source; accidental adjustment of the volume control will affect the repeat level. Speaker audio has a higher level of distortion than audio from earlier stages.

---

The controller works best when driven with flat (not pre-emphasized) audio at a level of 700mV RMS (2V peak-to-peak). At this level, the controller's RX1 pot (R97) will be in the mid range position when optimum audio is fed to internal circuits. The controller's actual input acceptance range is 200mV RMS (0.5V p-p) to 2V RMS (5.6V p-p) as shipped from the factory, controllable by the RX1 pot.

If your receiver's audio level is below the minimum of 200mV, you can increase the op amp's gain by cutting a feedback resistor.

- Resistor R30 (100K) has one lead marked "A" on the PC board; cut this lead and lift the resistor.
- This operation changes the input acceptance to a new range of 70mV RMS (0.2V p-p) to 700mV RMS (2V p-p).
- The midrange position of the RX1 pot will now correspond to 250mV RMS (0.7V p-p).

Some repeater owners will prefer to drive the controller with pre-emphasized audio from the receiver's discriminator circuit.

- To accommodate this, the op amp stage must provide a -6dB/octave rolloff response (de-emphasis), which results in flat audio being sent to the controller's circuits. (This is especially important for the DTMF decoder).
- Capacitor C67 (47pF) can be increased to 0.01 $\mu$ F if normal gain is used, or to 0.0047 $\mu$ F if the high-gain modification has been done, to provide the required de-emphasis.

---

After you have completed the repeater receiver audio interfacing, check the audio level at Pin #1 of U37A. It should be 700mV RMS (2V p-p) when the receiver is fed a fully- deviated 1KHz sine wave tone from a service monitor.

## Repeater Transmitter Audio

Your transmitter will require audio from the controller. Connect the audio input of the transmitter to Pin #14 of J2 (the female DB25S connector).

To get a better idea of how to interface your particular transmitter's audio input to the controller, let's examine the controller's repeater transmitter audio output circuit. This circuit consists of two op amps and a number of discrete parts. The first op amp, U34D, is an audio summer (mixer) with two inputs from the crosspoint switch. Typically, one input carries repeat audio and the other carries the CW ID tones; however, the controller's software can switch a number of sources to these mixed inputs. The second op amp, U34A, is the transmitter audio driver. The output impedance of the driver is 600  $\Omega$ . A 50K pot, R104, is connected between the two op amps and serves as the master gain pot for the transmitter audio.

The controller's driving capability depends upon the load impedance presented by the transmitter's audio input.

- If the controller is driving a load of 10K $\Omega$  or greater, the output level can be adjusted from 200mV RMS (0.5V p-p) to 2V RMS (5.6V p-p).
- If the controller is driving a 600 $\Omega$  load, the output level can be adjusted from 100mV RMS (0.3 p-p) to 1V RMS (2.8V p-p).

---

**Note:** In most 600 $\Omega$  systems, nominal level is 0dBm, or 775mV RMS. This corresponds to the 80% clockwise position of R104.

---

If your transmitter's audio input is much more sensitive than the level figures given above, or if you must drive the microphone input, the gain of the transmitter audio driver op amp should be reduced.

- This is accomplished by cutting an input resistor, R75 (27K). Clip one lead and lift the resistor. This modification reduces all audio sent to the transmitter.
- If the controller is driving a load of 10K $\Omega$  or greater, the output level can be adjusted from 40mV RMS (113mV p-p) to 400mV RMS (1.1V p-p).
- If the controller is driving a 600 $\Omega$  load, the output level can be adjusted from 20mV RMS (56mV p-p) to 200mV RMS (565mV p-p).

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**Note:** Although it is always a good idea to use shielded cable between the controller's audio connections and the repeater's audio connections, it is especially important to do so when driving sensitive mic inputs in transmitters.

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## Repeater CTCSS Decoder

*CTCSS*, or *Continuous Tone-Controlled Squelch System*, is a convenient problem solver for those bands that are being crowded with repeaters in various parts of the country. In addition, the controller allows CTCSS to be used as a qualifier for the entry of DTMF commands to increase the security of the repeater system. Well-known trademarked names for CTCSS include: *PL* or *Private Line*<sup>™</sup> (Motorola), *Channel Guard*<sup>™</sup> (General Electric), and *Call Guard*<sup>™</sup> (Johnson). Your repeater may already have a *CTCSS Decoder* built in, or you may wish to install one of the add-on boards readily available from a number of sources. The *TS-64*, from Communications Specialists, Inc., Orange, CA, 1-800-854-0547, <http://www.com-spec.com>, is a good example. This device is crystal-controlled for stability, and allows switch selection of one of 64 CTCSS tone frequencies.

The *CTCSS Decoder* should be installed in your repeater receiver following the instructions provided by the decoder manufacturer. The output from the decoder is usually an open-collector transistor driver which is either *low active* or *high active*. This signal should be connected to Pin #5 of J2 (the female DB25S connector).

### To check your installation:

- Measure the voltage at Pin #5 of J2 with the receiver, CTCSS decoder, and controller powered up.
- The voltage should swing above and below the 2.1V threshold as an incoming CTCSS tone is applied and removed.

You must also determine the *sense* of your CTCSS decoder output.

- Does the output go *low* or *high* when the correct CTCSS tone is received?
- If the output goes low when the tone is received and returns high when the tone is removed, then place DIP Switch #4 in the ON (closed) position.
- If, however, the output goes high when the tone is received and returns low when the tone is removed, the place DIP Switch #4 in the OFF (open) position.

An additional feature of this controller is the ability to change the CTCSS decoder's frequency remotely. To do so requires that you use a CTCSS decoder that has jumper- or switch-selectable tones, not pot-adjusted (tunable) tones.

