S-COM 7330

Three Port Repeater Controller

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Limited Warranty

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

Coverage

Except as specified below, this warranty covers all defects in material and workmanship in this product.

The following are *not* covered by the warranty:

- Damage to, or deterioration of, the external cabinet.
- Damage resulting from lightning, accident, misuse, abuse, or neglect.
- Damage resulting from failure to follow instructions contained in the owner's manual.
- Damage occurring during shipment of the product (claims must be presented to the carrier).
- Damage resulting from repair or attempted repair by anyone other than S-COM, LLC.
- Damage resulting from causes other than product defects, including lack of technical skill, competence, or experience of the user.
- Damage to any unit which has been altered or on which the serial number has been defaced, modified, or removed.

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This warranty may be enforced only by the original purchaser. The warranty is not transferrable.

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For both labor and parts, this warranty will be effective for one (1) year from the date of original purchase.

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We will pay all labor and material expenses for items covered by the warranty. Payment of shipping charges is discussed in the next section of the warranty.

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S-COM, LLC's liability for any defective products is limited to repair or replacement of the product, at S-COM, LLC's option.

S-COM, LLC reserves the right to make any changes in design or additions to, or improvements in, its products without any obligation to install such additions or improvements in equipment previously sold. S-COM, LLC further reserves the right to replace defective parts under warranty with different or improved parts.

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Chapter 1

Product Description

The S-COM 7330 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 7330 provides most-often-needed control functions and powerful new features not found in any comparably priced controller.

- The 7330 is fully remotely programmable via DTMF commands over the receiver ports, and locally programmable over an RS-232 port — eliminating the inconvenience of returning EPROMs, microcontroller ICs, and boards to the factory for reprogramming.
- No jumpers or diodes are used for programming.
- Data is retained in non-volatile memory, ensuring that no information is lost during power outages and eliminating extra trips to the repeater site.

Standard Hardware Features

Configuration
The standard 7330 controller package consists of a main board and an LED display board mounted in a 1U cabinet, a set of mating connectors, and a manual on CD. No options are required to perform the most-often-needed repeater control functions.

Cabinet
The 1U (single-height) cabinet 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 display 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 *7330 Main Board* measures 6″ deep by 16″ wide and operates 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 DTMF decoders, audio switches, tone and stored audio D/As, and audio interface circuits. Seven connectors (four DE9S, one DE9P, one DB25S and one locking 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.

Standard Software Features

Identifier

The software *Identifier* stores remotely-programmable multiple callsigns 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.

Messages and Paging Formats

Most *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 can be adjusted remotely.

The 7330 supports the following paging formats: Single-tone (group call), two-tone sequential, 5/6-tone, SELCAL, 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 7330 are derived from a crystal-controlled clock for improved accuracy over other methods. Most timers are remotely programmable, including: *Courtesy Delay, Dropout Delay,* and *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 and voice readout are available from the main board.

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.

A-to-D Inputs

A-to-D inputs can be programmed to measure and report changes in analog values at the repeater site including battery voltage, temperature, and received signal strength.

Command Language

Commands are given to the 7330 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.

Notes:

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 B-1.

When you first turn on your controller, the repeater will use the default identifier message of "ID" in CW. You will want to change that right away as well as change the identifer interval for your country, set a unique master password, and change the repeater access to include CTCSS if you want that. We'll cover these steps later in this chapter.

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

Initializing the Controller

Each time power is applied to the controller, it will check to see if the *INIT Push-Button* is being pressed. (The *INIT* push-button is located near the power connector 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 **pressed**), or retain the previously-stored information (push-button **not pressed**)

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 are:

- You've lost or forgotten the programming password.
- You want to erase all programming and start over.
- You're downloading a new software upgrade.
- You've replaced the on-board lithium battery.

To initialize the controller, follow these four steps:

- Press and hold down the *INIT* push-button.
- While holding down the *INIT* push-button, press and release the *RESET* push-button.
- Continue holding down the *INIT* push-button for several seconds after releasing the *RESET* push-button.

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. You can program the controller to send a message when a warm start occurs.

Default Condition

After an initialization, the controller's programming is in the *Default Condition*. Default conditions allow the controller to operate the repeater before you've had a chance to customize it with your programming. You can think of an initialization as a simple *pre-programming* of the controller. Most commands have default conditions. They remain in effect until you change them through programming. Default conditions are included in the command descriptions in this manual.

The most important defaults are described in the table below. These are the items that you need to change, or are likely to want to change, when you get started with your new controller.

Parameter	Cold-Start Default	To Set, See Page
Master Password	99	4-2
Identifier Message	"ID" in CW	12-5
Identifier Interval	3 Minutes	12-3
Path Courtesy Message	Various Beeps, 60ms	9-19
Path Timeout Timer	3 minutes	9-8
Enabled Paths	All Receivers to All Transmitters	9-2
Receiver/Path Access Mode	Carrier Access (COR)	9-2
DTMF Access Mode	Carrier Access (COR)	7-7
Dropout Delay	3 Seconds	11-6

Quick-Start Setup

In this section, we'll walk you through setting up the basic configuration so that you can start using the 7330 controller right away.

Set the Master Password
The default Master Password is 99. To change it to 1234, enter this:

```
99 93 1234 *
```

For more information, see the *Assign Master Password* command on page 4-2.

Note: in the examples that follow, the "99" at the beginning of the command is the Master Password. If you changed it to "1234", then replace the "99" with "1234".

Set the Identifier Message
For each transmitter you have connected to your controller, you need to set the *Normal Identifier Message*. To get started, set the message so it will send your callsign in CW. Lookup the 2-digit numbers in the CW character table on page 6-12.

For example, to program the Transmitter #1 *Normal Identifier Message* with WA9FBO as the callsign, the digits are 32, 10, 09, 15, 11, and 24:

```
99 31 0110 9900 32 10 09 15 11 24 *
```

To program the Transmitter #2 *Normal Identifier Message* with WA9FBO as the callsign, the digits are 32, 10, 09, 15, 11, and 24:

```
99 31 0210 9900 32 10 09 15 11 24 *
```

To program the Transmitter #3 *Normal Identifier Message* with WA9FBO as the callsign, the digits are 32, 10, 09, 15, 11, and 24:

```
99 31 0310 9900 32 10 09 15 11 24 *
```

For more information, see the *Select/Review Identifier Messages* command on page 12-5.

Set the Identifier Interval
For each transmitter you have connected to your controller, you need to set the *Identifier Interval* appropriate to meet the laws of your country.

For example, to program the Transmitter #1 *Identifier Message Interval* to 9.5 minutes (570 seconds), enter:

```
99 09 2106 570 *
```

To program the Transmitter #2 *Identifier Message Interval* to 9.5 minutes (570 seconds), enter:

```
99 09 2206 570 *
```

To program the Transmitter #3 *Identifier Message Interval* to 9.5 minutes (570 seconds), enter:

```
99 09 2306 570 *
```

For more information, see the *Select Identifier Message Interval* command on page 12-3.

Set the Path (Receiver) Access Mode

For each receiver you have connected to your controller, you need to set the *Path Access Mode* for each path to each transmitter you have connected to your controller. The most common Modes are *No Access, Carrier Access,* and *COR-AND-CTCSS.*

For this example, let's assume that you have a repeater with a CTCSS decoder on Port #1, an IRLP Node on Port #2, and Port #3 is unused. This is the command we use to disable paths we don't need. Set the *Path Access Mode* for each path as follows:

```
99 57 11 3 *     Rx1-to-Tx1, COR-AND-PL
99 57 21 1 *     Rx2-to-Tx1, Carrier Access
99 57 31 0 *     Rx3-to-Tx1, Off
99 57 12 3 *     Rx1-to-Tx2, COR-AND-PL
99 57 22 0 *     Rx2-to-Tx2, Off
99 57 32 0 *     Rx3-to-Tx2, Off
99 57 13 0 *     Rx1-to-Tx3, Off
99 57 23 0 *     Rx2-to-Tx3, Off
99 57 33 0 *     Rx3-to-Tx3, Off
```

For more information, see the *Select Path Access Mode* command on page 9-2.

Set the DTMF Access Mode

For each receiver you have connected to your controller, you need to set the *DTMF Access Mode* for each path to each DTMF Decoder. The most common Modes are *No Access, Carrier Access,* and *COR-AND-CTCSS.*

For this example, let's again assume that you have a repeater with a CTCSS decoder on Port #1, an IRLP Node on Port #2, and Port #3 is unused. You only want DTMF commands to be decoded on the repeater. Set the *DTMF Access Mode* for each DTMF Decoder as follows:

```
99 57 1 3 *     Rx1-to-DTMF1, COR-AND-CTCSS
99 57 2 0 *     Rx2-to-DTMF2, Off
99 57 3 1 *     Rx3-to-DTMF3, COR
```

For more information, see the *Select Path DTMF Access Mode* command on page 7-7.

Set the Transmitter Dropout Delay (Tail Time)

For each transmitter you have connected to your controller, you need to set an appropriate Dropout Delay. For repeater transmitters, a tail time of 4 or 5 seconds is appropriate. For link transmitters or IRLP Nodes, set the tail to zero.

For this example, let's again assume that you have a repeater on Port #1, an IRLP Node on Port #2, and Port #3 is unused. Set the *DTMF Access Mode* for each DTMF Decoder as follows:

```
99 09 0101 400 *     Tx1
99 09 0201 0 *       Tx2
```

For more information, see the *Select Dropout Delay* command on page 11-6.

Try It Out!

It's time to try out your changes. Key the repeater. Watch the Front Panel to verify that the COR and CTCSS inputs for Port #1 are on and the PTT for Port #1 and #2. When you unkey, the repeater should ID with the callsign you programmed. You'll hear the default Courtesy Message.

Where Do You Go From Here?

There are so many things to do from here! Start simple. Maybe try some messages (see chapter 6, *Messages*) to experiment with the speech library or new Courtesy Messages.

If you need some tips, send us an e-mail, either directly or via the SCOM Yahoo Group. We're here to help!

Chapter 3
Programming Fundamentals

Compared with other controllers, the 7330's innovative port design – and an improved set of programming commands to configure those ports – gives it a higher degree of flexibility.

Port Control

The 7330 is called a three-port controller because it can be interfaced to three pairs of receivers and transmitters. While that by itself isn't unusual, the 7330 goes much further in its ability to control those ports.

Internally, the 7330 handles the three receivers and three transmitters as six individual devices. No receiver is hardwired to any transmitter, thus the 7330 doesn't require you to use certain ports for repeaters and certain other ports for links and remote bases. In fact, there's no advantage or disadvantage in using any port for a given task. Instead, the 7330 lets you remotely choose (and rearrange later) any receiver or any transmitter for any application. You can use the 7330 to control any combination of repeaters, links, crossband repeaters, remote bases, control receivers, and so on.

Furthermore, when multiple receivers feed a transmitter, you can either prioritize or mix each receiver to the transmitter.

Paths

To make 7330 programming easier to understand, we use the word "path" to mean the hardware and software resources inside the controller that connect a receiver to a transmitter (and a receiver to its DTMF decoder). You set up, knock down, and change receiver-transmitter configurations by programming these paths.

Certain features that were formerly associated with a receiver or transmitter are now associated with the path that connects them.

For example, the job of a timeout timer is to shut down the repeater transmitter on excessively long transmissions . In a multiport controller, though, that kind of timeout timer would shut down a transmitter with no regard to which receiver caused the offense. Moving the timeout function to the receiver creates a new problem because a timed-out receiver would not feed any of the transmitters to which it is connected. The 7330 solves the problem by having an individual timeout timer on each path. Not only can the owner choose a different timeout value for each receiver-transmitter combination, but a timed-out link won't disable a repeater (or vice-versa) just because they have a common receiver or transmitter.

Besides timeout timers, with a 7330 you can select access modes, courtesy messages, and some other functions on a path basis as well. Other functions haven't changed. For example, the identifier and the dropout message, usually associated with the transmitter, have stayed that way.

The path numbering system uses one digit if the path is between a receiver and its associated DTMF decoder. Two digits are used if the path is between a receiver and a transmitter, with the first digit being the receiver number and the second being the transmitter number.

Path No.	Connects
1	RX1 to DTMF Dec 1
2	RX2 to DTMF Dec 2
3	RX3 to DTMF Dec 3
11	RX1 to TX1
21	RX2 to TX1
31	RX3 to TX1
12	RX1 to TX2
22	RX2 to TX2
32	RX3 to TX2
13	RX1 to TX3
23	RX2 to TX3
33	RX3 to TX3

Programming

The controller is programmed by sending it *Commands*. A command is a string of characters containing all of the information the controller needs to perform a task. The characters may be in the form of DTMF digits sent to one of the controller's receiver inputs, or serial data sent to its RS-232 programming port.

A standard 12-button DTMF keypad may be used for nearly all commands, with few commands requiring a 16-button keypad. (The fourth column characters, A, B, C, and D, can be used in passwords or macro names to increase the security of the system. See the *Special Keys* section on page 3-7.)

The controller can respond to commands by sending *Acknowledgment Messages (Acknowledgments)* and Error Messages. These responses may be disabled if desired using the *Enable/Disable Command Response Messages* command on page 7-3.

There are two types of commands, *Control Commands* and *Macro Commands*.

Note: Numerous *Programming Tables* appear throughout the manual. A collection of the most often used tables can be found in Appendix A (on page A-1). Additionally, all control commands used in this book appear in the *Command Quick Reference* on page A-40.

Control Command Structure

All control commands follow this format:

(Password) (Root Number) (Data Digits) (Enter)

A control command always begins with a ***Password***, often abbreviated as "(PW)" in this manual.

The controller supports four passwords: Master Password, Control Operator Password, Autopatch Password, and Remote Base Password.

- The default Master Password is 99, the default Autopatch Password is 10, and the default Remote Base Password is 98.
- Any password can be changed at any time.
- Passwords can be 2, 4, or 6 digits long.
- Passwords can consist of any combination of the characters 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, and D.
- The star (*) and pound (#) characters may not be used in passwords.

Note: Choose your passwords early in the programming process. If you create macros containing a default password and then change the password, you'll have to reprogram the macros.

A ***Root Number*** always follows the password.

- The root number selects a task to perform.
- Root numbers cannot be changed.
- Root numbers are either 2 or 4 digits long.
- Root numbers consist of the numerals 0 through 9 only.

Data Digits usually follow the root number.

- Data digits provide additional information needed to perform the task.
- A very simple command may not require any data digits.
- In this manual, letters are often used to indicate the format of data digits. For example, "xx yyy zzzz" means you need to enter two data digits for the first item, three for the second, and four for the third.

An ***Enter*** character (DTMF "*") marks the end of the command and is similar to the "carriage return" on a computer keyboard or the "equals" key on a calculator. Having an Enter character allows the controller to handle commands

of various lengths. The controller stores characters until either it sees an Enter character or it times out. When the controller sees the Enter character, it assumes the command is complete and sends it to a queue for execution.

The DTMF star ("*") is a dedicated Enter character.

There are three additional ways of simulating the Enter character:

- A loss of carrier can serve as an Enter character when entering DTMF commands via a receiver input. (The "Command Execution on End-of-Transmission" feature must be enabled.)
- Allowing the Interdigit Timer to expire can serve as an Enter character when entering DTMF commands. (The "Command Execution on Interdigit Timer" feature must be enabled.) This is a special application of the Interdigit Timer, which is more often used to flush an incomplete command.
- Allowing users to enter only macro names of a fixed number of digits means no Enter character is needed. (The "Command Execution on Digit Count" feature must be enabled). This is a special application because it restricts commands to macros only.

Note that the loss-of-carrier scheme won't work if another carrier holds up the input after you've released the PTT button. The "*" can serve as the Enter character in that case. Further, by using the "*" as the Enter character, you may enter a series of commands without releasing the PTT button. (You do not have to wait for the acknowledgment message before entering the next command.)

Example Control Command

Here's an example of a control command:

```
99 63 0112 0 *
```

Note: We've put the characters into groups to make the examples easier to understand. The spaces between groups do not represent pauses.

- The password in this example is 99, the default Master Password. If this password doesn't match one of the programmed passwords, the command will be ignored.
- The root number is 63. Root 63 controls software switches, but the controller needs to know the switch number and the desired status.
- The next four data digits point to switch 0112.
- The last data digit, 0, tells the controller to turn the switch off.
- The Enter character, *, marks the end of the command.

If we enter this command correctly, the controller will turn the switch OFF and respond with an acknowledgement message. If we make a mistake – by entering "2" instead of "0" for the last data digit, for example – the controller will not change the status of the switch and will send an *Error Message*. If we use an incorrect password or a non-existent root number, the controller will ignore the command and not send a response.

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 7-3.

Special Keys

Two keys, the star (*) and pound (#), have dedicated uses (they're also known as the asterisk and the octothorpe). You cannot use these characters in a password or macro name, and you won't find them in root numbers or data digits.

Enter (*)

As discussed previously, the Enter (*) character is used to end a command.

Clear (#)

If you realize you've made a mistake while entering a command, you can press the Clear (#) key to erase it. The Clear key erases partially-entered commands and has no effect after the Enter character is received.

- You may begin the next command immediately after pressing the Clear (#) key.
- No acknowledgment or error message is sent when you clear a command.

Valid DTMF Timing

DTMF characters must be at least 50 mS in duration and followed by a pause at least 50 mS in duration. That's a best-case transfer of 10 digits per second, assuming the audio is clean (not noisy). To send automatically-generated DTMF from a radio that stores DTMF strings or from a PC sound card or modem, configure your equipment for 50 mS minimum (and preferably longer) tone and pause durations.

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 partial 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 7-16.

If you haven't configured your controller with an Audio Delay, 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 for all digits, but it can be reprogrammed with different value for the first digit and subsequent digits if desired.

Chapter 4
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*. Disabling the *Front Panel Display* prevents display of all LEDs on the front panel except the power LED. The Power LED is always on when power is applied to the controller.

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 TBD.
- Remote base passwords are explained in the *Remote Base Interface* section on page TBD.

Command Form:

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

Acknowledgment: Sends *OK* message

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 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 TBD.
- Remote base passwords are explained in the *Remote Base Interface* section on page TBD.

Command Form:

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

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered

Default Condition: No *Control Operator Password* is assigned

Examples:

Assume 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 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* message

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 4-3.
Root 93 is the *Assign Master Password* command on page 4-2.

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 4-5.)

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* message

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 4-4.)