- You must remove any CTCSS frequency selection jumpers or open any DIP switches to allow the controller to control the frequency.
- Connect wires from the *frequency selection* sides of the jumpers or DIP switches to the *CTCSS Frequency* pins on the controller (see page C-16, connector J2).
- Connect jumper or switch #1 to *CTCSS Frequency #1*, jumper or switch #2 to *CTCSS Frequency #2*, and so on.
- The TS-64 will use all 6 *CTCSS Frequency* connections.
- Other CTCSS decoders, eg. the TS-32, will need only 5.
- By entering the proper commands, you can tell the controller to connect the jumpers or *throw* the switches on the decoder to change the tone frequency.

---

## Control Receiver COR

A control receiver is a wise addition to your repeater system, as it allows you to control the repeater on a frequency other than the repeater's input. Users of the repeater will not notice any change in operation while the control channel is occupied, except that the repeater will not accept any of their DTMF commands. Additionally, any *Command Response Messages* will be sent over the repeater transmitter that are caused by commands received from the control channel (unless these response messages have been turned OFF by command). When the control channel is released, all operations return to normal.

If you want to implement a control channel function, you must supply both the following from your control receiver: A COR signal and audio.

The control receiver COR signal can be either *low active* or *high active*. This signal should be connected to Pin #4 of J2 (the female DB25S connector), the *RX3 COR Input*.

No software currently exists to support the *RX3 PL Input*; therefore, if you wish to use a CTCSS decoder on the control channel, you must connect the output of the decoder to the *RX3 COR Input*.

Better yet, externally “and” together the COR and CTCSS decode signals, and feed the result into the RX3 COR input. Unless the correct CTCSS tone is recognized by the decoder, the controller will ignore the control receiver. The control receiver COR input to the controller is similar to the repeater receiver COR input. The voltage divider is made up of one resistor from network R10 and one resistor from network R11. The pullup resistor is R14. (You may refer to the *Repeater Receiver COR* section on page C-3 for a discussion of the hardware design of the input circuit.)

### To check your installation:

- Measure the voltage at Pin #4 of J2 with the control receiver and controller powered up.
- The voltage should swing above and below the 2.1V threshold as an incoming carrier is applied and removed.

You must also determine the *sense* of your control receiver COR output signal.

- Does the output go *low* or *high* when an incoming carrier is detected and returns high when the carrier is removed? If so, place DIP Switch #3 in the ON (closed) position.
- If, however, the output goes high when the carrier is detected and returns low when the carrier is removed, place DIP Switch #3 in the OFF (open) position.

---

**Note:** If you do not use a control receiver, be sure DIP Switch #3 is in the ON (closed) position. This configures the controller for a low-active COR signal. The pullup resistor on the input will hold the input high, thus releasing the DTMF decoder from the control channel.

---

## Control Receiver Audio

If you are adding a control receiver to your repeater system, you must supply both a COR signal and an audio signal from the control receiver to the controller. The COR signal has been previously discussed. *Control Receiver Audio* should be connected to Pin #25 of J2 (the female DB25S connector), shown in the schematics as *RX3*.

The design of the control receiver audio input is similarly to the design of the repeater receiver audio input. Refer to the *Repeater Receiver Audio* section on page C-6 for additional information. The control receiver level pot is R99.

- To increase the gain of the control receiver input stage, cut the lead labeled “C” of resistor R37 (100K).
- To accommodate pre-emphasized audio, change capacitor C74 from 47pF to 0.01μF if normal gain is used, or 0.0047μF if the high-gain modification has been done.

After you have completed the control receiver audio interfacing, check the audio level at Pin #8 of U37C. The level should be about 700mV RMS (2V p-p) when the control receiver is fed a fully-deviated 1KHz sine wave tone from a service monitor.

## DC Power

The controller requires a power source of +12 to +15VDC.

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**Note: Do not exceed a supply voltage of +15V.** The controller’s DC power input is protected by a 15V transient suppressor, which will start to draw current when the input voltage exceeds 15VDC.

---

The amount of current drawn by the controller depends upon the configuration.

- The 7K Main Board draws less than 125 mA.
- The Telephone Interface Module draws negligible current.
- The Speech Synthesis Module draws about 180 mA.
- A *loaded* system, then, can be expected to draw about 300 mA.

The controller does not require a regulated power source, since it contains local voltage regulator ICs for its analog and digital circuits. However, The power source must be free of “sags” that may occur, for example, when the transmitter is keyed. If significant ripple is present on the power source output, the ripple “peaks” must not exceed +15V. Ripple “valleys” must not fall below +12V.

The controller contains circuitry to protect the data stored in memory during the power outages. No external battery backup is needed to prevent loss of memory data. Owners may wish to provide backup power to both the repeater and the controller to ensure continuous service during utility power outages.

Power should be supplied to the controller via the 2.5mm x 5.5mm DC power plug (supplied).

- The center hold forms the positive (+) connection.
- The sleeve forms the negative (-) connection.

---

**Note:** *Owners of alternatively-powered repeaters* (solar, fuel cell, battery, etc.) should be aware that the 7K has been designed to behave predictably when the DC power source is slowly reduced. Such behavior is important to prevent damage to the energy source. For example, some controllers will suddenly stop operating (i.e. reset) when a low voltage limit is reached. If an output, such as the transmitter PTT line, was enabled at the time, and the transmitter PTT line, was likewise enabled, the transmitter could stay keyed until the power source failed.

Your S-COM controller will cease microprocessor operation when the power supply voltage fails, but it will also reset the digital outputs at that time. This condition will be held until the power source voltage drops considerably. With little load on the source. This will take a long time to occur.

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## Logic Inputs

The controller has the ability to monitor logical (ON/OFF) devices at the repeater site. There are 7 *Logic Inputs* for this purpose. Any of the 3 *Receiver COR Inputs* and the 3 *CTCSS Decoder Inputs* may be used as additional logic inputs. Each logic input has a hardware interface that is similar to the repeater receiver COR input. Refer to the *Repeater Receiver COR* section on page C-3 for details on the design of the input circuit.

The controller can sense either a low-to-high or a high-to-low transition, or both, on each logic input. Therefore, there is no need for *Sense-Reversal DIP Switches* on the 7 logic inputs.

Logic inputs are very handy for informing the controller when some external condition has changed. Examples include detection of high water, high SWR, power failure, intrusion, and so on. Since the controller will execute macro commands upon sensing a change, the owner can control the action that will be taken. (This is a big improvement over controllers that take fixed action when an input is tripped, such as appending an alarm CW message to the tail.)

## Logic Outputs

The controller has the ability to control logical (ON/OFF) devices at the repeater site. There are 7 *Logic Outputs* for this purpose.

Each logic output has a hardware interface that is similar to the transmitter PTT output, except that the power MOSFET devices are smaller. Refer to the

*Repeater Transmitter PTT* section on page C-5 for details on the design of the output circuit.

The power MOSFETS used as logic output drivers appear as 5Ω resistances to ground when in the conducting state (ON), and can sink up to 75mA. They appear as open circuits when in the non-conducting state (OFF). *Do not* apply over 40VDC, as the transient suppressors start conducting at 40V.

Since the drain connections of the MOSFETs are brought out to the connector without *pullup* resistors, this configuration is called *open drain* (similar to *open collector* circuits using bipolar transistors). An ohmmeter cannot be used to check the logic outputs, since no change will be seen when the outputs are turned ON and OFF. A DC power source and a load of some type will be needed to see the outputs change state. If you need *TTL- Compatible Outputs*, simply connect pullup resistors of 3KΩ from the desired outputs to the 5V power supply of the TTL device being driven.

Logic outputs are very handy for controlling external devices and appliances at the site. Loads include incandescent lamps, LEDs, integrated or discrete logic, and relay coils.

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**Note:** Although the power MOSFETS are protected by transient suppressors in the controller, it is still important to wire diodes across inductive loads (such as relays) in the non-conducting direction.

---

Each logic output may be commanded to be *Latched ON* or *OFF*, or *Momentary* turned *ON* or *OFF* for 0.5 seconds.

The controller will remember the status of each logic output during power outages. When power returns, the controller will turn the outputs ON or OFF to match the conditions before the power loss. An initialization sequence will force all outputs OFF.

## Telephone Line Connection

If your controller is equipped with the *Telephone Interface Module*, you can connect the controller to the telephone network. The 14-foot cable supplied with your controller has a modular USOC (Universal Service Order Code) plug at each end. This plug mates with the USOC RJ11C jack. Connect one end of the cable to the controller, and the other end to the RJ11C jack at your repeater site.

The Telephone Interface Module is registered under Part 68 of the FCC Rules and Regulations for direct connection to the telephone line. A label is attached on the rear of the cabinet, listing the registered number and ringer equivalence. It reads:

**Complies with Part 68, FCC Rules  
FCC Registration No. GHZ37K-10180-DP-N  
Ringer Equivalence: 1.3B**

The Telephone Interface Module contains lightning protection circuitry. However, it is still a good practice to install additional protection at the telephone line service entrance. The following companies market phone line suppressors:

<b>Telephone Line Suppressors Market Sources</b>	
Citel America, Inc. 1111 Parkcentre Blvd., Suite 474 Miami FL 33169 (305) 621-0022 (FL) (800) 248-3548	L-COM Data Products 1755 Osgood Street, Rt. 125 North Andover MA 01845 (617) 682-6936 (617) 689-9484 (FAX)
ITW Linx Communications Products 201 Scott Street Elk Grove IL 60007 (312) 952-8844 (312) 952-1633 (FAX)	MCG Electronics Inc. 12 Burt Drive Deer Park NY 11729 (516) 586-5125 Telex 645518
Telebyte Technology, Inc. 270 East Pulaski Road Greenlawn NY 11740 (516) 385-8184 (FAX) (800) 835-3298 (516) 423-3232	PolyPhaser Corporation 1425 Industrial Way Gardnerville NV 89410-1237 (800) 325-7170 (702) 782-4476 (FAX) Telex 272718
TII Industries, Inc. 1375 Akron Street Copiague NY 11726 (516) 789-5020 (Sales) (516) 789-5000 Telex 144631	L.E.A. Dynatech 12516 Lakeland Road Santa Fe Springs CA 90670 (213) 944-0916 (800) 654-8087 (213) 944-0781 (FAX)

## **FCC Part 68 Rules**

FCC rules and regulations, Part 68 require the following information be provided to the user of FCC Registered Terminal Equipment:

### **Section 68.100 General.**

Terminal equipment may be directly connected to the telephone network in accordance with the rules and regulations ... of this part.

### **Section 68.104 Standard Plugs And Jacks.**

(a) General. "Except for telephone company-provided ringers, all connections to the telephone network shall be made through standard (USOC) plugs and standard telephone company-provided jacks, in such manner as to allow for easy and immediate disconnection of the terminal equipment. Standard jacks shall be so arranged that if the plug connected thereto is withdrawn, no interference to the operation of the equipment at the customer's premises which remains connected to the telephone network shall occur by reason of such withdrawal."

### **Section 68.106 Notification to Telephone Company.**

"Customers connecting terminal equipment or protective circuitry to the telephone network shall, before such connection is made, give notice to the telephone company of the particular line(s) to which such connection is to be made, and shall provide to the telephone company the FCC Ringer Equivalence of the registered terminal equipment or protective circuitry. The customer shall give notice to the telephone company upon final disconnection of such equipment or circuitry from the particular line(s)."

**Section 68.108 Incidence of Harm.**

“Should terminal equipment or protective circuitry cause harm to the telephone network, the telephone company shall, where practicable, notify the customer that temporary discontinuance of service may be required; however, where prior notice is not practicable, the telephone company may temporarily discontinue service forthwith, if such action is reasonable in the circumstances. In case of such temporary discontinuance, the telephone company shall

(1) promptly notify the customer of such temporary discontinuance, (2) afford the customer the opportunity to correct the situation which gave rise to the temporary discontinuance, and (3) inform the customer of the right to bring a complaint to the Commission pursuant to the procedures set forth in Subpart E of this part.”