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 Green Power LED is always on.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Front Panel Display	(PW) 63 0000 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: the Front Panel Display is enabled.

Chapter 5

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 340 macros. If you use, for example, 220 macros for autopatch autodial commands, you will still have 120 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 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 5-9.

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 Within A Macro

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 programmming command in the macro will be executed.

Your controller has the ability to queue up to 40 commands or macros at one time for each DTMF decoder. In addition, up to 40 commands or macros can be queued by Event-Triggered Macros.

Changing The Sequence: If/Then/Else

Macros can adjust their own execution sequence based on the values of timers and counters and the current state of software switches and booleans. (See *If/Then/Else* on page 5-18.) This allows a macro to adapt to the current operation of the repeater.

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 Command Executive associated with that DTMF decoder or serial port that will

require you to delete the offending macros from another input or enter 40 commands on the locked up input – on the 41st command, the buffer is cleared.

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.

Macro Execution: DTMF Entry

Each receiver has its own DTMF decoder. Users can enter commands on all receivers simultaneously. Macro names and commands entered by users are executed by a Command Executive that is dedicated to its DTMF decoder.

You can execute commands and macros in four ways:

- Enter the command or macro 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 7-15).

- Enter the command digits, then wait the Interdigit Time if you have turned ON the *Enable/Disable Command Execution on Interdigit Timer* feature. **Special applications only!**

- Enter only macro names of the correct number of digits if you have turned ON the Enable/Disable Command Execution on 4th Digit feature. **Special applications only!**

Note, difference from the S-COM 7K Controller: The *S-COM 7K Controller* had only a single DTMF decoder and required configuration of its DTMF scan and priority parameters to operate as expected. In the *S-COM 7330 Controller*, DTMF scanning has been eliminated. All receivers have dedicated DTMF decoders.

Macro Execution: Serial Port

Macro names and commands entered on a serial port are executed by a Command Executive that is dedicated to that serial port You can enter commands on the serial port simultaneously with users entering commands via the receivers' DTMF decoders.

You can execute commands and macros by entering the command or macro name followed by the (*). See chapter 8, *Serial Commands*, for more information on using the serial port.

Macro Execution: Event-Triggered Macros

You can instruct the controller to automatically execute macros based on hardware or software state changes. There are many of these *Event-Triggered Macros* described throughout the manual.

Here are some examples of Event-Triggered Macros:

- Execute a macro when the controller restarts after a power failure (Power ON-Triggered Macro).
- Execute a macro when a Logic Input changes from Low to High.
- Execute a macro on a LiTZ DTMF digit (DTMF Long Tone Macros).
- Execute a macro after the repeater hasn't been in use for 5 minutes (Activity Timer/Macro)

Event-Triggered Macros are executed by a Command Executive that is dedicated to Event-Triggered Macros. This way, they won't delay the execution of any macros entered via DTMF by users.

Applications of Macros

If you create a macro that contains the autopatch command (see *Telephone Interface*, chapter TBD), the macro becomes an *Autodial Code*. You can personalize the autodial by having it identify the call with a message. Here's how it's 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 TBD), and perhaps enable the CTCSS Encoder (for remote tape recorders). (See page 13-2.)
- Reverse these commands using the *Select Autopatch Dump-Triggered Macro* command on page TBD.

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, 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 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 handhelds 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.
- Enter the password, the 2-digit root number, the 4-digit macro name, and a complete controller command. Add leading zeros to the macro name, if required.

Command Form:

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

Acknowledgment: Sends *OK* message

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

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

```
(PW) 70 01 *
```

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 01 *
```

If additional commands are to be executed by entering 6A, they can be appended. See the *Append to Macro* command on page 5-9.

Note: The macro name is entered with leading zeroes, since the name chosen is less that 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).
- Enter the password, the 2-digit root number, the 4-digit macro name, and a complete controller command. Add leading zeros to the macro name, if required.

Command Form:

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

Acknowledgment: Sends *OK* message

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 5-7.

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.

Remove Last Command From Macro

Remove the last command from an existing macro.

- Removing the last command from the macro frees up that space in the macro.
- If there's only one command in the macro, the command will not be removed. Use the *Erase Macro* command in this case and recreate the macro.
- Enter the password, the 2-digit root number and the 4-digit macro name. Add leading zeros to the macro name, if required.

Command Form:

Command	Form
Remove Last Command From Macro	(PW) 24 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered
? not found	macro name does not exist in the directory
? last	There is only one command in the macro

Default: None

Examples:
Assume that a macro exists under the macro name `6A`, and that it contains several commands. To remove the last command from the end of this macro, enter:

```
(PW) 24 006A *
```

After the above command is entered, the macro storage area used by the last command is freed and available for another command to be appended to the macro.

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 "star".
- The macro name must be entered using 4 digits.
- If the macro you wish to list has a shorter name, enter leading zeros.
- Enter the password, the 2-digit root number and the 4-digit macro name. Add leading zeros to the macro name, if required.

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 5-7 and 5-9). 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 01 * 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 01 / 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 zero one star one zero six six three six zero zero zero star"

Erase Macro

Erases an existing macro.

- Enter the password, the 2-digit root number and the 4-digit macro name. Add leading zeros to the macro name, if required.
- If you wish to erase all macros, see the *Erase All Macros* command on page 5-15.

Command Form:

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

Acknowledgment: Sends *OK* message

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 5-14.
- Enter the password, the 2-digit root number and the digits "00".

Command Form:

Command	Form
Erase All Macros	(PW) 22 00 *

Acknowledgment: Sends *OK* message

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.
- Enter the password, the 2-digit root number and the 4-digit old macro name and the 4-digit new macro name. Add leading zeros to the macro name, if required.

Command Form:

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

Acknowledgment: Sends *OK* message

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).

If-Then-Else

Causes the controller to test a value to decide what macro to execute next.

- Executes a True Macro if the value is On/Nonzero/True.
- Optionally executes a False Macro if the value is Off/Zero/False.
- Enter password, the 2-digit root number, the 2-digit value type, the 4-digit value number, the 4-digit "true" macro name, and, optionally, the 4-digit "false" macro name.

Command Form:

Command	Form	Data Digit
If-Then-Else	(PW) 76 ww xxxx yyyy [zzzz] *	ww = value type xxxx = value to test yyyy = "True" macro zzzz = "False" macro

Value Types:

Type Number	Type Name	Value To Test	True Condition	False Condition
00	Timers	Timer Number. See timer command and summary table starting on page A-30.	Nonzero	Zero
03	Software Switch	Software Switch Number. See software switch command and summary table starting on page A-35.	Enabled, One, On	Disabled, Zero, Off
04	Boolean	Boolean Number. See summary table starting on page A-38.	One, On	Zero, Off

Acknowledgment: None

Errors:

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

Default Condition: N/A

Examples:

To test the value of the Rx1-Tx1 Timeout Timer (#2100) and execute macro 9045 if the Timer is not zero, enter:

```
(PW) 76 00 2100 9045 *
```

Enable/Disable User Software Switch

Enables or disables the specified User Software Switch.

- User switches have no direct effect on the operation of the controller. They can be tested in the If-Then-Else command to alter the execution of macros depending on whether they are ON or OFF.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable User Software Switch 1	(PW) 63 0190 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 2	(PW) 63 0191 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 3	(PW) 63 0192 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 4	(PW) 63 0193 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 5	(PW) 63 0194 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 6	(PW) 63 0195 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 7	(PW) 63 0196 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 8	(PW) 63 0197 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 9	(PW) 63 0198 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable User Software Switch 10	(PW) 63 0199 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All User Switches are OFF (disabled)

Examples:

Show use with If-Then-Else to implement options shown here…

Use to configure modes.

Cause macros to only be executable from some DTMF Decoders.

To test the value of the Rx1-Tx1 Timeout Timer (#2100) and execute macro 9045 if the Timer is not zero, enter:

```
(PW) 76 00 2100 9045 *
```

More Examples Here!!!:

```
(PW) 76 00 2100 9045 *
```

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 in this command queue.
- Enter 3 digits corresponding to the number of seconds of pause desired.

Command Form:

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

NOT CURRENTLY IMPLEMENTED IN THE BETA!!!

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.

Select Power ON-Triggered Macro

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

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Power ON-Triggered Macro	(PW) 26 0000 (macro name) *

Acknowledgment: Sends *OK* message

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 interuption. 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 0000 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.*

Notes:

Chapter 6

Messages

Each of the 7330's three ports has a very flexible *message system* that allows it to transmit messages independently of the other ports.

Each message system consists of a first-in, first-out *message buffer* (an area of memory that holds queued messages) and a *message handler* (a program that parses the messages and operates the appropriate hardware to transmit them).

Unlike many controllers, you're not limited to a small set of characters and beeps. Any message can contain CW characters, single- and dual-tone beeps, DTMF characters, paging tones, and speech.

You can change the 7330's default values for CW speed, CW frequency, beep duration, beep frequency, audio level, and so on. You can also change these values within messages with *control characters*.

Control Characters

You put *control characters* into a message when you want to send special instructions to the message handler. Control characters are identified by their leading digits (98 or 99), and are used to select the type of message, change the audio level, and so on.

Note: Control characters are <u>only</u> used within messages. Don't confuse control characters with the default password (99) that is used initially to enter commands.

Any message can have one or more control characters. The message handler obeys control characters *as it finds them* in the message. Since it doesn't "look ahead" to see if you will be changing any conditions, the control character(s) must appear ahead of the affected portion of the message.

Control characters and their descriptions are discussed next. You're encouraged to use them in all messages so that the messages are well defined. The message handler will use defaults for certain items if it doesn't find them programmed into the message. For example, if the message type isn't indicated, the controller will send the message in CW.

Message Control Characters

Control Character	Definition	Page
9900	CW characters follow	6-10
9901	CW Primary characters follow	6-10
9902	CW Secondary characters follow	6-10
9903	CW Speed Change characters follow	6-12
9904	CW Frequency Change characters follow	6-12
9905	CW Message Level characters follow	6-11
9910	Beep characters follow	6-18
9911	Beep Primary characters follow	6-18
9912	Beep Secondary characters follow	6-18
9913	Beep Message Level characters follow	6-19
9915	Dual-Tone Beep characters follow	6-28
9916	Dual-Tone Beep Primary characters follow	6-28
9917	Dual-Tone Beep Secondary characters follow	6-28
9918	Dual-Tone Beep Message Level characters follow	6-29
9920	Single-Tone page follows	6-35
9930	Two-Tone Sequential page follows	6-37
9940	5/6-Tone page follows	6-39
9950	DTMF page follows	6-40
9955	SELCAL page follows	6-48
9960	Speech characters follow	6-50
9961	Speech Primary characters follow	6-50
9962	Speech Secondary characters follow	6-50
9963	Speech Message Level characters follow	6-51
9991	Mixed Audio Allowed	6-4
9992	Non-Mixed Audio Only	6-4
9993	Pause characters follow	6-5
9999	Execute the macro that follows	6-6

Control characters 9900 through 9963 tell the message handler what kind of message you want. 9991 and 9992 chooses whether the message should be mixed with receiver audio. 9993 inserts a programmable delay in the message. 9999 synchronizes messages with macros.

Audio Mixing Control Characters

For each message, or portion of a message, you can specify whether the message should be mixed with receiver audio or whether the receiver audio should be muted during the message (non-mixed).

Most users expect CW messages, beeps and perhaps speech messages to be mixed with receiver audio, since sending them non-mixed would mute receiver audio for the duration of the message. However, pages, announcements, and so forth may be sent non-mixed to ensure they are received and decoded properly.

Mixed Audio
The format for mixed audio control characters is as follows:

- Enter 9991.

For example, to play a courtesy beep mixed with receiver audio, enter the following message characters:

```
9991 9910 16
```

Non-Mixed Audio
The format for non-mixed audio control characters is as follows:

- Enter 9992.

For example, to play a DTMF page non-mixed, ie. all receiver audio is muted during the DTMF page, enter the following message characters:

```
9992 9950 01 02 03
```

Defaults
This table shows the default mixing for each message type.

Message Type	Default
CW	Mixed
Beep	Mixed
Dual-Beep	Mixed
Single-Tone Page	Non-Mixed
Two-Tone Page	Non-Mixed
Five-Six Tone Page	Non-Mixed
DTMF Page	Non-Mixed
SELCAL Page	Non-Mixed
Speech Playback	Mixed

Pause Control Characters

Control Character

A configurable delay maybe be inserted before, or during, any message.

Format

The format for a Pause Control Character is as follows:

- Enter 9993xx.
- The two digits shown as "xx" represent the time delay in 100 millisecond (one-tenth second) increments, 00 thru 99.

For example, to insert a 1 second delay into a message, enter the digits `999310.`

Defaults

There are no pauses entered into messages by default.

Synchronizing Messages and Commands

In the controller, the Message Handler processes messages from the Message Buffer. 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 unless you use the message control character to keep everything in synchronization.

Suppose you want to send a DTMF page of "1234", then turn on logic output number 1. You might create a macro like this one:

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

However, this command sequence will not give you the expected results. The first command sends the DTMF page to the message buffer for execution. The second immediately executes the command to turn on the logic output. The logic output will change before the DTMF page is completed.

To force the second command in the macro to wait until after the first command has sent the DTMF page, you create two macros, 9000 and 9001:

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

"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 message control character 9999 must be 4 digits long. Insert leading zeros if needed.

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.

Message Levels

Messages Levels can be set for each of the controller message types, e.g., CW, beep, speech, etc. Default values can be set by controller command (see page 6-8), or can be temporarily customized in each message via Message Level control characters (see the *Message Level* description in each command).

Message Level Values

The two digits in the "level" column of the following table are used in the *Set Default Message Level* command (see page 6-8) and following the *Message Level Control Characters* (above). Each 6 dB of reduction in level reduces the apparent message volume by half. 0 dB represents the fully-deviated level.

Message Levels									
Level	Value dB	Level	Value dB	Level	Value dB	Level	Value dB	Level	Value dB
00	0.0	20	-10.0	40	-20.0	60	-30.0	80	-40.0
01	-0.5	21	-10.5	41	-20.5	61	-30.5	81	-40.5
02	-1.0	22	-11.0	42	-21.0	62	-31.0	82	-41.0
03	-1.5	23	-11.5	43	-21.5	63	-31.5	83	-41.5
04	-2.0	24	-12.0	44	-22.0	64	-32.0	84	-42.0
05	-2.5	25	-12.5	45	-22.5	65	-32.5	85	-42.5
06	-3.0	26	-13.0	46	-23.0	66	-33.0	86	-43.0
07	-3.5	27	-13.5	47	-23.5	67	-33.5	87	-43.5
08	-4.0	28	-14.0	48	-24.0	68	-34.0	88	-44.0
09	-4.5	29	-14.5	49	-24.5	69	-34.5	89	-44.5
10	-5.0	30	-15.0	50	-25.0	70	-35.0	90	-45.0
11	-5.5	31	-15.5	51	-25.5	71	-35.5	91	-45.5
12	-6.0	32	-16.0	52	-26.0	72	-36.0	92	-46.0
13	-6.5	33	-16.5	53	-26.5	73	-36.5	93	-46.5
14	-7.0	34	-17.0	54	-27.0	74	-37.0	94	-47.0
15	-7.5	35	-17.5	55	-27.5	75	-37.5	95	-47.5
16	-8.0	36	-18.0	56	-28.0	76	-38.0	96	-48.0
17	-8.5	37	-18.5	57	-28.5	77	-38.5	97	-48.5
18	-9.0	38	-19.0	58	-29.0	78	-39.0	98	-49.0
19	-9.5	39	-19.5	59	-29.5	79	-39.5		

Set Default Message Level

Selects the default level for each of the controller message types for each port.

- You can set the default level to a specific value (see *Message Levels* table).
- Enter the password, followed by the 2-digit root number, the 4-digit level control number, and the 2-digit level code.
- The level is taken from the table on page 6-7. Do not omit leading zeroes.

Command Form:

Command	Form	Data Digits
Select Default CW Level	(PW) 10 0x00 yy *	
Select Default Beep Level	(PW) 10 0x01 yy *	
Select Default Dual-Tone Beep Level	(PW) 10 0x02 yy *	
Select Default Single-Tone Page Level	(PW) 10 0x03 yy *	x = transmitter (1,2,3)
Select Default Two-Tone Page Level	(PW) 10 0x04 yy *	yy = level (see table)
Select Default Five/Six-Tone Page Level	(PW) 10 0x05 yy *	
Select Default DTMF Page Level	(PW) 10 0x06 yy *	
Select Default SELCAL Page Level	(PW) 10 0x07 yy *	
Select Default Speech Playback Level	(PW) 10 0x08 yy *	

Acknowledgment: Sends *OK* message

Errors:

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

Defaults:

Message Type	Default Level
CW Level	12 (-6dB)
Beep Level	12 (-6dB)
Dual-Beep Level	12 (-6dB)
Single-Tone Page Level	06 (-3dB)
Two-Tone Page Level	06 (-3dB)
Five-Six Tone Page Level	06 (-3dB)
DTMF Page Level	06 (-3dB)
SELCAL Page Level	06 (-3dB)
Speech Playback Level	00 (0dB)

Examples:

To set the default CW level on transmitter #1 to -3 dB, enter:

```
(PW) 10 0100 06 *
```

To set the default Speech Playback level on transmitter #2 to 0 dB (the same level as repeat audio), enter:

```
(PW) 10 0208 00 *
```

CW Messages

Control Character
When creating a CW message, enter the control character 9900 ahead of the CW characters. (If a message does not contain a message type control character, the message will be sent in CW. Therefore, a CW-only message would not require the 9900. However, a message containing mixed types – a series of beeps followed by CW characters, for example – would require the 9900 ahead of the CW portion of the message.)

Format
The format for CW messages is as follows:

- Enter the control character 9900, 9901, or 9902.
- Enter the desired CW character codes from the *CW Characters* table on page 6-13 to create the desired message.
- End the CW message with the (*) character, or enter another control character and continue with another message type.

Primary/Secondary (Interruptable) CW Messages
CW Messages can be defined to be non-interruptable or interruptable.

- A CW Message defined with the control character 9900 is not interruptable.
- A CW Primary Message, defined with a control character of 9901, will cease playback if any path is active to a transmitter associated with the message playback at the time the playback commences, or anytime during the playback.
- A CW Secondary Message, defined with a control character of 9902, will only play in circumstances when a primary message would not. A secondary message is optional. A primary message defined without a secondary message would immediately stop when interrupted – there would be no replacement message played.

For example, this identifier message would speak "WA1JHK Repeater", but if a receiver became active, the message would revert to "WA1JHK" in CW:

```
(PW) 31 0110 9961 0069 0045 0001 0054 0052 0055 0342
9902 32 10 01 19 17 20 *
```

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message.

The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4). The timer starts when the PTT is activated, and when it expires, the *Message Handler* is allowed to proceed. The purpose of the delay is to hold off sending messages until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio. If a transmitter has been keyed beyond the turn-on delay when a message is queued, the message will be sent with no delay (unless the user has programmed one into the message). There are separate *Transmitter Turn-On Delay* commands for each transmitter, so the controller can handle slow or fast transmitters individually.

Message Level

The CW Message Level may be changed before—or during—a CW message. This feature allows you to draw attention to a certain message or a part of a message.

- Enter "9905xx" ahead of the 9900/9901/9902 CW Control Characters.
- The two digits shown as "xx" represent the temporary message level and are taken from the *Message Levels* table on page 6-7.
- The message level may be changed as often as desired.

The temporary message level will stay in effect until either changed by other control codes, or until the CW message ends.

If you wish to change the CW Message Level for all CW messages, see the *Set Default CW Level* command on page 6-8.

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 in a CW message, but the duration of the pause will depend upon the current sending speed of the CW.

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.
- An alternate way to temporarily change the CW pitch is to enter 9904xxxx ahead of the 9900 CW Control Characters.
- The four digits 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 CW message ends. 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 6-15.

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.
- An alternate way to temporarily change the sending speed is to enter 9903 followed by 0x where x is one of the Speed Change Table entries used with the *Select CW Speed* command on page 6-16.
- 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 CW message ends. 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 CW Speed* command on page 6-16.

CW Characters

The CW library contains 55 characters and includes the numerals 0 through 9, the letters A through Z, punctuation, and standard Morse abbreviations.

- Each character is represented by a 2-digit code from 00 to 54.
- Do not omit leading zeroes.

The following table lists the CW characters and their codes.

<table>
<tr><th colspan="7">CW Characters</th></tr>
<tr><td colspan="7">Control Character 9900/9901/9902</td></tr>
<tr><th>Character</th><th>Code</th><th>Character</th><th>Code</th><th>Character</th><th>Symbol</th><th>Code</th></tr>
<tr><td>0</td><td>00</td><td>I</td><td>18</td><td>Period</td><td>.</td><td>36</td></tr>
<tr><td>1</td><td>01</td><td>J</td><td>19</td><td>Comma</td><td>,</td><td>37</td></tr>
<tr><td>2</td><td>02</td><td>K</td><td>20</td><td>Fraction</td><td>/</td><td>38</td></tr>
<tr><td>3</td><td>03</td><td>L</td><td>21</td><td>Question</td><td>?</td><td>39</td></tr>
<tr><td>4</td><td>04</td><td>M</td><td>22</td><td>Word space</td><td></td><td>40</td></tr>
<tr><td>5</td><td>05</td><td>N</td><td>23</td><td>End-of-message</td><td>(AR)</td><td>41</td></tr>
<tr><td>6</td><td>06</td><td>O</td><td>24</td><td>Wait</td><td>(AS)</td><td>42</td></tr>
<tr><td>7</td><td>07</td><td>P</td><td>25</td><td>Break</td><td>(BK)</td><td>43</td></tr>
<tr><td>8</td><td>08</td><td>Q</td><td>26</td><td>Double dash</td><td>(BT)</td><td>44</td></tr>
<tr><td>9</td><td>09</td><td>R</td><td>27</td><td>End-of-work</td><td>(SK)</td><td>45</td></tr>
<tr><td>A</td><td>10</td><td>S</td><td>28</td><td>Hyphen</td><td>-</td><td>46</td></tr>
<tr><td>B</td><td>11</td><td>T</td><td>29</td><td>Colon</td><td>:</td><td>47</td></tr>
<tr><td>C</td><td>12</td><td>U</td><td>30</td><td>Semicolon</td><td>;</td><td>48</td></tr>
<tr><td>D</td><td>13</td><td>V</td><td>31</td><td>Parenthesis</td><td>( )</td><td>49</td></tr>
<tr><td>E</td><td>14</td><td>W</td><td>32</td><td>Apostrophe</td><td>'</td><td>50</td></tr>
<tr><td>F</td><td>15</td><td>X</td><td>33</td><td>Exclamation</td><td>!</td><td>51</td></tr>
<tr><td>G</td><td>16</td><td>Y</td><td>34</td><td>Quotation</td><td>"</td><td>52</td></tr>
<tr><td>H</td><td>17</td><td>Z</td><td>35</td><td>Understood</td><td>(SN)</td><td>53</td></tr>
<tr><td></td><td></td><td></td><td></td><td>At-symbol</td><td>@</td><td>54</td></tr>
</table>

CW Frequency Change and Speed Change Characters

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

CW Frequency Change	
Control Character 9900/9901/9902/9904	
Change	**Code**
Frequency	59xxxx *(xxxx = tone code)*

CW Speed Change	
Control Character 9900/9901/9902/9903	
Change	**Code**
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

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.
- The frequency range is 300 Hz to 3 kHz.
- To select frequencies for the Owner-Fixed Frequency Beeps, see page 6-24. To select the frequency of CTCSS, see page 13-5.

Command Form:

Command	Form	Data Digits
Select Frequency of CW for TX 1	(PW) 06 10 xxxx *	
Select Frequency of CW for TX 2	(PW) 06 20 xxxx *	Tone Code Table
Select Frequency of CW for TX 3	(PW) 06 30 xxxx *	

Acknowledgment: Sends *OK* message

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 xxxx

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

```
(PW) 06 00 xxxx *
```

Select CW Speed

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

- A single digit from 0–9 programs the desired speed.
- See the *CW Speed Table* below.

Command Form:

Command	Form	Data Digit
Select CW Speed for TX 1	(PW) 12 10 x *	
Select CW Speed for TX 2	(PW) 12 20 x *	CW Speed Table
Select CW Speed for TX 3	(PW) 12 30 x *	

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 *CW Speed Table*, above, is based on the number of milliseconds duration of an element of CW (dit = 1 element, 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* message

Errors:

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

Default Condition:

Command	Default Condition
Select CW Speed	20 WPM

Examples:
To change the CW sending speed for transmitter #1 to 17 words per minute, enter:

```
(PW) 12 10 5 *
```

Note: There are two ways to change the speed of a CW message. One way is to use the command shown above; this is usually done upon installation to set the default CW rate for each transmitter. The other method is to insert a CW speed change control 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 tables that follow in this section.
- You may end the beep message with the (*) character, or enter another control character (99xx) and continue with another message type.

Primary/Secondary (Interruptable) Beep Messages

Beep Messages can be defined to be non-interruptable or interruptable.

- A *Beep Message*, defined with the control character 9910, is not interruptable.
- A *Beep Primary Message*, defined with a control character of 9911, will cease playback if any path is active to a transmitter associated with the message playback at the time the playback commences, or anytime during the playback.
- A *Beep Secondary Message*, defined with a control character of 9912, will only play in circumstances when a primary message would not. A secondary message is optional. A primary message defined without a secondary message would immediately stop when interrupted – there would be no replacement message played.

For example, the message following sets the Rx1 courtesy tone on Tx1 as a primary beep message such that any activity on the repeater will cause the courtesy message to be discarded:

```
(PW) 31 0100 9911 76 24 *
```

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 that follow.

Beep Parameters (General)	
Control Character 9910/9911/9912	
Beep Parameter	**Code**
Custom beep	57xxxxyy
Custom beep delay	58xx
Automatic beep gap OFF	55
Automatic beep gap ON	56

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message.

The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4). The timer starts when the PTT is activated, and when it expires, the Message Handler is allowed to proceed. The purpose of the delay is to hold off sending messages until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio. If a transmitter has been keyed beyond the turn-on delay when a message is queued, the message will be sent with no delay (unless the user has programmed one into the message). There are separate *Turn-On Delay* commands for each transmitter, so the controller can handle slow or fast transmitters individually.

Message Level

The Beep Message Level may be changed before—or during—a Beep message. This feature allows you to draw attention to a certain message (or part of a message).

- Enter 9913xx ahead of the 9910/9911/9912 Beep Control Characters.
- The two digits shown as "xx" represent the temporary message level and are taken from the *Message Levels* table on page 6-7.
- The message level may be changed as often as desired.

The temporary message level will stay in effect until either changed by other control codes, or until the Beep message ends.

If you wish to change the Beep Message Level for all Beep messages, see the *Set Default Beep Level* command on page 6-8.

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 range 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 *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 9910/9901/9902								
Freq (Hz)	Note	Beep	Freq (Hz)	Note	Beep	Freq (Hz)	Note	Beep
262	C3	00	659	E4	16	1661	G#5	32
277	C#3	01	698	F4	17	1760	A5	33
294	D3	02	740	F#4	18	1865	A#5	34
311	D#3	03	784	G4	19	1976	B5	35
330	E3	04	831	G#4	20	2093	C6	36
349	F3	05	880	A4	21	2217	C#6	37
370	F#3	06	932	A#4	22	2349	D6	38
392	G3	07	988	B4	23	2489	D#6	39
415	G#3	08	1046	C5	24	2637	E6	40
440	A3	09	1109	C#5	25	2794	F6	41
466	A#3	10	1175	D5	26	2960	F#6	42
494	B3	11	1244	D#5	27	3136	G6	43
523	C4	12	1319	E5	28	3322	G#6	44
554	C#4	13	1397	F5	29	3520	A6	45
587	D4	14	1480	F#5	30	3729	A#6	46
622	D#4	15	1568	G5	31	3951	B6	47

Owner-Fixed Frequency Beeps

To save programming keystrokes, you can define the frequencies of six beeps and use their two-digit codes, 48 through 53, in your beep messages. The default frequencies are shown in the chart below. When you've defined the beeps, write their frequencies in the chart for future reference.

Owner-Fixed Frequency Beeps		
Control Character 9910/9911/9912		
Beep Code	Frequency (Fill In)	Default (Hz)
48		500
49		750
50		1000
51		1250
52		1500
53		1750

To change the frequency of the *Owner-Fixed Frequency Beeps*, use the *Select Frequency of Owner-Fixed Frequency Beeps* command on page 6-24.

Custom Beeps

Custom Beeps allow you to define a beep of any frequency and any duration from 10 ms to 990 ms *on-the-fly.* This flexibility requires 8 characters for each beep.

- Custom beeps are in the form: 57xxxxyy.
- "xxxx" must be four digits and represents the frequency of the beep as found in the *Tone Code Table* on page A-20.
- "yy" must be two digits and represents the duration of the beep in tens of milliseconds.

For example, the custom beep code for a 1275 Hz beep of 70 ms duration would be 57020307.

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 6-23). This parameter reverts to the default at the end of the beep message.

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

Beep Gap Change Characters	
Control Character 9910/9911/9912	
Beep Gap (ms)	**Code**
10	60
20	61
30	62
40	63
60	64
80	65
120	66
160	67
240	68
320	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 it found within the message, or the default if none was found. 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 reverts to the default at the end of the beep message.

The following table shows *Beep Duration Change Characters*:

Beep Duration Change Characters	
Control Character 9910/9911/9912	
Beep Duration (ms)	Code
10	70
20	71
30	72
40	73
60	74
80	75
120	76
160	77
240	78
320	79

Note: Any time a beep duration change is made (including a custom beep), the duration will be remembered by the message handler until the end of the message. When any succeeding beep is encountered, the message handler will use the duration that it remembered from the previous beep duration change. At the end of the beep message, the beep durations reverts to the default.

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 within the message. It defaults to 20ms upon a cold start and can be changed with the *Select Default Beep and Gap Durations* command on page 6-26.

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 = 20ms
- Automatic beep gap = OFF

Select Frequency of Owner-Fixed Frequency Beeps

Changes the frequency (pitch) of the tones.

- 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.
- The frequency range is 300Hz to 3KHz.

Command Form:

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

Acknowledgment: Sends OK

Errors:

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

Default Condition:

Command	Default Freq (Hz)	Tone Code
Select Frequency of Beep 48	500	xxxx
Select Frequency of Beep 49	750	xxxx
Select Frequency of Beep 50	1000	xxxx
Select Frequency of Beep 51	1250	xxxx
Select Frequency of Beep 52	1500	xxxx
Select Frequency of Beep 53	1750	xxxx

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

```
(PW) 06 01 xxxx *
```

Select Default Beep and Gap Durations

Changes the default beep durations and beep gap durations for beeps and dual-tone beeps.

- Enter the password, followed by the 4-digit root number shown, followed by the 1- or 2-digit duration.

Command Form:

Command	Form	Data Digits
Select Default Beep Duration for TX1	(PW) 08 00 xx *	
Select Default Beep Gap Duration for TX1	(PW) 08 01 xx *	
Select Default Beep Duration for TX2	(PW) 08 04 xx *	01-99 = 10 ms-990 ms
Select Default Beep Gap Duration for TX2	(PW) 08 05 xx *	
Select Default Beep Duration for TX3	(PW) 08 08 xx *	
Select Default Beep Gap Duration for TX3	(PW) 08 09 xx *	

Acknowledgment: Sends OK

Errors:

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

Default Condition: Beep Duration is 60ms; Beep Gap Duration is 20ms.

Examples:
For Transmitter 2, let's change the default Beep Duration to 120ms
(12 x 10ms = 120ms) and the default Beep Gap Duration to 40ms
(4 x 10ms = 40ms). The commands are:

```
(PW) 08 04 12 *
(PW) 08 05 4 *
```

Enable/Disable Beep Gap Default

Enables or disables the Beep Gap as the default for all beep and dual-tone beep messages sent to a transmitter.

- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Beep Gap Default for Tx1	(PW) 63 0116 x *	0 = OFF (disabled)
Enable/Disable Beep Gap Default for Tx2	(PW) 63 0216 x *	1 = ON (enabled)
Enable/Disable Beep Gap Default for Tx3	(PW) 63 0316 x *	

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Beep Gap is OFF (disabled)

Dual-Tone Beep Messages

Control Character
The control character 9915 must be entered before the actual dual-tone beep characters when building a dual-tone beep message.

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

Format
The format for dual-tone beep messages is as follows:

- Enter the control character 9915.
- Then enter the various dual-tone beep character codes described in the dual-tone beep character tables that follow in this section to create the desired message.
- You may end the dual-tone beep message with the (*) character, or enter another control character (99xx) and continue with another message type.

Primary/Secondary (Interruptable) Dual-Tone Beep Messages
Dual-Tone Beep Messages can be defined to be non-interruptable or interruptable.

- A *Dual-Tone Beep Message*, defined with the control character 9915, is not interruptable.
- A *Dual-Tone Beep Primary Message*, defined with a control character of 9916, will cease playback if any path is active to a transmitter associated with the message playback at the time the playback commences, or anytime during the playback.
- A *Dual-Tone Beep Secondary Message*, defined with a control character of 9917, will only play in circumstances when a primary message would not. A secondary message is optional. A primary message defined without a secondary message would immediately stop when interrupted – there would be no replacement message played.

For example, the message following sets the Rx1 courtesy tone on Tx1 as a primary dual-tone beep message such that any activity on the repeater will cause the courtesy message to be discarded:

```
(PW) 31 0100 9916 16 21 *
```

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message.

The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4). The timer starts when the PTT is activated, and when it expires, the Message Handler is allowed to proceed. The purpose of the delay is to hold off sending messages until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio. If a transmitter has been keyed beyond the turn-on delay when a message is queued, the message will be sent with no delay (unless the user has programmed one into the message). There are separate *Turn-On Delay* commands for each transmitter, so the controller can handle slow or fast transmitters individually.

Message Level

The Dual-Tone Beep Message Level may be changed before—or during—a Dual-Tone Beep message. This feature allows you to draw attention to a certain message (or part of a message).

- Enter 9918xx ahead of the 9915/9916/9917 Dual-Tone Beep Control Characters.
- The two digits shown as "xx" represent the temporary message level and are taken from the *Message Levels* table on page 6-7.
- The message level may be changed as often as desired.

The temporary message level will stay in effect until either changed by other control codes, or until the Dual-Tone Beep message ends.

If you wish to change the Dual-Tone Beep Message Level for all Dual-Tone Beep messages, see the *Set Default Dual-Tone Beep Level* command on page 6-8.

Dual-Tone Beep Parameters

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

Dual-Tone Beep Parameters	
Control Character 9915/9916/9917	
Beep Parameter	**Code**
custom dual-tone beep	57xxxxyyyyzz
custom beep delay	58xx
automatic beep gap OFF	55
automatic beep gap ON	56

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 range 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 *Fixed Frequency Beeps*:

Factory-Fixed Frequency Beeps								
Control Character 9910/9901/9902								
Freq (Hz)	**Note**	**Beep**	**Freq (Hz)**	**Note**	**Beep**	**Freq (Hz)**	**Note**	**Beep**
262	C3	00	659	E4	16	1661	G#5	32
277	C#3	01	698	F4	17	1760	A5	33
294	D3	02	740	F#4	18	1865	A#5	34
311	D#3	03	784	G4	19	1976	B5	35
330	E3	04	831	G#4	20	2093	C6	36
349	F3	05	880	A4	21	2217	C#6	37
370	F#3	06	932	A#4	22	2349	D6	38
392	G3	07	988	B4	23	2489	D#6	39
415	G#3	08	1046	C5	24	2637	E6	40
440	A3	09	1109	C#5	25	2794	F6	41
466	A#3	10	1175	D5	26	2960	F#6	42
494	B3	11	1244	D#5	27	3136	G6	43
523	C4	12	1319	E5	28	3322	G#6	44
554	C#4	13	1397	F5	29	3520	A6	45
587	D4	14	1480	F#5	30	3729	A#6	46
622	D#4	15	1568	G5	31	3951	B6	47

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.

The *Factory Fixed-Frequency Beeps* must be entered in pairs to define the pair of tones generated simultaneously. For example, to generate the dual-tone beep pair of 350Hz and 440Hz for the default duration, enter the command:

```
99 15 9915 05 09 *
```

Custom Dual-Tone Beeps

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

- A 12-digit character, 57xxxxyyyyzz, defines the dual-tone beep.
- The four digits following the 57, shown as xxxx, represent the frequency of the higher tone and are taken from the *Tone Code Table* on page A-20.
- The four digits following the xxxx, shown as yyyy, represent the frequency of the lower tone and are taken from the *Tone Code Table* on page A-20.
- The next two digits, shown as zz, represent the duration in tens of milliseconds.

Dual-tone beeps allow you to create a unique message with any frequency and any duration to 990ms. As an example, let's define a dual-tone beep of 350Hz and 440Hz for 70ms. The custom beep code would be 57xxxxyyyy07.

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.

Dual-Tone Beep Gap Change Characters

Dual-Tone 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. Dual-tone 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 6-33). This parameter reverts to the default at the end of the beep message.

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

<table>
<tr><td colspan="2">Dual-Tone Beep Gap Change Characters</td></tr>
<tr><td colspan="2">Control Character 9915/9916/9917</td></tr>
<tr><td>Beep Gap (ms)</td><td>Code</td></tr>
<tr><td>10</td><td>60</td></tr>
<tr><td>20</td><td>61</td></tr>
<tr><td>30</td><td>62</td></tr>
<tr><td>40</td><td>63</td></tr>
<tr><td>60</td><td>64</td></tr>
<tr><td>80</td><td>65</td></tr>
<tr><td>120</td><td>66</td></tr>
<tr><td>160</td><td>67</td></tr>
<tr><td>240</td><td>68</td></tr>
<tr><td>320</td><td>69</td></tr>
</table>

Note: Any time a dual-tone 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 dual-tone beep gap change character it found within the message, or the default if none was found. This is also true of the custom dual-tone beep delay character.

Dual-Tone Beep Duration Change Characters

Dual-Tone Beep Duration Change characters are used to set the duration of the dual-tone beep characters that follow. Ten (10) dual-tone beep duration change characters have been defined from 10ms to 320ms using the codes 70–79. The dual-tone beep duration may be changed as often as desired within a dual-tone beep message (even between each pair of beeps). This parameter reverts to the default at the end of the dual-tone beep message.

The following table shows *Dual-Tone Beep Duration Change Characters*:

Dual-Tone Beep Duration Change Characters	
Control Character 9915/9916/9917	
Beep Duration (ms)	**Code**
10	70
20	71
30	72
40	73
60	74
80	75
120	76
160	77
240	78
320m	79

Note: Any time a dual-tone beep duration change is made (including a custom dual-tone beep), the duration will be remembered by the message handler until the end of the message. When any succeeding dual-tone beep is encountered, the message handler will use the duration that it remembered from the previous dual-tone beep duration change. At the end of the dual-tone beep message, the dual-tone beep durations revert to the default.

Automatic Beep Gap ON Character

The *Automatic Beep Gap ON Character*, 56, causes the message handler to place a gap between each pair of beeps. The duration of the gap depends on that last gap that was encountered within the message. It defaults to 20ms upon a cold start and can be changed with the *Select Default Beep and Gap Durations* command on page 6-26.

Automatic Beep Gap OFF Character

The *Automatic Beep Gap OFF Character*, 55, causes the message handler to send the pairs of 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 = 20ms
- 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.

Pre-Message Delays
The *7330* has two methods of creating a pre-message delay.

In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message.

The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4). The timer starts when the PTT is activated, and when it expires, the Message Handler is allowed to proceed. The purpose of the delay is to hold off sending messages until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio. If a transmitter has been keyed beyond the turn-on delay when a message is queued, the message will be sent with no delay (unless the user has programmed one into the message).

Inter-Page Delays
An *Inter-Page Delay* is created by the message handler for all tone pages. This delay is inserted immediately after each tone page. This delay defaults to 1.0 second but you may change it with the *Select Inter-Page Delay* command (see page 6-36).

Message Level
If you wish to change the Single Tone Page Message Level for all Single Tone Page messages, see the *Set Default Single Tone Page Level* command on page 6-8. There are no characters to temporarily change the level.

Select Inter-Page Delay

Programs the minimum amount of quiet time after a tone page.

- The *Inter-Page Delay* is the minimum amount of time inserted after a tone page before the *Message Handler* generates any other message.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select TX1 Inter-Page Delay	(PW) 09 0114 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select TX2 Inter-Page Delay	(PW) 09 0214 xxxxx *	
Select TX3 Inter-Page Delay	(PW) 09 0314 xxxxx *	

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	invalid timer or seconds parameter

Default Condition: *Inter-Page Delay* is 1.00 second.

Example:

To set the Transmitter 1 Inter-Page Delay to 2.00 seconds, enter the command:

    (PW) 09 0114 200 *

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 9930xxxx10xxxx30.

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message.

The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4). The timer starts when the PTT is activated, and when it expires, the Message Handler is allowed to proceed. The purpose of the delay is to hold off sending messages until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio. If a transmitter has been keyed beyond the turn-on delay when a message is queued, the message will be sent with no delay (unless the user has programmed one into the message).

Inter-Page Delays

An *Inter-Page Delay* is created by the message handler for all tone pages. This delay is inserted immediately after each tone page. This delay defaults to 1.0 second but you may change it with the *Select Inter-Page Delay* command (see page 6-36).

Message Level

If you wish to change the Two-Tone Page Message Level for all Two-Tone Page messages, see the *Set Default Two-Tone Page Level* command on page 6-8. There are no characters to temporarily change the level.

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.

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message. The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4).

Inter-Page Delays

An *Inter-Page Delay* is created by the message handler for all tone pages. This delay is inserted immediately after each tone page. This delay defaults to 1.0 second but you may change it with the *Select Inter-Page Delay* command (see page 6-36).

Message Level

If you wish to change the Five/Six-Tone Page Message Level for all Five/Six-Tone Page messages, see the *Set Default Five/Six-Tone Page Level* command on page 6-8. There are no characters to temporarily change the level.

DTMF Page Messages

Control Character
The control character 9950 must 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* below 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.

Pre-Message Delays
The *7330* has two methods of creating a pre-message delay. In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message. The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4) delays the message until the transmitter is at full power and any user's CTCSS decoder has unsquelched his radio.

Inter-Page Delays
An *Inter-Page Delay* is created by the message handler for all tone pages. This delay is inserted immediately after each DTMF page. This delay defaults to 1.0 second but you may change it with the *Select Inter-Page Delay* command (see page 6-36). 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.

Message Level
If you wish to change DTMF Page Message Level for all DTMF Page messages, see the *Set Default DTMF Page Level* command on page 6-8. There are no characters to temporarily change the level.

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. 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):

DTMF Characters			
Control Character 9950			
DTMF Character	Code	DTMF Character	Code
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 reverts to the default at the end of the DTMF message.

The following table shows *DTMF Duration Change Characters*:

DTMF Duration Change Characters	
Control Character 9950	
DTMF Duration (ms)	Code
30	20
40	21
50	22
60	23
70	24
80	25
90	26
100	27
150	28
200	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 until the end of the DTMF message.

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 until the end of the DTMF message.

The following table shows *DTMF Gap Change Characters*:

DTMF Gap Change Characters	
Control Character 9950	
DTMF Gap (ms)	Code
20	30
30	31
40	32
50	33
60	34
70	35
80	36
90	37
100	38
150	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 until the end of the DTMF message.

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

DTMF Pause Characters	
Control Character 9950	
DTMF Pause (ms)	Code
100	40
200	41
300	42
400	43
500	44
600	45
700	46
800	47
900	48
1000	49

Messages

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 summarizes *DTMF Custom Changes* affecting duration, gap, and pause. It is generally related to preceding sections.

DTMF Custom Changes (Duration Gap Pause)		
Control Character 9950		
DTMF Custom Change	**Code**	**Data Digit**
custom DTMF duration change (10-990 ms)	50xx	01-99 x 10 ms
custom DTMF duration change (100-9900 ms)	51xx	01-99 x 100 ms
custom DTMF gap change (10-990 ms)	52xx	01-99 x 10 ms
custom DTMF gap change (100-9900 ms)	53xx	01-99 x 100 ms
custom DTMF pause (10-990 ms)	54xx	01-99 x 10 ms
custom DTMF pause (100-9900 ms)	55xx	01-99 x 100 ms
to ignore each custom DTMF change code		enter 00 for xx in any of above codes

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 may begin with a delay if the transmitter was just keyed or if there was another page just before this one. When the page is finished, an *Inter-Page 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 until the end of the message or until changed by another code within the same message. 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 6-45. 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.

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 reverts to the defaults of 100ms duration and 100ms gap at the end of the message.

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 = DTMFcustom 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.

Select Default DTMF Durations

Changes the default DTMF durations and DTMF gap durations.

- Enter the password, followed by the 4-digit root number shown, followed by the 1- or 2-digit duration.

Command Form:

Command	Form	Data Digits
Select Default DTMF Duration for TX1	(PW) 08 02 xx *	
Select Default DTMF Gap Duration for TX1	(PW) 08 03 xx *	
Select Default DTMF Duration for TX2	(PW) 08 06 xx *	01-99 = 10 ms-990 ms
Select Default DTMF Gap Duration for TX2	(PW) 08 07 xx *	
Select Default DTMF Duration for TX3	(PW) 08 10 xx *	
Select Default DTMF Gap Duration for TX3	(PW) 08 11 xx *	

Acknowledgment: Sends OK

Errors:

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

Default Condition: DTMF Duration is 100ms; DTMF Gap Duration is 100ms.

Examples:
For Transmitter 1, let's change the default DTMF Duration to 180ms (18 x 10ms = 180ms) and the default DTMF Gap Duration to 120ms (12 x 10ms = 120ms). The commands are:

```
(PW) 08 02 18 *
(PW) 08 03 12 *
```

SELCAL Page Messages

Control Character

The control character 9955 must be entered before the actual page code when building a *SELCAL 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!) If several SELCAL pages are to be sent, control character 9955 must exist before each SELCAL page code.

Format

SELCAL is a tone paging format of two simultaneous tones, a gap, and another two simultaneous tones.

The format for specifying a SELCAL page message is as follows:

- Enter the control character, 9955.
- The format is 8 digits, wwxxyyzz, where "ww" and "xx" make up the first tone pair and "yy" and "zz" make up the second tone pair, two digits per SELCAL character. Enter the 4 2-digit codes from the table below.
- 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 particular SELCAL page *ARBS* is 995500140115. The *7330* will send the first tone pair for 1.25 seconds, pause 0.2 seconds, then send the second tone pair for 1.0 second.

SELCAL Characters		
Designation	Frequency (Hz)	Digit Code
Red A	312.6	00
Red B	346.7	01
Red C	384.6	02
Red D	426.6	03
Red E	473.2	04
Red F	524.8	05
Red G	582.1	06
Red H	645.7	07
Red J	716.1	08
Red K	794.3	09
Red L	881	10
Red M	977.2	11
Red P	1083.9	12
Red Q	1202.3	13
Red R	1333.5	14
Red S	1479.1	15

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you can insert a "9993 xx" Pause Control Code (see page 6-6) ahead of your message. The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4).

Inter-Page Delays

An *Inter-Page Delay* is created by the message handler for all tone pages. This delay is inserted immediately after each tone page. This delay defaults to 1.0 second but you may change it with the *Select Inter-Page Delay* command (see page 6-36). If desired, a SELCAL page can consist of a SELCAL page message, a pause, another SELCAL page message, and so on. This feature allows you to place a series of SELCAL pages within one message.

Message Level

If you wish to change the SELCAL Page Message Level for all SELCAL Page messages, see the *Set Default SELCAL Page Level* command on page 6-8. There are no characters to temporarily change the level.

Speech Messages

Control Character

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

Format

The format for *Speech Messages* is as follows:

- Enter the control character 9960.
- Enter the various speech word codes described in the *Speech Vocabulary Tables* beginning on page A-14 to create the desired message.
- Each file is represented by a four-digit code. Do not omit leading zeroes.
- You may end the message with the (*) character, or enter another control character (99xx) and continue with another message type.

Primary/Secondary (Interruptable) Speech Messages

Speech messages can be defined to be non-interruptable or interruptable.

- A *Speech Message*, defined with the control character 9960, is not interruptable.
- A *Speech Primary Message*, defined with a control character of 9961, will cease playback if any path is active to a transmitter associated with the message playback at the time the playback commences, or anytime during the playback.
- A *Speech Secondary Message*, defined with a control character of 9962, will only play in circumstances when a primary message would not. A secondary message is optional. A primary message defined without a secondary message would immediately stop when interrupted – there would be no replacement message played.

For example, this identifier message would speak "WA1JHK Repeater", but if a receiver became active, the message would revert to "WA1JHK" in CW:

```
(PW) 31 0110 9961 0069 0045 0001 0054 0052 0055 0342
9902 32 10 01 19 17 20 *
```

Pre-Message Delays

The *7330* has two methods of creating a pre-message delay.

In the first method, you insert a "9993xx" Pause Control Code (see page 6-6) ahead of your message. The second method makes use of a new timer called the *Transmitter Turn-On Delay* (see page 11-4).

Message Level

The speech message playback level may be changed before—or during—a message. This feature allows you to draw attention to a certain message (or part of a message).

- Enter 9963xx ahead of the 9960/9961/9962 Speech Control Characters.
- The two digits shown as "xx" represent the temporary message level and are taken from the *Message Levels* table on page 6-7.
- The level may be changed as often as desired.

The temporary message level will stay in effect until either changed by other control codes, or until the Speech message ends.

If you wish to change the level for all Speech messages, see the *Set Default Speech Playback Level* command on page 6-8.

Speech Vocabulary

Speech messages utilize the *Speech Vocabulary Tables* beginning on page A-14.

Tone Codes

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

Tone Code Table Explained

The *Tone Code Table* was created to simplify your programming efforts by listing frequencies from 260Hz to 3KHz (in various increments), and the appropriate tone code for each frequency. The complete *Tone Code Table* begins on page A-20 and look similar to this:

Tone Code Table											
Freq	**Code**	**Freq**	**Code**	**Freq**	**Code**	**Freq**	**Code**	**Freq**	**Code**	**Freq**	**Code**
260	0000	460	0040	660	0080	860	0120	1060	0160	1260	0200
265	0001	465	0041	665	0081	865	0121	1065	0161	1265	0201
270	0002	470	0042	670	0082	870	0122	1070	0162	1270	0202
275	0003	475	0043	675	0083	875	0123	1075	0163	1275	0203
280	0004	480	0044	680	0084	880	0124	1080	0164	1280	0204
285	0005	485	0045	685	0085	885	0125	1085	0165	1285	0205
290	0006	490	0046	690	0086	890	0126	1090	0166	1290	0206

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

Calculating Tone Codes

A simple formula is defined to access the correct tone code entry in the table:

ADD FORMULA HERE

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.

Message Run-Time Variables		
Run-Time Variable	**Meaning**	**Example**
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, speech	two forty-five
9821	AM/PM, speech	PM
9824	hour & minute, 24-hr format, speech	14 hours, 45 minutes
9825	same as 9824 without "hours" & "minutes"	fourteen forty-five
9826	day of week, speech	Wednesday
9827	cardinal day-of-month, speech	One
9828	ordinal day-of-month, speech	First
9829	month, speech	January
9831	"morning/afternoon/evening", speech	Afternoon
9832	Seconds, speech	Twenty-seven
98XX	Analog Inputs	NOT IN BETA
9896	Call Count, CW	105
9897	Call Count, speech	One zero five
9898	Software Version, CW	300
9899	Software Version, speech	Three point zero zero

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, which is a spoken 12-hour time RTV, 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."
- 9831 switches 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 21, Clock and Calendar.*)

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 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/Review/Play User Messages

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

- *User Messages* can be used in the *Select Initial and Normal ID Tail Messages* command (see page 12-10.)
- 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 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 0015 (message) *
Select User Message #2	(PW) 31 0016 (message) *
Select User Message #3	(PW) 31 0017 (message) *
Select User Message #4	(PW) 31 0018 (message) *
Select User Message #5	(PW) 31 0019 (message) *
Select User Message #6	(PW) 31 0020 (message) *
Select User Message #7	(PW) 31 0021 (message) *
Select User Message #8	(PW) 31 0022 (message) *
Select User Message #9	(PW) 31 0023 (message) *
Select User Message #10	(PW) 31 0024 (message) *
Review/Play User Message #1	(PW) 34 0015 *
Review/Play User Message #2	(PW) 34 0016 *
Review/Play User Message #3	(PW) 34 0017 *
Review/Play User Message #4	(PW) 34 0018 *
Review/Play User Message #5	(PW) 34 0019 *
Review/Play User Message #6	(PW) 34 0020 *
Review/Play User Message #7	(PW) 34 0021 *
Review/Play User Message #8	(PW) 34 0022 *
Review/Play User Message #9	(PW) 34 0023 *
Review/Play User Message #10	(PW) 34 0024 *

Acknowledgment: Sends *OK* message

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 used throughout the controller, 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, at 30 WPM and 1000Hz frequency.

Looking up the *CW Characters Table* beginning on page 6-13, 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 6-18, 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 Change and Speed Change Tables* on page 6-14, we see that the control character is 9900 again. To get 30 WPM we must enter:

```
68
```

To get 1000Hz frequency, we must enter:

```
59xxxx
```

and 1, 2, 3 is:

```
01 02 03
```

Therefore, our complete command to send this message is:

```
(PW) 15 9900101112 9910755661252627282930 99006591000010203*
```

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

Copy Message

Copies the contents of a message from one message number to another.

- Enter the password, followed by the 2-digit root number shown, the 4-digit source message number (yyyy) and the 4-digit destination message number (zzzz).

Command Form:

Command	Form
Copy Message	(PW) 13 yyyy zzzz *

Acknowledgment: Sends *OK* message

Errors:

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

Default: None

Select/Review Warm Reset Message

Selects, changes, or reviews the warm reset message.

- 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 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 0000 (message) *	?RES in CW
Review Warm Reset Message	(PW) 34 0000 *	none

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See default column of table.

Notes:

Chapter 7
DTMF Decoder

The 7330 has a separate, dedicated *DTMF Decoder* for each of the three receivers. For each DTMF decoder, there is a separate, dedicated command queue. Many parameters regarding each decoder are programmable.

DTMF Entry Overview

- Access Modes
- Nth Digit
- Interdigit Timer
- Anti-Falsing Timer
- Mute
- Cover Tones

DTMF Long Tones Overview

Effects of Antikerchunker, COR and CTCSS Filters, on DTMF Decoder

Note that much of the same software that's used in the RX-TX paths is also used in the RX-DTMF decoder paths. While it may seem strange to turn on the antikerchunker in an RX-DTMF path, doing that means the user must hold down the mic PTT switch for a while before entering the first command, which may help to discourage troublemakers.

All the same modes apply for RX-DTMF paths as for RX-TX paths, but there is no timeout timer on RX-DTMF paths.

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 programmable messages which are sent to assist the programmer. Most commands send the *OK* message 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 the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Command Response Messages for RX1	(PW) 63 0100 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Response Messages for RX2	(PW) 63 0200 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Response Messages for RX3	(PW) 63 0300 y *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

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 for receiver #1, enter:

```
(PW) 63 0100 0 *
```

To turn them back ON, enter:

```
(PW) 63 0100 1 *
```

Enable/Disable OK Command Response Messages

Turns ON or OFF the OK command responses returned to the programmer.

- *Command Response Messages* are the programmable messages which are sent to assist the programmer. Most commands send the *OK* message when properly entered, although some send back the actual message that was entered.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).
- Will not be sent if *Command Responses Software Switch* is disabled.

Command Form:

Command	Form	Data Digit
Enable/Disable OK Command Response Messages for RX1	(PW) 63 0101 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable OK Command Response Messages for RX2	(PW) 63 0201 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable OK Command Response Messages for RX3	(PW) 63 0301 y *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: OK Command Response Messages are ON (enabled)

Examples:
When commands are placed into macros, OK command response messages may be undesirable. To turn them OFF for receiver #1, enter:

```
(PW) 63 0101 0 *
```

To turn them back ON, enter:

```
(PW) 63 0101 1 *
```

Enable/Disable Error Command Response Messages

Turns ON or OFF the Error command responses returned to the programmer.

- *Command Response Messages* are the programmable messages which are sent to assist the programmer. Most commands send the *Error* message to indicate bad data or incorrect number of keystrokes.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).
- Will not be sent if *Command Responses Software Switch* is disabled.

Command Form:

Command	Form	Data Digit
Enable/Disable OK Command Response Messages for RX1	(PW) 63 0102 y *	y = 0 = OFF (disabled) or 1 = ON (enabled)
Enable/Disable OK Command Response Messages for RX2	(PW) 63 0202 y *	y = 0 = OFF (disabled) or 1 = ON (enabled)
Enable/Disable OK Command Response Messages for RX3	(PW) 63 0302 y *	y = 0 = OFF (disabled) or 1 = ON (enabled)

Acknowledgment: Sends *Error* message

Errors:

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

Default Condition: Error Command Response Messages are ON (enabled)

Examples:
When commands are placed into macros, Error command response messages may be undesirable. To turn them OFF for receiver #1, enter:

```
(PW) 63 0102 0 *
```

To turn them back ON, enter:

```
(PW) 63 0102 1 *
```

Select/Review Programmable Command Response Messages

Changes or reviews the command response messages sent by the controller.

• To change a message: enter the password, the 2-digit root number and 4-digit message 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 speech words, and so on.
• To delete a message, enter the password, the 2-digit root number, the 4-digit message number, and the (*) (do not enter any message).
• To review a message: enter the password, the 2-digit root number, and the 4-digit message number shown.

Command Form:

Command	Form	Default
Select OK Command Response Message	(PW) 31 0001 (message) *	OK in CW
Select Error 1 Command Response Message	(PW) 31 0002 (message) *	?ERR1 in CW
Select Error 2 Command Response Message	(PW) 31 0003 (message) *	?ERR2 in CW
Review OK Command Response Message	(PW) 34 0001 *	
Review Error 1 Command Response Message	(PW) 34 0002 *	
Review Error 1 Command Response Message	(PW) 34 0003 *	

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See default column of table.

Select DTMF Decoder Access Mode

Selects one of seven possible Access Modes for each Receiver to DTMF Decoder Path.

• Enter the password, the 2-digit root number, the 1-digit receiver number, and 1 digit, 0 through 6, from the table below.

Command Form:

Command	Form	Data Digit
Select Access Mode for Rx1-to-DTMF Decoder #1	(PW) 57 1 x *	DTMF Decoder Access Mode Table (below)
Select Access Mode for Rx2-to-DTMF Decoder #2	(PW) 57 2 x *	DTMF Decoder Access Mode Table (below)
Select Access Mode for Rx3-to-DTMF Decoder #3	(PW) 57 3 x *	DTMF Decoder Access Mode Table (below)

Mode	DTMF Access Mode	Explanation
0	No Access	Activity on the COR and CTCSS inputs is ignored.
1	Carrier Access	Activity on the COR input will allow access to the DTMF decoder. Activity on the CTCSS input is ignored.
2	CTCSS Access	Activity on the CTCSS input will allow access to the DTMF decoder. Activity on the COR input is ignored.
3	Carrier-And-CTCSS Access	Activity on both the COR and CTCSS inputs simultaneously will allow access to the DTMF decoder.
4	Carrier-Or-CTCSS Access	Activity on either the COR or CTCSS inputs will allow access to the DTMF decoder.
5	Anti-CTCSS Access	Activity on the COR input simultaneously with no activity on the CTCSS input will allow access to the DTMF decoder.
6	Always On	Access is always allowed to the DTMF decoder.

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Access Mode 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 serial port!

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 2 0 *
```

Assume that the DTMF decoder for Receiver 1 is in Mode 1 (Carrier Access), and that Mode 2 (CTCSS Access) is desired. Enter the following command to change the mode on Receiver 1:

```
(PW) 57 1 2 *
```

A better mode for many repeater installations is Mode 3 (Carrier-And-CTCSS Access). This mode has better rejection of adjacent-channel interference than Mode 2 (CTCSS Access), since noise falsing from unsquelched audio is eliminated. Enter the following command to change the mode on Receiver 1:

```
(PW) 57 1 3 *
```

Mode 4 (Carrier-Or-CTCSS Access) allows both Carrier Access and CTCSS Access operation.   Since CTCSS is more easily detected, CTCSS users will find increased range. Carrier Access users are unaffected. The squelch may be tightened to suppress band opening problems.

Mode 5 (Anti-CTCSS Access) is used when the repeater is on the same channel with a CTCSS-accessed repeater. Users of the second system are kept out of the Anti-CTCSS system.

Mode 6 (Always On) is used when a receiver without a COR input, eg. a scanner, is used for repeater control. Enter the following command to change the mode on Receiver 3:

```
(PW) 57 3 6 *
```

Select DTMF Decoder Anti-Falsing Timer

Programs the minimum amount of time a DTMF digit must be decoded before the controller will accept the DTMF digit.

• Reduces DTMF "falsing", since the DTMF decoder requires a digit to be decoded for a longer period of time than the minimum hardware default time.
• Set timer to zero use the hardware default decode time of ~40 msec.
• Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Enable/Disable DTMF Decoder Anti-Falsing Timer for RX1	(PW) 09 0108 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Enable/Disable DTMF Decoder Anti-Falsing Timer for RX2	(PW) 09 0208 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Enable/Disable DTMF Decoder Anti-Falsing Timer for RX3	(PW) 09 0308 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Anti-Falsing Timer defaults to 0.00 seconds for all receivers.

Examples:
If the timer is set to zero, the controller will wait for the 40 msec hardware timer to expire before accepting the digit.

If the is set to a nonzero value, the DTMF digit is validated for the programmed time plus the default hardware time of 40 msec.

To set the Anti-Falsing Timer to 0.20 seconds for Receiver #2:

```
(PW) 09 0208 20 *
```

This causes the controller to wait 0.24 seconds (240 msec) to validate the DTMF digit.

Enable/Disable DTMF Decoder Disconnect Timer

Allows controller to "disconnect" the DTMF decoder from a receiver if it appears no DTMF command will be entered during a transmission.

- Reduces DTMF "falsing", since the DTMF decoder only listens during the beginning of the transmission.
- Entry of each DTMF digit restarts the timer for an additional *n* seconds.
- The timer is programmable; see *Select DTMF Decoder Disconnect Timer* on page 7-11.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable DTMF Decoder Disconnect Timer for RX1	(PW) 63 0105 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable DTMF Decoder Disconnect Timer for RX2	(PW) 63 0205 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable DTMF Decoder Disconnect Timer for RX3	(PW) 63 0305 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Disconnect 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 user transmission.

If this feature is enabled, the receiver will feed the DTMF decoder for the first *n* seconds of the transmission. If a user wishes to enter a command and has already transmitted more than *n* 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 an additional *n* seconds.

Select DTMF Decoder Disconnect Timer

Programs the maximum amount of time the controller will accept a DTMF digit before "disconnecting" the DTMF decoder from a receiver.

- Reduces DTMF "falsing", since the DTMF decoder only listens during the beginning of the transmission.
- Entry of each DTMF digit restarts the timer for an additional n seconds.
- The timer must be enabled; see *Enable/Disable DTMF Decoder Disconnect Timer* on page 7-10.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Enable/Disable DTMF Decoder Disconnect Timer for RX1	(PW) 09 0107 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Enable/Disable DTMF Decoder Disconnect Timer for RX2	(PW) 09 0207 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Enable/Disable DTMF Decoder Disconnect Timer for RX3	(PW) 09 0307 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Disconnect Timer defaults to 5.00 seconds for all receivers.

Examples:

If this feature is disabled, the receiver will feed the DTMF decoder for the duration of the user transmission.

If this feature is enabled, the receiver will feed the DTMF decoder for the first n seconds of the transmission. If a user wishes to enter a command and has already transmitted more than n 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 an additional n seconds.

Enable/Disable Command Execution
on Interdigit Timer

Selects whether DTMF Decoder Interdigit Timer serves to cancel a
partial command or execute a command without requiring the
Enter (*) character.

- 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 password, 2-digit root number, 4-digit software switch number, and
  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 0104 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Execution on Interdigit Timer for RX2	(PW)•63 0204 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Command Execution on Interdigit Timer for RX3	(PW) 63 0304 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

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 Decoder 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.

Select DTMF Decoder Interdigit Timer

Programs the maximum amount of time allowed between DTMF digits received by the controller for each receiver.

- If a delay occurs that is greater than the value specified in the command, the command buffer in the controller will be cleared.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 3 digits in the range 20 to 990 (0.20 to 9.90 seconds).

Command Form:

Command	Form	Data Digit
Select DTMF Decoder Interdigit Timer for RX1	(PW) 09 0104 xxx *	xxx = (20-990) = (0.20-9.90) seconds
Select DTMF Decoder Interdigit Timer for RX2	(PW) 09 0204 xxx *	xxx = (20-990) = (0.20-9.90) seconds
Select DTMF Decoder Interdigit Timer for RX3	(PW) 09 0304 xxx *	xxx = (20-990) = (0.20-9.90) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Interdigit Time is 5.00 seconds

Enable/Disable Execute Command on 4th Digit

Turns ON or OFF the option to execute a command on the 4th digit.

- When enabled, an Enter character (*) is not required.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable RX1 Execute Command on 4th Digit	(PW) 63 0107 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2 Execute Command on 4th Digit	(PW) 63 0207 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3 Execute Command on 4th Digit	(PW) 63 0307 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: OFF (disabled)

Warning: If you enable this option, you will must have a macro to turn it off if you don't have another receiver or serial port access to turn it off.

Examples:
A customer may wish to operate a DTMF decoder under very simple (or highly-restricted) conditions such that only four-digit commands (macros) are accepted and no "*" character is needed. To do this, you can instruct a DTMF decoder to execute commands upon receiving the fourth digit.

Enable/Disable End-of-Transmission Command Execution

Allows commands to be executed by ending the transmission (releasing user PTT). This is in addition to the usual (*) character.

- The Enter (*) character will execute 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 the password, the 2-digit root number, the 4-digit software switch number, and 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 0103 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable End-of-Transmission Command Execution for RX2	(PW) 63 0203 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable End-of-Transmission Command Execution for RX3	(PW) 63 0303 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

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; Enter (*) character required for all commands

Examples:

Whether or not this feature is enabled, the Enter (*) character will always queue a command for execution. 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.

Enable/Disable DTMF Decoder Mute

Turns ON or OFF DTMF muting on any path between any receiver and transmitter pair.

• Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable RX1-TX1 DTMF Mute	(PW) 63 0151 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2-TX1 DTMF Mute	(PW) 63 0152 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3-TX1 DTMF Mute	(PW) 63 0153 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX1-TX2 DTMF Mute	(PW) 63 0251 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2-TX2 DTMF Mute	(PW) 63 0252 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3-TX2 DTMF Mute	(PW) 63 0253 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX1-TX3 DTMF Mute	(PW) 63 0351 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX2-TX3 DTMF Mute	(PW) 63 0352 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable RX3-TX3 DTMF Mute	(PW) 63 0353 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

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 a transmitter, you may turn OFF the muting associated with the desired receiver(s) and transmitter(s).

To turn off muting from Receiver #1 to Transmitter #1, enter the command:

```
(PW) 63 0151 0 *
```

Select DTMF Decoder Mute Hang Time for 1st Digit, "*" or "#"

Sets the amount of muting that occurs after the 1st DTMF digit or "*" or "#" is received by the controller for each receiver.

• Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 3 digits representing the delay duration; 0.00 through 2.00 seconds.

Command Form:

Command	Form	Data Digit
Select DTMF Decoder Mute Hang Time for 1st Digit for RX1	(PW) 09 0105 xxx *	(000–200) = (0.00–2.00) seconds
Select DTMF Decoder Mute Hang Time for 1st Digit for RX2	(PW) 09 0205 xxx *	(000–200) = (0.00–2.00) seconds
Select DTMF Decoder Mute Hang Time for 1st Digit for RX3	(PW) 09 0305 xxx *	(000–200) = (0.00–2.00) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Mute 1st Digit Hang Time is 0.50 seconds

Examples:
When the 1st DTMF digit or "*" or "#" is recognized by the controller, the audio is muted 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 setting the mute hang time. This allows a string of DTMF digits to be entered, with all but the first one fully muted. The *Enable/Disable DTMF Decoder Mute* command (see page 7-16) enables/disables this timer.

• If set to zero, the muting will end when the DTMF digit is released.
• If set to 200, the muting will last 2.00 seconds beyond the release of the DTMF digit.

Since a voice will occasionally trip the DTMF decoder, a long mute hang time may not be desired. The delay on the first digit is usually programmed shorter than the delay for additional digits to minimize this interruption of audio.

Select DTMF Decoder Mute Hang Time for Other Digits

Sets the amount of muting that occurs after other DTMF digits are received by the controller for each receiver.

- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 3 digits representing the delay duration; 0.00 through 2.00 seconds.

Command Form:

Command	Form	Data Digit
Select DTMF Decoder Mute Hang Time for Other Digits for RX1	(PW) 09 0106 xxx *	(000–200) = (0.00–2.00) seconds
Select DTMF Decoder Mute Hang Time for Other Digits for RX2	(PW) 09 0206 xxx *	(000–200) = (0.00–2.00) seconds
Select DTMF Decoder Mute Hang Time for Other Digits for RX3	(PW) 09 0306 xxx *	(000–200) = (0.00–2.00) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Decoder Mute Hang Time for Other Digits is 0.50 seconds

Examples:
When DTMF digits other than the 1st are recognized by the controller, the audio is muted so that the digit is not re-transmitted. A timer started on the 1st digit is restarted with this new value for the purpose of setting the other digit mute hang time. The *Enable DTMF Decoder Mute* command (see page 7-16) enables/disables this timer.

- If set to zero, the muting will end when the DTMF digit is released.
- If set to 200, the muting will last 2.00 seconds beyond the release of the DTMF digit.

To change the mute hang time for other digits to 0.30 seconds for receiver #2, for example, enter the following command:

```
(PW) 09 0206 30 *
```

Enable/Disable DTMF Long Tones

Turns ON or OFF the controller's ability to execute macros based on reception of long DTMF characters.

- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable DTMF Long Tones for RX1	(PW) 63 0106 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable DTMF Long Tones for RX2	(PW) 63 0206 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable DTMF Long Tones for RX3	(PW) 63 0306 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Long Tone feature for all receivers is OFF (disabled).

Examples:
A *Long Tone* is a DTMF digit sent by a user that lasts continuously for the *Long Tone Time* 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 7-22 for information on assigning the appropriate macros to the long DTMF characters.

Select DTMF Long Tone Timer

Sets the time required to recognize a DTMF digit as a Long Tone Digit for each receiver.

- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits representing the delay duration; 0.0 through 6553.5 seconds.