**Section 68.110 Compatibility of the Telephone Network and Terminal Equipment.**

(b) Changes in Telephone Company Facilities, Equipment Operations or Procedures.

“The telephone company may make changes in its communications facilities, equipment, operations or procedures, where such action is reasonably required in the operation of its business and is not inconsistent with the rules and regulations in the Part. If such changes can be reasonably expected to render any customer’s terminal equipment incompatible with telephone company communications facilities, or require modification or alteration of such terminal equipment, or otherwise materially affect its use or performance, the customer shall be given adequate notice in writing, to allow the customer an opportunity to maintain uninterrupted service.”

**Section 68.216 Repair of Registered Terminal Equipment and Registered Protective Circuitry.**

“Repair of registered terminal equipment and registered protective circuitry shall be accomplished only by the manufacturer or assembler thereof or by their authorized agent; however, routine repairs may be performed by a user, in accordance with the instruction manual if the applicant certifies that such routine repairs will not result in noncompliance with the rules in Subpart D of this Part.”

**Section 68.218 (b) Additional Instructions To User.**

1. “... registered terminal equipment or protective circuitry may not be used with party lines or coin lines.”
2. “... when trouble is experienced the customer shall disconnect the registered equipment from the telephone line to determine if the registered equipment is malfunctioning, and ... if the registered equipment is malfunctioning, the use of such equipment shall be discontinued until the problem has been corrected.”
3. “... the user must give notice to the telephone company in accordance with the requirements of section 68.106 ...”

## Input and Output Connectors

Two 25-position D-subminiature connectors, one male and one female, are mounted on the 7K Main Board for interfacing to external devices. J2 is a female connector (DB25S). J3 is a male connector (DB25P). Use the mating connectors supplied with the 7K for your cable assemblies.

<b>Input and Output Connectors</b>		
Controller Main Board		
<b>Pin #</b>	<b>J2 Female Connector</b>	<b>J3 Male Connector</b>
1	receiver #1 audio input	logic input #1
2	receiver #1 COR	logic input #2
3	receiver #2 COR	logic input #3
4	receiver #3 COR	logic input #4
5	receiver #1 CTCSS decoder	logic input #5
6	receiver #2 CTCSS decoder	logic input #6
7	receiver #3 CTCSS decoder	phone line busy input
8	receiver #2 audio input	logic output #1
9	CTCSS frequency #1	logic output #2
10	transmitter #1 PTT	logic output #3
11	transmitter #2 PTT	logic output #4
12	CTCSS frequency #2	logic output #5
13	CTCSS frequency #3	logic output #6
14	transmitter #1 audio output	logic output #7
15	transmitter #2 audio output	phone line busy output
16	CTCSS frequency #4	FC1 (reserved)
17	CTCSS frequency #5	FC2 (reserved)
18	CTCSS frequency #6	FC3 (reserved)
19	ground	+5V test
20	ground	+10V test
21	ground	+12V test
22	ground	ground
23	CTCSS encoder in	ground
24	CTCSS encoder out	ground
25	receiver #3 audio input	ground

## Audio Level Potentiometers

The 7K Main Board contains 12 potentiometers. The pots are used to adjust audio levels only. Signalling tones are digitally generated and do not require frequency adjustment.

<b>Audio Level Potentiometers</b>		
Controller Main Board		
<b>Pot</b>	<b>Location</b>	<b>Function</b>
RX1	R97	adjusts audio level from receiver #1
RX2	R98	adjusts audio level from receiver #2
RX3	R99	adjusts audio level from receiver #3
TX1	R104	adjusts audio level to transmitter #1
TX2	R105	adjusts audio level to transmitter #2
CW-TX	R102	adjusts level of CW feeding the transmitters
CW-PL	R101	adjusts level of CW feeding the phone line
tone page	R103	adjusts level of paging tones feeding the transmitters (1-tone, 2-tone, 5/ 6-tone)
DTMF page	R100	adjusts level of DTMF paging tones feeding the transmitters
AGCPL	R107	adjusts audio level of phone line feeding the transmitters (AGC'd)
PL	R106	adjusts audio level of phone line feeding the DTMF decoder (non- AGC'd)
speech	R108	adjusts the level of the speech synthesizer

**Note:** There is also a pot on the Speech Synthesis Module, R3, which is used to adjust the pitch of the synthesizer. This pot may be adjusted to suit your taste.

## Message Level Potentiometers

Five of the 12 pots located on the 7K Main Board are used to set levels associated with messages. The five pots are shown in the table which follows:

<b>Message Level Potentiometers</b>	
Controller Main Board	
<b>Pot</b>	<b>Sets Level</b>
R100	DTMF to transmitter
R101	CW to phone line
R102	CW to transmitter
R103	tone page to transmitter
R108	Speech Synthesizer Module

- All pots are adjusted clockwise to increase level, and counter-clockwise to decrease level.
- R100 adjusts the level of the DTMF characters sent to the transmitter. The level of DTMF characters sent to the phone line during autopatch dialing is not adjustable.
- R101 adjusts the level of CW characters and beep characters sent into the phone line.
- R102 adjusts the level of CW characters and beep characters sent to the transmitter. Many repeater owners adjust the level of CW to a low deviation (.5–1.5KHz) to prevent interference with voice conversations.
- R103 adjusts the level of tone pages (single-tone, two-tone sequential, and 5/6-tone) sent to the transmitter. Typically, the deviation for these types of pages is 3 to 3.3KHz. Pages sent to the phone line as acknowledgments will be at the same level as CW characters sent to the phone line.
- R108 adjusts the level of the speech synthesizer, and controls the level of speech characters to both the transmitter and the phone line.

## DIP Switches

The 7K Main Board contains a group of 8 *DIP Switches*. They are used to invert the logic of the 3 COR inputs, the 3 CTCSS decoder inputs, and the 2 PTT outputs. In all cases, a switch in the ON (closed) position means low active; a switch in the OFF (open) position means high active.

<b>DIP Switches</b>	
Controller Main Board	
<b>Switch #</b>	<b>Function</b>
1	inverts receiver #1 COR
2	inverts receiver #2 COR
3	inverts receiver #3 COR
4	inverts CTCSS decoder for receiver #1
5	inverts CTCSS decoder for receiver #2
6	inverts CTCSS decoder for receiver #3
7	inverts transmitter #1 PTT
8	inverts transmitter #2 PTT

## Testing The Controller-To-Repeater Transmitter Interface

Apply power to both the controller and the repeater while monitoring the repeater with an extra receiver. When power is applied, the transmitter should key and send the reset CW message.

If the transmitter does not key at all:

- Check the wiring. Both the controller and the repeater should be powered up.
- Check the connection between the controller's PTT output and the transmitter's PTT input.

If the transmitter keying is acting "upside down" (unkeying during the message but keying afterwards), reverse the repeater transmitter PTT DIP switch.

If the transmitter is keying properly but no CW message is heard, check the wiring from the controller's repeater transmitter audio output to the transmitter's audio input.

If the CW message is too loud or too soft:

- Adjust the CW-to-TX pot on the main board.
- See the *Messages* chapter on page 4-1.
- Turn the pot clockwise to increase the level, and counter-clockwise to decrease the level.

If the CW message is still too loud with the pot turned nearly all the way down, you may be attempting to drive the microphone input of the transmitter instead of a later stage.

If you cannot drive a later stage, check the *Transmitter Audio Output* on page C-7 for hints for decreasing the transmitter drive level.

## Testing The Controller-To-Repeater Receiver Interface

Generate an RF signal on the repeater's input frequency. The controller should key the repeater transmitter. When the signal disappears, a short courtesy beep should be heard. The transmitter should stay keyed for a few more seconds, then it should unkey.

If this does not happen:

- Check the wiring between the repeater receiver's COR driver and the controller's Receiver #1 COR Input.
- Check the voltage on the COR line to see if it swings above and below the required threshold. (Check the voltage with the controller and receiver connected, not just the open-circuit COR output from the receiver).

If the repeater is acting *upside down* (unkeying when a signal exists but keying afterwards), reverse the Receiver #1 COR DIP Switch.

The default condition of the controller causes a 0.5-second delay between the loss of carrier and the courtesy beep. The transmitter will stay keyed for an additional 3.0 second dropout delay. These characteristics may all be changed later, so do not be concerned if this is not the way you wish the repeater to act.

- Generate a modulated RF signal on the repeater's input frequency (a service monitor is quite helpful).
- Check the audio level as instructed in the *Repeater Receiver Audio* section on page C-6.
- Check the transmitter for proper deviation, and
- Adjust the Transmitter #1 Audio Output pot as necessary.

## Testing The DTMF Decoder

Your controller uses an *8800-Type DTMF Transceiver IC*. This crystal-controlled device encodes and decodes all 16 DTMF digits. It has an extremely wide dynamic range (30 dB), and can detect digits that have as much as -6 dB to +6 dB of twist.

*Twist* refers to the difference in amplitude between the two individual tones that are summed to make up a DTMF digit. The more twist a system gives to DTMF digits, the more difficult it is to detect the digits. In repeater systems, twist can be caused by the user's transmitter.

The audio fed into the transmitter is pre-emphasized before it is applied to the limiter circuit. Pre-emphasis causes high frequency tones to have more amplitude than low frequency tones, so the high frequency tone of a DTMF

digit can be severely clipped while the low frequency tone is not. The result is twist, and the solution is to keep the DTMF pad audio at a reasonably low level. Twist can also be introduced by the repeater receiver if it has poor audio response, or if a poor impedance match exists between the receiver and the controller.

### **Command Sources**

The DTMF decoder can monitor all receiver inputs and the phone line for incoming digits. However, it can monitor only one device at a time. Therefore, a priority scheme is used to determine which source feeds the decoder at any given time. If no source is active, the decoder's input is grounded.

### **Local Control**

You can program the controller with a local DTMF keyboard, if desired.

- Connect the audio from the keyboard to the Receiver #1 Audio Input.
- Connect a switch between the RX #1 COR Input and ground.
- Whenever the switch is ON (closed), the controller will accept commands from the keyboard.
- Alternately, you can use the same scheme with Receiver #3 and leave the keyboard permanently connected.

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**Note:** Return the switch to the OFF (open) position when finished programming, so the repeater Receiver #1 can drive the DTMF decoder once again.

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### **Performing the Tests**

Generate an RF signal on the repeater's input frequency.

- While listening to the repeater output on an extra receiver, send some DTMF digits to the repeater.
- You should hear a short burst of DTMF, followed by silence, as the controller detects the digit and then mutes it.
- If the digits are passed through to the transmitter with no muting taking place, the DTMF decoder is not recognizing the digits.

There are several areas to check:

- Check the audio level at the output of the Receiver #1 Audio Op Amp; it should be 700 mV RMS (2V p-p) as discussed in the *Repeater Transmitter Audio* section on page C-7.
- Check the operation of the Receiver #1 COR Input. If the COR input isn't active, the DTMF decoder will not be monitoring the repeater receiver audio.
- Check the other receiver COR inputs and their associated DIP switches. If a higher- priority input is active, the DTMF decoder will be monitoring that input, not the repeater receiver.
- Check to see if a command was entered to disable the DTMF decoder from the repeater receiver.

## Falsing

Some user's voices can contain frequency components that appear as DTMF digits to the decoder. If such a digit is detected, *falsing* is said to occur. If the DTMF muting feature is enabled, the result of falsing is the loss of repeat audio for a syllable or two. In addition, an accidental digit is stored into the controller's command buffer. This last item is not usually a problem, however, because the digit will be discarded after a few seconds when the controller discovers that the digit was no part of a valid command. In any case, falsing is annoying and can usually be cured to an acceptable extent.

Several solutions to falsing are available:

- **Turn OFF the DTMF muting feature.** Use the *Select DTMF Decoder Mute Delay* command on page 11-8. If you do this, all DTMF digits will be repeated. This is a simple fix, but it may not be acceptable for repeaters that need security for DTMF commands.
- **Don't overdrive the DTMF decoder.** The higher the audio level to the decoder, the more likely it is to false. Check the audio level at the output of the receiver's op amp. If over the recommended 700 mV RMS (2V p-p), turn the audio level down. Overdriving the decoder will not help it decode any better.
- **Increase the DTMF decoder's detect time.** The decoder's tone detect time is controlled by resistor R7, which is 300K as shipped from the factory. This provides a rather fast 40mS detect time (a telephone company standard). Increasing R7 will require a longer detect time, thus reducing the possibility of falsing. The disadvantage of slowing the detection time is that some DTMF autodialers generate digits at a rapid rate; a long detection time could result in missed digits. If autodialers are not a problem, increasing the detection time will make a noticeable improvement in falsing. Field experience has shown that changing R7 to 500K will solve minor cases, and changing it to 1M will solve nearly all cases. The slower response to DTMF digits has not been a problem for users, since the increase in time is small by human operator standards.

## Real-Time Clock

The *Controller* features a year 2000-compliant hardware real-time clock and calendar circuit with a lithium power source. Accurate time keeping is maintained during loss of main power.

The clock and calendar circuit is accurate to  $\pm 1$  minute per month. For improved accuracy, commands are provided to manually or automatically adjust the clock to compensate for drift. (See page 8-1.)



*Appendix D*

# Parts Lists and Schematics

## Controller Main Board

<b>Parts Controller Main Board</b>		
Dated 06-05-89 Revised 07-31-89 Revised 11-30-90 For Serial Numbers 207 and up Purchased After 12-90		
<b>Part # or Type</b>	<b>Qty</b>	<b>Location</b>
<b>Resistors</b>		
237 $\frac{3}{4}$ 1% 1/4W	1	R28
604 $\frac{3}{4}$ 1% 1/4W	2	R78, R86
1.69K $\frac{3}{4}$ 1% 1/4W	1	R109
11.3K $\frac{3}{4}$ 1% 1/4W	1	R50
14.0K $\frac{3}{4}$ 1% 1/4W	1	R51
22.6K $\frac{3}{4}$ 1% 1/4W	2	R61, R119
47 $\frac{3}{4}$ 5% 1/4W	7	R32, R56, R64, R70, R113, R114, R116
100 $\frac{3}{4}$ 5% 1/4W	2	R52, R90
1K $\frac{3}{4}$ 5% 1/4W	1	R65
2K $\frac{3}{4}$ 5% 1/4W	1	R115
4.7K $\frac{3}{4}$ 5% 1/4W	20	R12, R13, R14, R15, R16, R17, R21, R22, R23, R24, R25, R26, R27, R41, R42, R58, R110, R111, R112, R118
10K $\frac{3}{4}$ 5% 1/4W	9	R45, R49, R54, R55, R57, R60, R69, R77, R85
20K $\frac{3}{4}$ 5% 1/4W	24	R29, R33, R36, R39, R40, R43, R44, R46, R47, R48, R62, R63, R71, R72, R73, R79, R80, R81, R87, R88, R89, R92, R94, R96

22K <sup>3</sup> / <sub>4</sub> 5% 1/4W	1	R5
27K <sup>3</sup> / <sub>4</sub> 5% 1/4W	2	R75, R83
47K <sup>3</sup> / <sub>4</sub> 5% 1/4W	2	R6, R59
51K <sup>3</sup> / <sub>4</sub> 5% 1/4W	1	R117
68K <sup>3</sup> / <sub>4</sub> 5% 1/4W	4	R76, R84, R93, R95
82K <sup>3</sup> / <sub>4</sub> 5% 1/4W	2	R74, R82
100K <sup>3</sup> / <sub>4</sub> 5% 1/4W	5	R30, R34, R37, R53, R91
200K <sup>3</sup> / <sub>4</sub> 5% 1/4W	3	R31, R35, R38
300K <sup>3</sup> / <sub>4</sub> 5% 1/4W	1	R7
470K <sup>3</sup> / <sub>4</sub> 5% 1/4W	4	R66, R67, R68, R120
4.7K <sup>3</sup> / <sub>4</sub> 8-pin sip	5	R1, R8, R9, R11, R20
4.7K <sup>3</sup> / <sub>4</sub> 10-pin sip	4	R2, R3, R4, R18
10K <sup>3</sup> / <sub>4</sub> 14-pin DIP	2	R10, R19
50K <sup>3</sup> / <sub>4</sub> 3/8" pot	12	R97, R98, R99, R100, R101, R102, R103, R104, R105, R106, R107, R108
<b>Capacitors</b>		
3-23pF trimmer	1	C22
18pF ceramic NPO	3	C2, C3, C23
47pF ceramic NPO	3	C67, C71, C74
100pF ceramic	39	C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C42, C43, C46, C47, C48, C49, C50, C51, C52, C53, C65, C69, C72, C98, C103, C111, C112, C113, C114, C115, C116, C117, C118, C119, C120, C121
470pF ceramic NPO	2	C96, C101
.001μF film	3	C16, C60, C86, C122
.0022μF film	1	C17
.0039μF film	1	C85
.1μF film	1	C20
.1μF MLC	28	C1, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C19, C21, C25, C26, C27, C41, C44, C45, C54, C55, C56, C57, C58, C59, C110
.47μF film	16	C18, C66, C70, C73, C75, C76, C77, C78, C79, C81, C84, C95, C100, C104, C105, C106
1μF tantalum	4	C24, C62, C63, C88
4.7μF tantalum	5	C87, C90, C91, C94, C99
10μF tantalum	13	C64, C68, C80, C82, C83, C89, C92, C93, C97, C102, C107, C108, C109
330μF electrolytic	1	C61, C123
<b>Diodes</b>		
1N4002	2	D12, D13
ICTE-15/MPTE-15	1	D11
SA40A	10	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10

<b>Transistors</b>		
2N3904	1	Q4
2N7000/VN10KM	9	Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15
MPQ3904	3	Q1, Q2, Q3
RFP12N08L	2	Q5, Q6
<b>Integrated Circuits</b>		
27C256 factory program	1	U5
74C906	3	U29, U30, U31
74HC00	1	U24
74HC04	1	U26
74HC86	2	U27, U28
74HC138	2	U7, U8
74HC139	2	U6, U11
74HC251	2	U13, U14
74HC259	3	U15, U16, U17
74HC374	3	U18, U19, U20
74HC4078	1	U25
CA3080	1	U32
CD4053	1	U36
DS1210	1	U3
DS1232	1	U1
HD6340	1	U9
HD63B09	1	U2
HM62256LP	1	U4
ICM7170	1	U12
LM317	1	U21
LM7805	1	U22
LMC660	4	U33, U34, U37, U38
MF6CN-50	1	U23
MT8812	1	U35
MT8880	1	U10
<b>Crystals</b>		
32.768KHz	1	Y2
3.579MHz	1	Y3
4.000MHz	1	Y1
<b>Batteries</b>		
lithium 3V	2	B1, B2
<b>Switches</b>		
push-button, momentary	1	S1
DIP switch, 8 pole	1	S2
<b>Ferrite Beads</b>		
2943666661	1	L1

<b>Connectors</b>		
2-pin male header	2	P3(MEM), P5(RTC)
4-pin male header	2	P1(ADM1), P2(ADM2)
10-pin male header	1	P9(DISPLAY)
14-pin male header	1	P7(TIM)
16-pin male header	1	P8(SSM)
8-pin IC socket	3	
14-pin IC socket	16	
16-pin IC socket	10	
20-pin IC socket	4	
24-pin IC socket	1	
28-pin IC socket	3	
40-pin IC socket	2	
2.5mm DC power jack	1	J1
DB25P PC mount	1	J3
DB25S PC mount	1	J2
<b>Hardware</b>		
PC board	1	
heat sink 5910B	2	
4-40 x 3/8" machine screw	4	
#4 int tooth lockwasher	4	
4-40 hex nut	4	
6-32 x 1/4" machine screw	2	
6-32 hex nut	2	

Main Board schematic page 1 of 4 to be provided.

Main Board schematic page 2 of 4 to be provided.

Main Board schematic page 3 of 4 to be provided.

Main Board schematic page 4 of 4 to be provided.

Main Board layout to be provided.

## Speech Synthesizer Module (SSM)

<b>Parts: Speech Synthesizer Module (SSM)</b>		
Dated 05-05-89 Revised 04-08-91		
Part # or Type	Qty	Location
<b>Resistors</b>		
47 $\frac{3}{4}$ 5% 1/4W	3	R5, R10, R12
1K $\frac{3}{4}$ 5% 1/4W	1	R11
1.2K $\frac{3}{4}$ 5% 1/4W	1	R4
10K $\frac{3}{4}$ 5% 1/4W	1	R1
20K $\frac{3}{4}$ 5% 1/4W	3	R7, R8, R9
47K $\frac{3}{4}$ 5% 1/4W	1	R2
100K $\frac{3}{4}$ 5% 1/4W	1	R6
4.7K $\frac{3}{4}$ 8-pin sip	1	RN1
4.7K $\frac{3}{4}$ 10-pin sip	1	RN2
100K $\frac{3}{4}$ 3/8" pot	1	R3
<b>Diodes</b>		
1N4002	2	D1, D2
ICTE-15/MPTE-15	1	D3
<b>Capacitors</b>		
10pF ceramic NPO	1	C6
18pF ceramic NPO	1	C2
120pF ceramic NPO	1	C11
.0047 $\mu$ F film	1	C9
.039 $\mu$ F film	1	C10
.1 $\mu$ F MLC	9	C3, C4, C5, C13, C14, C15, C16, C17, C18
.47 $\mu$ F film	1	C8
1 $\mu$ F tantalum	1	C1
10 $\mu$ F tantalum	5	C7, C12, C19, C20, C24
22 $\mu$ F electrolytic	3	C21, C22, C23
<b>Transistors</b>		
2N3904	1	Q1
<b>Integrated Circuits</b>		
27C512 standard vocabulary	1	U5
27C512 expansion vocab	1	U6
74HC138	1	U4
74HC374	3	U7, U8, U9
LM7805	1	REG1
LM7906	1	REG2

LMC662/TLC272	1	U3
MC68705P3S	1	U1
Si7661	1	U10
TSP5220C	1	U2
<b>Crystals</b>		
3.579545MHz	1	Y1
<b>Connectors</b>		
16-pin (dual 8) header	1	P1
ribbon cable assembly	1	
8-pin IC socket	2	for U3, U10
16-pin IC socket	1	for U4
20-pin IC socket	3	for U7, U8, U9
28-pin IC socket	4	for U1, U2, U5, U6
<b>Hardware</b>		
PC board	1	
heat sink	1	for REG1
6-32 x 1/4" machine screw	2	for REG1, REG2
6-32 hex nut	2	for REG1, REG2

SSM schematic to be provided.

## Telephone Interface Module (TIM)

<b>Parts: Telephone Interface Module (TIM)</b>		
Dated 05-05-89		
Part # or Type	Qty	Location
<b>Resistors</b>		
1.00K $\frac{3}{4}$ 1% 1/4W	2	R31, R50
3.01K $\frac{3}{4}$ 1% 1/4W	1	R49
10.0K $\frac{3}{4}$ 1% 1/4W	6	R2, R3, R8, R10, R15, R21
18.2K $\frac{3}{4}$ 1% 1/4W	1	R18
20.0K $\frac{3}{4}$ 1% 1/4W	5	R5, R9, R40, R46, R47
24.9K $\frac{3}{4}$ 1% 1/4W	1	R22
49.9K $\frac{3}{4}$ 1% 1/4W	4	R4, R37, R42, R48
22 $\frac{3}{4}$ 5% 1/4W	1	R14
22 $\frac{3}{4}$ 5% 1/4W	2	R52, R53
47 $\frac{3}{4}$ 5% 1/4W	2	R1, R17
100 $\frac{3}{4}$ 5% 1/4W	5	R6, R11, R12, R16, R30
620 $\frac{3}{4}$ 5% 1/4W	1	R23
1K $\frac{3}{4}$ 5% 1/4W	8	R28, R32, R35, R38, R43, R51, R55, R56
1.5K $\frac{3}{4}$ 5% 1/4W	1	R29
2.2K $\frac{3}{4}$ 5% 1/4W	1	R54
2.7K $\frac{3}{4}$ 5% 1/4W	1	R26
10K $\frac{3}{4}$ 5% 1/4W	2	R27, R39
20K $\frac{3}{4}$ 5% 1/4W	2	R34, R45
47K $\frac{3}{4}$ 5% 1/4W	8	R7, R13, R19, R24, R33, R36, R41, R44
62K $\frac{3}{4}$ 5% 1/4W	1	R20
240K $\frac{3}{4}$ 5% 1/4W	1	R25
<b>Capacitors</b>		
.001 $\mu$ F film	2	C14, C19
.0047 $\mu$ F film	1	C1
.01 $\mu$ F film	1	C15
.022 $\mu$ F film	1	C4
.1 $\mu$ F film	2	C2, C17
.47 $\mu$ F film	4	C6, C11, C13, C25
.47 $\mu$ F 250V met poly	1	C30
2.2 $\mu$ F tantalum	1	C18
4.7 $\mu$ F tantalum	13	C3, C5, C7, C8, C9, C20, C21, C22, C23, C24, C26, C27, C28
10 $\mu$ F tantalum	2	C10, C16
10 $\mu$ F 50V elect	1	C29
22 $\mu$ F 25V elect	1	C12

<b>Diodes</b>		
1N4002	2	D5, D6
1N4732 4.7V	4	D1, D2, D4, D12
1N4735 6.2V	1	D7
1N914	5	D3, D8, D9, D10, D11
ICTE-15/MPTE-15	1	M1
<b>Transistors</b>		
2N3904	2	Q2, Q3
2N3906	1	Q1
<b>Integrated Circuits</b>		
CD4053	1	U2
CLM6500	2	VR1, VR2
ICM7555	1	U4
LCA110/LH1056	1	U5
LMC660/TLC274	2	U1, U3
TCM1520A	1	U7
TIL181	1	U6
<b>Gas Discharge Tubes</b>		
DSA301LS-270	3	E1, E2, E3
<b>Transformers</b>		
SPT-109	1	T1
<b>Ferrite Beads</b>		
2943666661	2	L1, L2
<b>Connectors</b>		
14-pin (dual 7) header	1	J1
ribbon cable assembly	1	
modular jack 66011-001	1	J2
6-pin IC socket	2	(for U5, U6)
8-pin IC socket	2	(for U4, U7)
14-pin IC socket	2	(for U1, U3)
16-pin IC socket	1	(for U2)
<b>Hardware</b>		
PC board	1	

TIM Schematic to be provided.

TIM Board Layout to be provided.

## Audio Delay Module (ADM)

<b>Parts: Audio Delay Module (ADM)</b>		
Part # or Type	Qty	Location
<b>Resistors</b>		
4.99K $\frac{3}{4}$ 1% 1/4W	1	R30
11.3K $\frac{3}{4}$ 1% 1/4W	1	R13
14.0K $\frac{3}{4}$ 1% 1/4W	1	R14
20.0K $\frac{3}{4}$ 1% 1/4W	8	R3, R4, R5, R7, R8, R9, R10, R11
47 $\frac{3}{4}$ 5% 1/4W	4	R15, R21, R26, R31
100 $\frac{3}{4}$ 5% 1/4W	1	R16
120 $\frac{3}{4}$ 5% 1/4W	1	R32*
2.7K $\frac{3}{4}$ 5% 1/4W	2	R27, R28
10K $\frac{3}{4}$ 5% 1/4W	6	R1, R12, R17, R20, R22, R25
100K $\frac{3}{4}$ 5% 1/4W	4	R2, R6, R18, R23
20K $\frac{3}{4}$ pot	1	R29
100K $\frac{3}{4}$ pot	2	R19, R24
<b>Capacitors</b>		
100pF ceramic NPO	2	C5, C9
.001 $\mu$ F film	2	C11, C24
0039 $\mu$ F film	1	C7
.0047 $\mu$ F film	1	C3
.039 $\mu$ F film	2	C4, C8
.1 $\mu$ F film	4	C16, C18, C20, C22
.47 $\mu$ F film	6	C2, C6, C10, C17, C21, C25*
10 $\mu$ F tantalum	7	C1, C12, C13, C14, C15, C19, C23
<b>Diodes</b>		
1N961B 10V 400mW zener	1	D1*
<b>Integrated Circuits</b>		
7555 CMOS timer	1	U4
LMC660 CMOS op amp	1	U1
RD5108A delay	2	U2, U3
<b>Connectors</b>		
4-pin male header, 1/4"post	1	P1
8-pin IC sockets	2	(for U2 & U3)
ribbon cable assembly	1	
<b>Hardware</b>		
PC board	1	

- Model ADM/U (Universal) utilizes marked components.
- Model ADM/K (*K* series of repeater controllers) omits R32, C25, and D1; R32 and C25 are replaced by wire jumpers

ADM Schematic to be provided.

ADM Board Layout to be provided