Command Form:

Command	Form	Data Digits
Select DTMF Long Tone Timer for RX1	(PW) 09 1103 xxxxx *	(000–65535) = (0.0–6553.5) seconds
Select DTMF Long Tone Timer for RX2	(PW) 09 1203 xxxxx *	(000–65535) = (0.0–6553.5) seconds
Select DTMF Long Tone Timer for RX3	(PW) 09 1303 xxxxx *	(000–65535) = (0.0–6553.5) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: DTMF Long Tone Timer is 3.0 seconds for all receivers

Examples:
To change the duration of a DTMF digit required to recognize it as a DTMF Long Tone to 7 seconds for Receiver #1:

```
(PW) 09 1103 70 *
```

Select DTMF Long Tone Macros

Assigns a macro to be executed by the Long Tone shown.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the macro name you wish to have executed by the long tone.
- If the macro name has fewer than 4 digits, enter leading zeroes
- If you wish to unassign a previously assigned macro, enter just the password, the root number, the event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to Long Tone Zero for RX1	(PW) 26 0184 (macro name) *
Assign Macro to Long Tone One for RX1	(PW) 26 0185 (macro name) *
Assign Macro to Long Tone Two for RX1	(PW) 26 0186 (macro name) *
Assign Macro to Long Tone Three for RX1	(PW) 26 0187 (macro name) *
Assign Macro to Long Tone Four for RX1	(PW) 26 0188 (macro name) *
Assign Macro to Long Tone Five for RX1	(PW) 26 0189 (macro name) *
Assign Macro to Long Tone Six for RX1	(PW) 26 0190 (macro name) *
Assign Macro to Long Tone Seven for RX1	(PW) 26 0191 (macro name) *
Assign Macro to Long Tone Eight for RX1	(PW) 26 0192 (macro name) *
Assign Macro to Long Tone Nine for RX1	(PW) 26 0193 (macro name) *
Assign Macro to Long Tone A for RX1	(PW) 26 0194 (macro name) *
Assign Macro to Long Tone B for RX1	(PW) 26 0195 (macro name) *
Assign Macro to Long Tone C for RX1	(PW) 26 0196 (macro name) *
Assign Macro to Long Tone D for RX1	(PW) 26 0197 (macro name) *
Assign Macro to Long Tone Star (*) for RX1	(PW) 26 0198 (macro name) *
Assign Macro to Long Tone Pound (#) for RX1	(PW) 26 0199 (macro name) *

Command	Form
Assign Macro to Long Tone Zero for RX2	(PW) 26 0284 (macro name) *
Assign Macro to Long Tone One for RX2	(PW) 26 0285 (macro name) *
Assign Macro to Long Tone Two for RX2	(PW) 26 0286 (macro name) *
Assign Macro to Long Tone Three for RX2	(PW) 26 0287 (macro name) *
Assign Macro to Long Tone Four for RX2	(PW) 26 0288 (macro name) *
Assign Macro to Long Tone Five for RX2	(PW) 26 0289 (macro name) *
Assign Macro to Long Tone Six for RX2	(PW) 26 0290 (macro name) *
Assign Macro to Long Tone Seven for RX2	(PW) 26 0291 (macro name) *
Assign Macro to Long Tone Eight for RX2	(PW) 26 0292 (macro name) *
Assign Macro to Long Tone Nine for RX2	(PW) 26 0293 (macro name) *
Assign Macro to Long Tone A for RX2	(PW) 26 0294 (macro name) *
Assign Macro to Long Tone B for RX2	(PW) 26 0295 (macro name) *
Assign Macro to Long Tone C for RX2	(PW) 26 0296 (macro name) *
Assign Macro to Long Tone D for RX2	(PW) 26 0297 (macro name) *
Assign Macro to Long Tone Star (*) for RX2	(PW) 26 0298 (macro name) *
Assign Macro to Long Tone Pound (#) for RX2	(PW) 26 0299 (macro name) *
Assign Macro to Long Tone Zero for RX3	(PW) 26 0384 (macro name) *
Assign Macro to Long Tone One for RX3	(PW) 26 0385 (macro name) *
Assign Macro to Long Tone Two for RX3	(PW) 26 0386 (macro name) *
Assign Macro to Long Tone Three for RX3	(PW) 26 0387 (macro name) *
Assign Macro to Long Tone Four for RX3	(PW) 26 0388 (macro name) *
Assign Macro to Long Tone Five for RX3	(PW) 26 0389 (macro name) *
Assign Macro to Long Tone Six for RX3	(PW) 26 0390 (macro name) *
Assign Macro to Long Tone Seven for RX3	(PW) 26 0391 (macro name) *
Assign Macro to Long Tone Eight for RX3	(PW) 26 0392 (macro name) *
Assign Macro to Long Tone Nine for RX3	(PW) 26 0393 (macro name) *
Assign Macro to Long Tone A for RX3	(PW) 26 0394 (macro name) *
Assign Macro to Long Tone B for RX3	(PW) 26 0395 (macro name) *
Assign Macro to Long Tone C for RX3	(PW) 26 0396 (macro name) *
Assign Macro to Long Tone D for RX3	(PW) 26 0397 (macro name) *
Assign Macro to Long Tone Star (*) for RX3	(PW) 26 0398 (macro name) *
Assign Macro to Long Tone Pound (#) for RX3	(PW) 26 0399 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macros assigned

Select DTMF Any Long Tone Macro

Assigns a macro to be executed by Any Long Tone for each receiver.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the macro name you wish to have executed when any long tone is decoded.
- If the macro name has fewer than 4 digits, enter leading zeroes
- If you wish to unassign a previously assigned macro, enter just the password, the root number, the event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to Any Long Tone for RX1	(PW) 26 0100 (macro name) *
Assign Macro to Any Long Tone for RX2	(PW) 26 0200 (macro name) *
Assign Macro to Any Long Tone for RX3	(PW) 26 0300 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macro assigned

Select DTMF Decoder Digit-Decoded Macro

Assigns a macro to be triggered when a DTMF digit is first decoded.

- Can be used to implement a DTMF cover tone.
- Macro is executed when the DTMF digit is first decoded, not when the button is released.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select DTMF Digit-Decoded Macro for RX1	(PW) 26 0101 (macro name) *
Select DTMF Digit-Decoded Macro for RX2	(PW) 26 0201 (macro name) *
Select DTMF Digit-Decoded Macro for RX3	(PW) 26 0301 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: None assigned.

Notes:

Chapter 8
Serial (RS-232) Commands

Overview

The *7330 Controller* has two serial ports referred to as RS232-1 and RS232-2. Either port can be configured as the *Console* port, the port that you use to enter commands to the repeater controller and to perform firmware updates. Whichever port is not being used as the *Console* port can be used as the *Auxiliary* port.

The *7330 Controller* accepts commands on the *Console* port. This serial port has a dedicated command queue so that commands can be processed without being delayed by user commands from the DTMF decoders. Commands entered via the serial port have the same format as commands entered via DTMF.

Configuration

By default, a new *7330 Controller* is configured with the *Console* port assigned to RS232-2 and the *Auxiliary* port assigned to RS232-1. The ports default to the following parameters:

Console Port Default

Parameter	Value
Baud Rate	57,600
Data Bits	8
Parity	None
Stop Bits	1

Auxiliary Port Default

Parameter	Value
Baud Rate	9600
Data Bits	8
Parity	None
Stop Bits	1

Changing the Defaults

The *7330 Controller's* SBOOT utility has options for changing the serial port baudrates and port assignments. (See *Controller Command Format*, below, for how to invoke the SBOOT utility.)

On the SBOOT main menu, the following options are available:

```
P  - Set Baudrate of Console Port
N  - Set Baudrate of Auxiliary Port
W  - Set Console Port Number
```

To set the baudrate of the Console port, enter P. The following baudrates are available:

```
Select a Baudrate for Console Port
  Currently set to 57600
    0 - 1200
    1 - 2400
    2 - 4800
    3 - 9600
    4 - 19200
    5 - 38400
    6 - 57600
    Q - Return to Main Menu
    H - Redisplay these options
```

To set the baudrate of the Auxiliary port, enter N. The following baudrates are available:

```
Select a Baudrate for Auxiliary Port
  Currently set to 9600
    0 - 1200
    1 - 2400
    2 - 4800
    3 - 9600
    4 - 19200
    5 - 38400
    6 - 57600
    Q - Return to Main Menu
    H - Redisplay these options
```

To change the serial port assignments, enter W. The following port assignments are available:

```
Select Serial Port Assignments
  Console Port is currently on RS232-2
  Auxiliary Port is currently on RS232-1
    1 - Console Port on RS232-1, Auxiliary Port on RS232-2
    2 - Console Port on RS232-2, Auxiliary Port on RS232-1
    Q - Return to Main Menu
    H - Redisplay these options
```

Cabling

The *7330 Controller* serial port RS232-2 9-pin female connector is wired as a DCE (Data Communication Equipment). Serial port RS232-1 9-pin male connector is wired as a DTE (Data Terminal Equipment). (See page B16, *Installation*, for pinout details.)

When RS232-2 is configured as the *Console,* you can connect the 7330 serial port RS232-2 to a personal computer using a 9-pin serial straight-through cable. Only the TXD, RXD, and ground pins need to be connected:

7330 DE9S	Personal Computer DE9P
Pin 2, TXD	Pin 2, RXD
Pin 3, RXD	Pin 3, TXD
Pin 5, Ground	Pin 5, Ground

When RS232-1 is configured as the *Console,* you can connect the 7330 serial port RS232-1 to a personal computer using a 9-pin serial crossover cable. Only the TXD, RXD, and ground pins need to be connected:

7330 DE9P	Personal Computer DE9P
Pin 3, TXD	Pin 2, RXD
Pin 2, RXD	Pin 3, TXD
Pin 5, Ground	Pin 5, Ground

Terminal Emulator

For Windows, terminal emulators HyperTerm and TTermPro have been tested with the 7330. For other operating systems, choose an appropriate terminal program.

Set the Terminal Emulator parameters as follows:

Parameter	Value
Baud Rate	57,600
Data Bits	8
Parity	None
Stop Bits	1
Delay Per Character	See table
Delay Per Line	50 milliseconds

Select the appropriate *Delay Per Character* value for your baudrate:

Baudrate	Delay Per Character Value
1200	0 milliseconds
2400	0 milliseconds
4800	0 milliseconds
9600	0 milliseconds
19,200	2 milliseconds
38,400	4 milliseconds
57,600	6 milliseconds

Note: If you will be sending commands to the *7330 Controller* from a text file, it's very important to set the *Delay Per Character* value as shown in the table above. If you don't do this, the controller will not properly interpret commands sent to the controller.

Controller Command Format

There are two types of commands supported by the *7330 Controller*. ASCII commands implement functions only available via the serial port. DTMF-compatible commands are available on both the serial port and a radio port via DTMF.

ASCII Commands

The following ASCII commands are implemented in the *7330 Controller.*

Command	Description
VER	Displays the version of the repeater controller firmware.
SBOOT	Stops the repeater controller and begins execution of the SBOOT utility. This utility allows configuration of the serial ports and provides firmware update facilities.

DTMF-Compatible Commands

DTMF-compatible commands are sequences of digits that represent valid instructions for the controller. Each command is entered on one line and ends with Enter (also known as a CR/LF):

```
994501000*(Enter)
```

The asterisk that normally ends a DTMF command is optional for serial commands when no comment follows the command on the same line:

```
994501000(Enter)
```

A command may optionally begin with an exclamation point (!). Accepting an exclamation point makes the command line compatible with the 7KDAB format:

```
!994501000(Enter)
```

To execute a macro, send the macro's name:

```
6500*(Enter)
```

Spaces

Any number of spaces or tabs may be inserted in commands or comments to make them more readable. The spaces and tabs are ignored:

```
99 45 0100 0 *(Enter)
```

Comments

Comments begin with a semicolon (;) and can be placed on a line by themselves:

```
; TX1 Identifier Message Interval(Enter)
```

or at the end of lines containing commands:

```
99 09 2106 570 *     ; 9.5 Minutes/570 seconds(Enter)
```

When a comment is on the same line as the command, the asterisk terminating the command is required.

Entering Commands

Type each command, then press Enter.

The *7330 Controller* sends back a command response text message for each command you enter. For DTMF-compatible commands, the command response is the text version of what you would hear as CW from the controller when you entered a command via a DTMF Decoder:

CW Response	Serial Port Response
OK	OK
? err 1	Error: Wrong number of digits
? err 2	Error: Incorrect digits
? not found	Error: Macro name not found
? dir full	Error: Macro directory full
? too big	Error: Macro exceeds 100 digits
? name used	Error: Macro name already exists
? last	Error: Macro, no last command to delete
	Error: Line too long
	Error: Invalid DTMF character
	Error: Serial input overflow or receive error

Commands and comments can be typed into a text file. This file can be sent to the *7330 Controller* using the Send File feature of your terminal emulator.

If the command you enter causes an audio message to be played, that message is played on *Transmitter #1*.

Chapter 9

Paths

The *7330* controller supports a total of 3 receivers and 3 transmitters. Any receiver may feed any transmitter by turning on or off the 9 possible paths. A path must be enabled in order for an audio signal to be routed from a receiver to a transmitter. Paths are controlled in the *Select Path Access Mode* command on page 9-2. The priority of the audio routed from each receiver to each transmitter can be selected (see page 9-5). If a particular receiver feeding a transmitter has higher priority than another receiver feeding that same transmitter, then the higher priority receiver audio will prevent the audio from the lower priority receiver from being transmitted. On the other hand, if neither receiver audio has priority, then both audio signals will be mixed and then transmitted. There is complete flexibility about mixing and providing receiver priority.

Timeout Timer Operation

Messages Overview

Event-Triggered Macro Overview

Select Path Access Mode

Selects one of 7 possible Access Modes for each receiver-to-transmitter path.

- This command is used to enable and disable paths from receivers to transmitters. To disable a path, set its Mode to *No Access*.
- Enter password, the 2-digit root number, 2-digit path number, and 1 digit mode from the *Path Access Mode* table.

Command Form:

Command	Form	Data Digit
Select Rx1-to-Tx1 Access Mode	(PW) 57 11 x *	Path Access Mode Table (below)
Select Rx2-to-Tx1 Access Mode	(PW) 57 21 x *	Path Access Mode Table (below)
Select Rx3-to-Tx1 Access Mode	(PW) 57 31 x *	Path Access Mode Table (below)
Select Rx1-to-Tx2 Access Mode	(PW) 57 12 x *	Path Access Mode Table (below)
Select Rx2-to-Tx2 Access Mode	(PW) 57 22 x *	Path Access Mode Table (below)
Select Rx3-to-Tx2 Access Mode	(PW) 57 32 x *	Path Access Mode Table (below)
Select Rx1-to-Tx3 Access Mode	(PW) 57 13 x *	Path Access Mode Table (below)
Select Rx2-to-Tx3 Access Mode	(PW) 57 23 x *	Path Access Mode Table (below)
Select Rx3-to-Tx3 Access Mode	(PW) 57 33 x *	Path Access Mode Table (below)

Path Access Modes:

Mode	Access	Explanation
0	No Access/Disabled	Activity on the COR and CTCSS inputs is ignored.
1	Carrier Access (COR)	Activity on the COR input will enable the path. Activity on the CTCSS input is ignored.
2	CTCSS Access	Activity on the CTCSS input will enable the path. Activity on the COR input is ignored.
3	COR-And-CTCSS Access	Activity on both the COR and CTCSS inputs simultaneously will enable the path.
4	COR-Or-CTCSS Access	Activity on either the COR or CTCSS inputs will enable the path.
5	COR–And-Anti-CTCSS Access	Activity on the COR input simultaneously with no activity on the CTCSS input will enable the path.
6	Always Access	Activity on the COR and CTCSS inputs is ignored. The path is always enabled.

Acknowledgment: Sends *OK* message

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 paths 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 21 0 *
```

Assume that the path for Receiver 1 to Transmitter 1 is in Mode 1 (Carrier Access), and that Mode 2 (CTCSS Access) is desired. Enter the following command to change the mode:

```
(PW) 57 11 2 *
```

A better mode for many repeater installations is Mode 3 (And-CTCSS Access). This mode has better rejection of adjacent-channel interference than Mode 2 (CTCSS Access), since noise falsing from unsquelched audio is eliminated. Enter the following command to change the mode on the path from Receiver 1 to Transmitter 1 to Mode 3 (And-CTCSS Access):

```
(PW) 57 11 3 *
```

Mode 4 (Or-CTCSS Access) allows either Carrier Access or CTCSS Access operation.   Since CTCSS is more easily detected, CTCSS users will find increased range. Carrier Access users are unaffected. The squelch may be tightened to suppress band-opening problems.

Mode 5 (Anti-CTCSS) is used when the repeater is on the same channel with a CTCSS-accessed repeater. Users of the second system are kept out of the Anti-CTCSS 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 CTCSS signal, enter the following:

```
(PW) 57 31 6 *
```

To disable this path, enter the following:

```
(PW) 57 31 0 *
```

Select Path Priority

Selects the priority of audio routed from paths to the transmitters.

- For routing to transmitters, audio is only routed when the receiver-to-transmitter path is enabled (see page 9-2).

- Enter the password, the 2-digit root number, the 1-digit transmitter, and none or more receivers in priority order from highest to lowest. If no receivers are specified, all receivers are mixed to the transmitter. Receivers not listed are mixed.

Command Form:

Command	Form	Data Digit
Select Rx-to-Tx1 Audio Routing Priority	(PW) 90 1 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3
Select Rx-to-Tx2 Audio Routing Priority	(PW) 90 2 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3
Select Rx-to-Tx3 Audio Routing Priority	(PW) 90 3 x x x *	1 = Rx1, 2 = Rx2, 3 = Rx3

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All enabled paths are mixed to each transmitter.

Example:

To specify a priority of RX2, RX1, then RX3 to TX1, enter:

```
(PW) 90 1 2 1 3 *
```

To mix all three receivers to TX1, enter:

```
(PW) 90 1 *,
```

where "1" is the transmitter number. Since the receiver numbers are not listed, they will all be mixed.

If RX3 should have priority to TX1, with RX1 and RX2 mixed, enter:

```
(PW) 90 1 3 *.
```

If RX1 should have priority over RX2, and RX2 should have priority over RX3, enter:

```
(PW) 90 1 1 2 3 *.
```

Enable/Disable Path Timeout Timer

Turns ON or OFF the *Timeout Timer* for a path.

- Each path has its own *Timeout Timer*. This allows a receiver to have a timeout to one transmitter, but not to another.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Path Timeout Timer for RX1-to-TX1	(PW) 63 0161 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX2-to-TX1	(PW) 63 0162 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX3-to-TX1	(PW) 63 0163 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX1-to-TX2	(PW) 63 0261 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX2-to-TX2	(PW) 63 0262 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX3-to-TX2	(PW) 63 0263 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX1-to-TX3	(PW) 63 0361 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX2-to-TX3	(PW) 63 0362 y *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Path Timeout Timer for RX3-to-TX3	(PW) 63 0363 y *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All Path Timeout Timers are ON (enabled)

Errors:

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

Default Condition: *Path Timeout Timer* is 3.0 minutes (180 seconds)

How it works:

If a signal exceeds the *Path Timeout Timer* value, the path is turned off and the *Timeout Message* and *Timeout Macro* are queued. When the offending signal finally disappears, a programmable penalty period follows. (The *Penalty Timer* starts over each time the signal reappears during the *Penalty Time*.) When the signal disappears long enough for the *Penalty Timer* to expire, the *End Timeout Message* and *End Timeout Macro* are queued.

Examples:

Some of the ways to program the path timeout timer follow: To change the timeout timer for the path from Receiver #2 to Transmitter #1 from its existing value to 4.5 minutes (270 seconds), enter:

```
(PW) 09 2101 270 *
```

To change the timeout timer for the path from Receiver #1 to Transmitter #1 to 10.0 minutes (600 seconds), enter:

```
(PW) 09 2100 600 *
```

To set the timeout timer for the path from Receiver #1 to Transmitter #3 to infinity (no timeout), enter:

```
(PW) 09 2300 0 *
```

Select Path Timeout Penalty Timer

Controls the amount of time an input carrier signal must be absent before the *Timeout Timer* is reset.

- The *Path Timeout Penalty Timer* starts timing when a path times out. becomes active (user keys), and continues to run until reset.
- The *Penalty Timer* starts over each time the signal reappears during the *Penalty Time*.
- When the signal disappears long enough for the *Penalty Timer* to expire, the *Timeout Timer* is reset and the *End Timeout Message* and *End Timeout Macro* are queued
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits from 0 to 65535 to set the penalty timer to 0 to 6553.5 seconds.

Command Form:

Command	Form	Data Digit
Select Rx1-to-Tx1 Penalty Timer	(PW) 09 1100 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx2-to-Tx1 Penalty Timer	(PW) 09 1101 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx3-to-Tx1 Penalty Timer	(PW) 09 1102 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx1-to-Tx2 Penalty Timer	(PW) 09 1200 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx2-to-Tx2 Penalty Timer	(PW) 09 1201 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx3-to-Tx2 Penalty Timer	(PW) 09 1202 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx1-to-Tx3 Penalty Timer	(PW) 09 1300 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx2-to-Tx3 Penalty Timer	(PW) 09 1301 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds
Select Rx3-to-Tx3 Penalty Timer	(PW) 09 1302 xxxxx *	xxxxx = (0-65535) = (0-6553.5) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: *Path Penalty Timer* is 5.0 seconds

Examples:
To change the penalty timer for the path from Receiver #2 to Transmitter #1 to 5.0 seconds, enter:

```
(PW) 09 1101 50 *
```

Reset Path Timeout Timer

Resets the Path Timeout Timer.

- If the path timeout timer has been exceeded, this command will allow the path to return to the air.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, the digit "1", and "*".

Command Form:

Command	Form	
Reset Path Timeout Timer for RX1-to-TX1	(PW) 63 0171 1 *	
Reset Path Timeout Timer for RX2-to-TX1	(PW) 63 0172 1 *	
Reset Path Timeout Timer for RX3-to-TX1	(PW) 63 0173 1 *	
Reset Path Timeout Timer for RX1-to-TX2	(PW) 63 0271 1 *	
Reset Path Timeout Timer for RX2-to-TX2	(PW) 63 0272 1 *	
Reset Path Timeout Timer for RX3-to-TX2	(PW) 63 0273 1 *	
Reset Path Timeout Timer for RX1-to-TX3	(PW) 63 0371 1 *	
Reset Path Timeout Timer for RX2-to-TX3	(PW) 63 0372 1 *	
Reset Path Timeout Timer for RX3-to-TX3	(PW) 63 0373 1 *	

Acknowledgment: Sends *OK* message

Errors:

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

Default: None

Examples:
If the transmitting station has caused a timeout to occur, the receiving station may be able to bring the path 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 Path Timeout Timer* command will reload the timer as well as return the path to the air.

Select/Review Timeout Messages

Changes or reviews the Timeout messages sent by the controller.

- To change a message: enter the password, the 2-digit root number and 4-digit message 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 speech words, and so on.
- To delete a message, enter the password, the 2-digit root number, the 4-digit message number, and the (*) (do not enter any message).
- To review a message: enter the password, the 2-digit root number, and the 4-digit message number shown.

Command Form:

Command	Form	Default
Select Timeout Message for RX1-to-TX1	(PW) 31 0103 (message) *	TO in CW, 523 Hz
Select Timeout Message for RX2-to-TX1	(PW) 31 0104 (message) *	TO in CW, 659 Hz
Select Timeout Message for RX3-to-TX1	(PW) 31 0105 (message) *	TO in CW, 784 Hz
Select Timeout Message for RX1-to-TX2	(PW) 31 0203 (message) *	TO in CW, 988 Hz
Select Timeout Message for RX2-to-TX2	(PW) 31 0204 (message) *	TO in CW, 1175 Hz
Select Timeout Message for RX3-to-TX2	(PW) 31 0205 (message) *	TO in CW, 1397 Hz
Select Timeout Message for RX1-to-TX3	(PW) 31 0303 (message) *	TO in CW, 1568 Hz
Select Timeout Message for RX2-to-TX3	(PW) 31 0304 (message) *	TO in CW, 1760 Hz
Select Timeout Message for RX3-to-TX3	(PW) 31 0305 (message) *	TO in CW, 1976 Hz
Review Timeout Message for RX1-to-TX1	(PW) 34 0103 *	none
Review Timeout Message for RX2-to-TX1	(PW) 34 0104 *	none
Review Timeout Message for RX3-to-TX1	(PW) 34 0105 *	none
Review Timeout Message for RX1-to-TX2	(PW) 34 0203 *	none
Review Timeout Message for RX2-to-TX2	(PW) 34 0204 *	none
Review Timeout Message for RX3-to-TX2	(PW) 34 0205 *	none
Review Timeout Message for RX1-to-TX3	(PW) 34 0303 *	none
Review Timeout Message for RX2-to-TX3	(PW) 34 0304 *	none
Review Timeout Message for RX3-to-TX3	(PW) 34 0305 *	none

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See table above.

Select/Review Timeout-End Messages

Changes or reviews the Timeout-End messages sent by the
controller.

- To change a message: enter the password, the 2-digit root number and 4-digit message 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 speech words, and so on.
- To delete a message, enter the password, the 2-digit root number, the 4-digit message number, and the (*) (do not enter any message).
- To review a message: enter the password, the 2-digit root number, and the 4-digit message number shown.

Command Form:

Command	Form
Select Timeout-End Message for RX1-to-TX1	(PW) 31 0106 (message) *
Select Timeout-End Message for RX2-to-TX1	(PW) 31 0107 (message) *
Select Timeout-End Message for RX3-to-TX1	(PW) 31 0108 (message) *
Select Timeout-End Message for RX1-to-TX2	(PW) 31 0206 (message) *
Select Timeout-End Message for RX2-to-TX2	(PW) 31 0207 (message) *
Select Timeout-End Message for RX3-to-TX2	(PW) 31 0208 (message) *
Select Timeout-End Message for RX1-to-TX3	(PW) 31 0306 (message) *
Select Timeout-End Message for RX2-to-TX3	(PW) 31 0307 (message) *
Select Timeout-End Message for RX3-to-TX3	(PW) 31 0308 (message) *
Review Timeout-End Message for RX1-to-TX1	(PW) 34 0106 *
Review Timeout-End Message for RX2-to-TX1	(PW) 34 0107 *
Review Timeout-End Message for RX3-to-TX1	(PW) 34 0108 *
Review Timeout-End Message for RX1-to-TX2	(PW) 34 0206 *
Review Timeout-End Message for RX2-to-TX2	(PW) 34 0207 *
Review Timeout-End Message for RX3-to-TX2	(PW) 34 0208 *
Review Timeout-End Message for RX1-to-TX3	(PW) 34 0306 *
Review Timeout-End Message for RX2-to-TX3	(PW) 34 0307 *
Review Timeout-End Message for RX3-to-TX3	(PW) 34 0308 *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Sends TO in CW.

Select Timeout Macro

Assigns a macro to be triggered when a path timeout occurs.

- Macro is executed when the path times out.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Timeout Macro for Path RX1-to-TX1	(PW) 26 0130 (macro name) *
Select Timeout Macro for Path RX2-to-TX1	(PW) 26 0131 (macro name) *
Select Timeout Macro for Path RX3-to-TX1	(PW) 26 0132 (macro name) *
Select Timeout Macro for Path RX1-to-TX2	(PW) 26 0230 (macro name) *
Select Timeout Macro for Path RX2-to-TX2	(PW) 26 0231 (macro name) *
Select Timeout Macro for Path RX3-to-TX2	(PW) 26 0232 (macro name) *
Select Timeout Macro for Path RX1-to-TX3	(PW) 26 0330 (macro name) *
Select Timeout Macro for Path RX2-to-TX3	(PW) 26 0331 (macro name) *
Select Timeout Macro for Path RX3-to-TX3	(PW) 26 0332 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: None assigned.

Select Timeout-End Macro

Assigns a macro to be triggered when the *Timeout Penalty Timer* for a path expires after a timeout.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Timeout-End Macro for Path RX1-to-TX1	(PW) 26 0138 (macro name) *
Select Timeout-End Macro for Path RX2-to-TX1	(PW) 26 0139 (macro name) *
Select Timeout-End Macro for Path RX3-to-TX1	(PW) 26 0140 (macro name) *
Select Timeout-End Macro for Path RX1-to-TX2	(PW) 26 0238 (macro name) *
Select Timeout-End Macro for Path RX2-to-TX2	(PW) 26 0239 (macro name) *
Select Timeout-End Macro for Path RX3-to-TX2	(PW) 26 0240 (macro name) *
Select Timeout-End Macro for Path RX1-to-TX3	(PW) 26 0338 (macro name) *
Select Timeout-End Macro for Path RX2-to-TX3	(PW) 26 0339 (macro name) *
Select Timeout-End Macro for Path RX3-to-TX3	(PW) 26 0340 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: None assigned.

Select/Review Courtesy Messages

Changes or reviews the courtesy messages sent by the controller.

- To change a message: enter the password, the 2-digit root number and 4-digit message 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 speech words, and so on.
- To delete a message, enter the password, the 2-digit root number, the 4-digit message number, and the (*) (do not enter any message).
- To review a message: enter the password, the 2-digit root number, and the 4-digit message number shown.

Command Form:

Command	Form	Default
Select Courtesy Message for RX1-to-TX1	(PW) 31 0100 (message) *	523 Hz, 60 ms
Select Courtesy Message for RX2-to-TX1	(PW) 31 0101 (message) *	659 Hz, 60 ms
Select Courtesy Message for RX3-to-TX1	(PW) 31 0102 (message) *	784 Hz, 60 ms
Select Courtesy Message for RX1-to-TX2	(PW) 31 0200 (message) *	988 Hz, 60 ms
Select Courtesy Message for RX2-to-TX2	(PW) 31 0201 (message) *	1175 Hz, 60 ms
Select Courtesy Message for RX3-to-TX2	(PW) 31 0202 (message) *	1397 Hz, 60 ms
Select Courtesy Message for RX1-to-TX3	(PW) 31 0300 (message) *	1568 Hz, 60 ms
Select Courtesy Message for RX2-to-TX3	(PW) 31 0301 (message) *	1760 Hz, 60 ms
Select Courtesy Message for RX3-to-TX3	(PW) 31 0302 (message) *	1976 Hz, 60 ms
Review Courtesy Message for RX1-to-TX1	(PW) 34 0100 *	
Review Courtesy Message for RX2-to-TX1	(PW) 34 0101 *	
Review Courtesy Message for RX3-to-TX1	(PW) 34 0102 *	
Review Courtesy Message for RX1-to-TX2	(PW) 34 0200 *	
Review Courtesy Message for RX2-to-TX2	(PW) 34 0201 *	
Review Courtesy Message for RX3-to-TX2	(PW) 34 0202 *	
Review Courtesy Message for RX1-to-TX3	(PW) 34 0300 *	
Review Courtesy Message for RX2-to-TX3	(PW) 34 0301 *	
Review Courtesy Message for RX3-to-TX3	(PW) 34 0302 *	

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See default column of table.

Select Courtesy Macros

Assigns a macro to be triggered when the *Courtesy Timer* expires.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Courtesy Macro for Path RX1-to-TX1	(PW) 26 0122 (macro name) *
Select Courtesy Macro for Path RX2-to-TX1	(PW) 26 0123 (macro name) *
Select Courtesy Macro for Path RX3-to-TX1	(PW) 26 0124 (macro name) *
Select Courtesy Macro for Path RX1-to-TX2	(PW) 26 0222 (macro name) *
Select Courtesy Macro for Path RX2-to-TX2	(PW) 26 0223 (macro name) *
Select Courtesy Macro for Path RX3-to-TX2	(PW) 26 0224 (macro name) *
Select Courtesy Macro for Path RX1-to-TX3	(PW) 26 0322 (macro name) *
Select Courtesy Macro for Path RX2-to-TX3	(PW) 26 0323 (macro name) *
Select Courtesy Macro for Path RX3-to-TX3	(PW) 26 0324 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: None assigned.

Select Path End-of-Activity Counter and Timer

Allows the programmer to execute macros based on the long-term activity of a path.

Commands set the *Path End-of-Activity Counter* and *Timer* (both the Event Count and the Duration).

- Select the *Path End-of-Activity Counter (Event Count).* Enter the password, the 2-digit root number, the 4-digit counter number, and the 1 to 5 digit count. Setting the counter to 0 (zero) means that the *End-of-Activity Macro* will execute each activity cycle. Setting the counter to 1 means that the end-of-activity macro will execute every other activity cycle, and so on. Setting the counter to 9, therefore, means that the end-of-activity macro will execute every 10th cycle.
- Select the *Path End-of-Activity Timer (Duration)* by entering the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits representing the delay.

Command Form:

Command	Form	Data Digit
Select Path RX1-to-TX1 End-of-Activity Counter	(PW) 45 0101 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX1-to-TX1 End-of-Activity Timer	(PW) 09 2103 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX2-to-TX1 End-of-Activity Counter	(PW) 45 0102 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX2-to-TX1 End-of-Activity Timer	(PW) 09 2104 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX3-to-TX1 End-of-Activity Counter	(PW) 45 0103 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX3-to-TX1 End-of-Activity Timer	(PW) 09 2105 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX1-to-TX2 End-of-Activity Counter	(PW) 45 0201 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX1-to-TX2 End-of-Activity Timer	(PW) 09 2203 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX2-to-TX2 End-of-Activity Counter	(PW) 45 0202 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX2-to-TX2 End-of-Activity Timer	(PW) 09 2204 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds

Command Form:

Select Path RX3-to-TX2 End-of-Activity Counter	(PW) 45 0203 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX3-to-TX2 End-of-Activity Timer	(PW) 09 2205 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX1-to-TX3 End-of-Activity Counter	(PW) 45 0301 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX1-to-TX3 End-of-Activity Timer	(PW) 09 2303 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX2-to-TX3 End-of-Activity Counter	(PW) 45 0302 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX2-to-TX3 End-of-Activity Timer	(PW) 09 2304 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select Path RX3-to-TX3 End-of-Activity Counter	(PW) 45 0303 xxxxx *	xxxxxx = (event count) = (0–65535)
Select Path RX3-to-TX3 End-of-Activity Timer	(PW) 09 2305 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default: End-of-Activity Counter is 0; Duration is 1.0 minutes (60 seconds)

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 *Select Path End-of-Activity Macros* commands (see page 9-25) allow the programmer to execute macros based on long-term path 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 end-of-activity counter/ timer allows the programmer to select how often to execute the macro.

The *Path 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 end-of-activity counter/timer finally expires, the *Path End-of-Activity Macro* is executed. The end-of-activity counter/timer, which watches the number of activity cycles, is programmable in duration from 0–63353 seconds and from 0–65535 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 end-of-activity macro was actually executed (it may have been waiting for the proper activity count).

Note: The *Path End-of-Activity Counter/Timer* starts when the user unkeys.

Select Path Start-of-Activity and
Path End-of-Activity Macros

Allows the programmer to execute macros based on the long-term activity of the path.

- Macros can be executed based on path activity.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Path RX1-to-TX1 Start-of-Activity Macro	(PW) 26 0146 (macro name) *
Select Path RX1-to-TX1 End-of-Activity Macro	(PW) 26 0154 (macro name) *
Select Path RX2-to-TX1 Start-of-Activity Macro	(PW) 26 0147 (macro name) *
Select Path RX2-to-TX1 End-of-Activity Macro	(PW) 26 0155 (macro name) *
Select Path RX3-to-TX1 Start-of-Activity Macro	(PW) 26 0148 (macro name) *
Select Path RX3-to-TX1 End-of-Activity Macro	(PW) 26 0156 (macro name) *
Select Path RX1-to-TX2 Start-of-Activity Macro	(PW) 26 0246 (macro name) *
Select Path RX1-to-TX2 End-of-Activity Macro	(PW) 26 0254 (macro name) *
Select Path RX2-to-TX2 Start-of-Activity Macro	(PW) 26 0247 (macro name) *
Select Path RX2-to-TX2 End-of-Activity Macro	(PW) 26 0255 (macro name) *
Select Path RX3-to-TX2 Start-of-Activity Macro	(PW) 26 0248 (macro name) *
Select Path RX3-to-TX2 End-of-Activity Macro	(PW) 26 0256 (macro name) *
Select Path RX1-to-TX3 Start-of-Activity Macro	(PW) 26 0346 (macro name) *
Select Path RX1-to-TX3 End-of-Activity Macro	(PW) 26 0354 (macro name) *
Select Path RX2-to-TX3 Start-of-Activity Macro	(PW) 26 0347 (macro name) *
Select Path RX2-to-TX3 End-of-Activity Macro	(PW) 26 0355 (macro name) *
Select Path RX3-to-TX3 Start-of-Activity Macro	(PW) 26 0348 (macro name) *
Select Path RX3-to-TX3 End-of-Activity Macro	(PW) 26 0356 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default: No Macros are assigned

Notes:

Chapter 10

Receiver Commands

The commands in this chapter relate to the three receiver ports.

Each receiver has access to any combination of transmitters, if enabled (see the *Paths* chapter on page 9-1). Each receiver has access to a dedicated DTMF decoder, if enabled (see the *DTMF Decoder* chapter on page 7-1).

Several receiver input filters are described in this section. These include the anti-kerchunker, the COR filter, and the CTCSS filter.

There are two facilities to help test out the receiver functions known as COR simulate and CTCSS simulate.

A Flutter Filter helps to minimize extra Courtesy Beeps and hold the audio gate open when mobile stations are picket-fencing.

The 7330 has an Audio Delay Line to eliminate squelch-closing noise and improves DTMF muting. An Audio Gate Delay allows the squelch-opening noise to be removed from the audio.

Finally, there are several different receiver-oriented macro features in the 7330. These include macros that execute when a receiver is keyed, and macros that can be used to respond to a rapid succession of PTT presses.

Front Panel COR and CTCSS LEDs

The Front Panel LEDs for COR and CTCSS show the status of the receiver COR and CTCSS hardware inputs, or the *Simulate COR/CTCSS Active* software switches, before the *COR Filtering Delay*, *CTCSS Filtering Delay*, *Anti-Kerchunker* and *Flutter Filter*.

COR Filtering

New commands have been added that delay the controller's response to the leading edge of COR signals. The delay is imposed on all transmissions and is programmable. Setting it to zero disables the delay. It defaults to zero upon a Cold Start.

Besides helping remove noise spikes, the delay makes the Anti-CTCSS access mode more useful. If you set the COR delay equal to (or greater than) the CTCSS decoder's turn-on delay, the controller won't respond to a COR signal until after the CTCSS decoder determines that there is no unwanted CTCSS tone accompanying it.

CTCSS Filtering

New commands have been added that delay the controller's response to the leading edge of CTCSS signals. The delay is imposed on all transmissions and is programmable. Setting it to zero disables the delay. It defaults to zero upon a Cold Start.

This filter helps to remove false CTCSS decoder output spikes.

Anti-Kerchunker

The *Anti-Kerchunker* is used to help filter out annoying kerchunks, which are brief repeater key-ups done without operator identification when the repeater is not in use. When the repeater is in use, the *Anti-Kerchunk* filter is disabled so that the repeater responds rapidly to a user who keys up the repeater during the transmitter tail.

There are two delays that make up this filter, the *Anti-Kerchunker Key-up Delay* and the *Anti-Kerchunker Re-Arm Delay*. The *Anti-Kerchunker Key-Up Delay* is the period of time that the user must key up the receiver before the key-up is allowed. Once the *Anti-Kerchunker Key-Up Delay* is exceeded, the anti-kerchunk feature is disabled until the anti-kerchunker is rearmed. This is to avoid unnecessary delay periods when the repeater is being used normally.

Each time COR drops, the *Anti-Kerchunker Re-Arm Delay* is started. If no transmission occurs before the delay timer expires, the Antikerchunker becomes rearmed; in other words, the *Anti-Kerchunker Key-Up Delay* goes back into effect. A user who wants to avoid the *Key-Up Delay* must begin his transmission during the *Anti-Kerchunker Re-Arm Delay*, which is typically set to last the length of the transmitter tail and an identification. That way the repeater is still responsive during active use.

Suggested use: Since the 7330 has multiple transmitters and each can drop at a different time, the *Anti-Kerchunker Re-Arm Delay* starts upon loss of receiver COR instead of loss of transmitter PTT. For this reason, you may want to set the *Anti-Kerchunker Re-Arm Delay* for at least the length of the repeater tail plus the identification so that users won't be subject to the delay while the transmitter is in active use.

The Anti-Kerchunker behaves differently when placed into No Hangtime Mode. In this mode, incoming signals cause the pathed transmitter(s) to key immediately, but they will unkey immediately if the input signal disappears before the Key-Up Delay timer expires.

Flutter Filter

The *7330 Flutter Filter* filters out mobile flutter that may be present when a mobile station is in a repeater's marginal coverage area. The Flutter Filter is applied to the trailing edge of the path access. It holds open the audio path and minimizes any extra Courtesy Beeps that would occur at each flutter.

Audio Gate Delay

Each *7330 Audio Delay Line* stores all audio input from its associated receiver. If the receiver input is connected to a discriminator, then the audio delay line fills with noise when a signal is not capturing the receiver. When a user signal is received, that noise comes out of the audio delay line before the user's audio. To prevent the noise in the audio delay line from being transmitted out of the repeater transmitter, an Audio Gate Delay can be programmed. The Audio Gate Delay is applied to the leading edge of the path access.

COR Pulse-Triggered Macros

The 7330 can execute a macro when a user keys the microphone PTT button several times in succession. This is handy when executing some type of logic output or control—for example, turning on a light or some other device. This feature is set up to respond reasonably well to users who key their PTT in a regular on-off pattern while preventing false triggers.

COR/CTCSS ETMs

Receiver ETMs

COR/CTCSS Simulate Software Switches

The *RX COR Simulate* and *RX CTCSS Simulate* software switches assist you in troubleshooting your system.

These commands force the selected COR and/or CTCSS inputs to appear active to the controller and allow you to study the system's operation without generating local COR and CTCSS signals.

But these commands don't do anything beyond simulating the inputs. In other words, they don't override the antikerchunkers, the path modes, any higher-priority receivers, and so on. That way, the results are exactly the same as if local signals were being received. (If you need to override these conditions, see the "Always On" Path Mode.)

You can use these commands for other things besides troubleshooting. For example, you can connect an audio device that lacks a COR output (such as a weather receiver or Space Shuttle audio feed) to one of the controller's receiver audio inputs and use the *COR Simulate* command to feed the audio to one or more transmitters.

Simulate COR/CTCSS Active

Forces the COR or CTCSS Input to Appear Active.

- Aids in troubleshooting a system and its programming.
- Enables an audio source that has no COR, e.g., a weather receiver.
- Turning the switch ON makes the input appear active, exactly simulating the assertion of the COR or CTCSS input.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Simulate COR for RX1	(PW) 63 0108 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Simulate COR for RX2	(PW) 63 0208 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Simulate COR for RX3	(PW) 63 0308 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Simulate CTCSS for RX1	(PW) 63 0109 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Simulate CTCSS for RX2	(PW) 63 0209 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Simulate CTCSS for RX3	(PW) 63 0309 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: OFF (disabled).

Examples:

If you want simulate COR on Receiver #3, enter:

```
(PW) 63 0308 1 *
```

To turn off the simulation of the COR on Receiver #3, enter:

```
(PW) 63 0308 0 *
```

Select COR Filtering Delay

Delays the Controller's Response to the Leading Edge of COR.

- Delay is imposed on every transmission.
- Helps to remove noise spikes.
- Improves the operation of the *Anti-CTCSS Access Mode* when the *COR Filtering Delay* is longer than the CTCSS decoder's decode time.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.
- To disable, enter the password, the 2-digit root number, the 4-digit timer number, and "0".

Command Form:

Command	Form	Data Digit
Select COR Filter Delay for RX1	(PW) 09 0112 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR Filter Delay for RX2	(PW) 09 0212 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR Filter Delay for RX3	(PW) 09 0312 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: COR Filter Delay is 0.00 seconds.

Examples:
If you want to select a COR filtering delay on Receiver #2 of 0.10 seconds, enter:

```
(PW) 09 0212 10 *
```

Select CTCSS Filtering Delay

Delays the Controller's Response to the Leading Edge of CTCSS.

- Delay is imposed on every transmission.
- Helps to remove false CTCSS decoder output spikes.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.
- To disable, enter the password, the 2-digit root number, the 4-digit timer number, and "0".

Command Form:

Command	Form	Data Digit
Select CTCSS Filter Delay for RX1	(PW) 09 0113 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Filter Delay for RX2	(PW) 09 0213 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Filter Delay for RX3	(PW) 09 0313 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: CTCSS Filter Delay is 0.00 seconds.

Examples:
If you want to select a CTCSS filtering delay on Receiver #2 of 0.020 seconds, enter:

```
(PW) 09 0212 2 *
```

Select Flutter Filter Timer

Filters out mobile flutter.

- Helps to remove mobile flutter on noisy stations.
- Filter is applied to the trailing edge of the signal after path access.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 3 digits, 0-100 for 0.00 through 1.00 seconds.
- To disable, enter the password, the 2-digit root number, the 4-digit timer number, and "0".

Command Form:

Command	Form	Data Digit
Select Flutter Filter Timer for RX1	(PW) 09 0118 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds
Select Flutter Filter Timer for RX2	(PW) 09 0218 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds
Select Flutter Filter Timer for RX3	(PW) 09 0318 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Flutter Filter Timer is 0.00 seconds (disabled).

Examples:
If you want to select a Flutter Filter timer on Receiver #2 of 0.04 seconds (40 milliseconds), enter:

```
(PW) 09 0218 4 *
```

Select Audio Gate Delay Timer

Removes audio delay line noise at the beginning of a transmission.

- Removes the noise that is stored in the Audio Delay Line at the beginning of a transmission.
- Filter is applied to the trailing edge of the signal after path access.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 3 digits, 0-100 for 0.00 through 1.00 seconds.
- To disable, enter the password, the 2-digit root number, the 4-digit timer number, and "0".

Command Form:

Command	Form	Data Digit
Select Audio Gate Delay Timer for RX1	(PW) 09 0117 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds
Select Audio Gate Delay Timer for RX2	(PW) 09 0217 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds
Select Audio Gate Delay Timer for RX3	(PW) 09 0317 xxxxx *	xxxxx = (0-100) = (0-1.00) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Audio Gate Delay Timer is 0.00 seconds (disabled).

Examples:
If you want to select an Audio Gate Delay on Receiver #3 of 0.12 seconds (120 milliseconds), enter:

```
(PW) 09 0317 12 *
```

Enable/Disable Anti-Kerchunker

Turns ON or OFF the Anti-Kerchunker for each receiver.

- The Anti-Kerchunker can be enabled to minimize abuse of a repeater by users "kerchunking" the receiver input.
- An Anti-Kerchunker looks only at the COR associated with a specific receiver. CTCSS is ignored.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Anti-Kerchunker for COR1	(PW) 63 0110 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Anti-Kerchunker for COR2	(PW) 63 0210 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Anti-Kerchunker for COR3	(PW) 63 0310 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: OFF (disabled).

Select Anti-Kerchunker Key-Up Delay

Programs the "Anti-Kerchunk" *Key-up Delay* for each receiver.

- Users must key for the selected length of time before the path is activated to key any pathed transmitters.
- A user who wants to avoid the *Key-Up Delay* must begin his transmission during the *Re-Arm Delay*.
- An Anti-Kerchunker looks only at the COR associated with a specific receiver. CTCSS is ignored.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select Anti-Kerchunker Key-Up Delay for COR1	(PW) 09 0109 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Anti-Kerchunker Key-Up Delay for COR2	(PW) 09 0209 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Anti-Kerchunker Key-Up Delay for COR3	(PW) 09 0309 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Anti-Kerchunker Key-Up Delay is 1.00 seconds.

Examples:
If you want to require a one-half second anti-kerchunker key-up delay on Receiver #1, enter:

```
(PW) 09 0109 50 *
```

Select Anti-Kerchunker Re-Arm Delay

Programs the "Anti-Kerchunk" *Re-Arm Delay* for each receiver.

- The Anti-Kerchunk *Key-Up Delay* is re-enabled after the *Re-Arm Delay* expires.
- The anti-kerchunker is *Re-Armed* if no activity is present for a selected length of time after the receiver access is dropped.
- A user who wants to avoid the *Key-Up Delay* must begin his transmission during the *Re-Arm Delay*.
- An Anti-Kerchunker looks only at the COR associated with a specific receiver. CTCSS is ignored.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0 through 65535 seconds.

Command Form:

Command	Form	Data Digit
Select Anti-Kerchunker Re-Arm Delay for COR1	(PW) 09 2109 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Anti-Kerchunker Re-Arm Delay for COR2	(PW) 09 2209 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Anti-Kerchunker Re-Arm Delay for COR3	(PW) 09 2309 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Anti-Kerchunker Re-Arm Delay defaults to 60 seconds.

Examples:
Unless changed, the anti-kerchunker will re-arm as soon as the user unkeys. If you want a 90 second delay in re-arming for Receiver #2, enter:

```
(PW) 09 2209 90 *
```

Enable/Disable Anti-Kerchunk No Hangtime Mode

Allows the programmer to modify the operation of the
Anti-Kerchunker.

- By default, and when the No Hangtime Mode is disabled, the Anti-Kerchunker does not key pathed transmitters during the *Key-Up Delay*.
- By enabling the *No Hangtime Mode*, the pathed transmitters are keyed during the *Key-Up Delay* but drop immediately if the input signal drops before the Key-Up Delay timer expires.
- An Anti-Kerchunker looks only at the COR associated with a specific receiver. CTCSS is ignored.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Anti-Kerchunk No Hangtime Mode for COR1	(PW) 63 0111 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Anti-Kerchunk No Hangtime Mode for COR2	(PW) 63 0211 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable Anti-Kerchunk No Hangtime Mode for COR3	(PW) 63 0311 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: OFF (disabled).

Assign Macro To COR Input

Assigns a macro to be executed by the COR input transition shown.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro 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 unassign a macro that was previously assigned, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to COR Input 1 Hi-to-Lo	(PW) 26 0115 (macro name) *
Assign Macro to COR Input 1 Lo-to-Hi	(PW) 26 0116 (macro name) *
Assign Macro to COR Input 2 Hi-to-Lo	(PW) 26 0215 (macro name) *
Assign Macro to COR Input 2 Lo-to-Hi	(PW) 26 0216 (macro name) *
Assign Macro to COR Input 3 Hi-to-Lo	(PW) 26 0315 (macro name) *
Assign Macro to COR Input 3 Lo-to-Hi	(PW) 26 0316 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No Macros assigned

Examples:

If you want have a command executed when the COR changes from low-to-high or high-to-low, you can define a macro that executes when this transition occurs.

For example, to assign a macro named "50" to COR input 1's low-to-high transition, enter the command::

```
(PW) 26 0116 0050 *
```

Assign Macro To CTCSS Input

Assigns a macro to be executed by the CTCSS input transition shown.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro 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 unassign a macro that was previously assigned, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to CTCSS Input 1 Hi-to-Lo	(PW) 26 0117 (macro name) *
Assign Macro to CTCSS Input 1 Lo-to-Hi	(PW) 26 0118 (macro name) *
Assign Macro to CTCSS Input 2 Hi-to-Lo	(PW) 26 0217 (macro name) *
Assign Macro to CTCSS Input 2 Lo-to-Hi	(PW) 26 0218 (macro name) *
Assign Macro to CTCSS Input 3 Hi-to-Lo	(PW) 26 0317 (macro name) *
Assign Macro to CTCSS Input 3 Lo-to-Hi	(PW) 26 0318 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No Macros assigned

Examples:

If you want to have a command executed when the CTCSS changes from low-to-high or high-to-low, you can define a macro that executes when this transition occurs.

For example, to assign a macro named "1234" to CTCSS input 3's high-to-low transition, enter the command::

```
(PW) 26 0317 1234 *
```

Add Receiver Event-Triggered Macros

Select COR Pulse-Triggered Macros

Selects a macro to be executed when a user keys his microphone PTT button several times in succession.

- The macro will be executed on the falling edge of the last pulse.
- The macro will *not* be executed if any pulse timing parameters are not met. This is designed to avoid false triggering on noise pulses.
- Enter the password, 2-digit root number, 4-digit event-triggered macro number, and the macro name.
- If you wish to unassign a macro that was previously assigned, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select COR Pulse-Triggered Macro for 1 Pulse for RX1	(PW) 26 0171 (macro name) *
Select COR Pulse-Triggered Macro for 2 Pulses for RX1	(PW) 26 0172 (macro name) *
Select COR Pulse-Triggered Macro for 3 Pulses for RX1	(PW) 26 0173 (macro name) *
Select COR Pulse-Triggered Macro for 4 Pulses for RX1	(PW) 26 0174 (macro name) *
Select COR Pulse-Triggered Macro for 5 Pulses for RX1	(PW) 26 0175 (macro name) *
Select COR Pulse-Triggered Macro for 6 Pulses for RX1	(PW) 26 0176 (macro name) *
Select COR Pulse-Triggered Macro for 7 Pulses for RX1	(PW) 26 0177 (macro name) *
Select COR Pulse-Triggered Macro for 8 Pulses for RX1	(PW) 26 0178 (macro name) *
Select COR Pulse-Triggered Macro for 9 Pulses for RX1	(PW) 26 0179 (macro name) *
Select COR Pulse-Triggered Macro for 1 Pulse for RX2	(PW) 26 0271 (macro name) *
Select COR Pulse-Triggered Macro for 2 Pulses for RX2	(PW) 26 0272 (macro name) *
Select COR Pulse-Triggered Macro for 3 Pulses for RX2	(PW) 26 0273 (macro name) *
Select COR Pulse-Triggered Macro for 4 Pulses for RX2	(PW) 26 0274 (macro name) *
Select COR Pulse-Triggered Macro for 5 Pulses for RX2	(PW) 26 0275 (macro name) *
Select COR Pulse-Triggered Macro for 6 Pulses for RX2	(PW) 26 0276 (macro name) *
Select COR Pulse-Triggered Macro for 7 Pulses for RX2	(PW) 26 0277 (macro name) *
Select COR Pulse-Triggered Macro for 8 Pulses for RX2	(PW) 26 0278 (macro name) *
Select COR Pulse-Triggered Macro for 9 Pulses for RX2	(PW) 26 0279 (macro name) *

Command Form:

Command	Form
Select COR Pulse-Triggered Macro for 1 Pulse for RX3	(PW) 26 0371 (macro name) *
Select COR Pulse-Triggered Macro for 2 Pulses for RX3	(PW) 26 0372 (macro name) *
Select COR Pulse-Triggered Macro for 3 Pulses for RX3	(PW) 26 0373 (macro name) *
Select COR Pulse-Triggered Macro for 4 Pulses for RX3	(PW) 26 0374 (macro name) *
Select COR Pulse-Triggered Macro for 5 Pulses for RX3	(PW) 26 0375 (macro name) *
Select COR Pulse-Triggered Macro for 6 Pulses for RX3	(PW) 26 0376 (macro name) *
Select COR Pulse-Triggered Macro for 7 Pulses for RX3	(PW) 26 0377 (macro name) *
Select COR Pulse-Triggered Macro for 8 Pulses for RX3	(PW) 26 0378 (macro name) *
Select COR Pulse-Triggered Macro for 9 Pulses for RX3	(PW) 26 0379 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered, or conflict in parameters

Default: No Macros are defined.

Examples:

To execute macro 1234 if 3 COR pulses are detected on RX2 within the defined window:

```
(PW) 26 0273 1234 * ;(which assigns macro "1234").
```

Select COR Pulse-Triggered Macro Timers

Sets required characteristics of received pulses to activate a COR Pulse-Triggered Macro.

The following characteristics help ensure that the repeater responds to regular on/off keying pulses while avoiding false triggering due to noise pulses. You may want to experiment by trying different "rhythms" of pulsing the PTT to make sure that you have the parameters set to work well for most operators.

- *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.
- *Maximum Gap* is the maximum amount of time between 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.
- Pulse detection is unaffected by changes to *COR Filtering* or *Anti-Kerchunker* settings.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select COR1 PTM Minimum Duration	(PW) 09 0110 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR2 PTM Minimum Duration	(PW) 09 0210 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR3 PTM Minimum Duration	(PW) 09 0310 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR1 PTM Maximum Gap	(PW) 09 0111 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR2 PTM Maximum Gap	(PW) 09 0211 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select COR3 PTM Maximum Gap	(PW) 09 0311 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	illegal digit entered, or conflict in parameters

Default: *Minimum Duration* is 0.25 sec; *Maximum Gap* Is 2.00 sec

---

Note, difference from the S-COM 7K Controller: *Maximum Gap* replaces the *Window Time* parameter used in the *S-COM 7K Controller*. *Window Time* was the overall time allowed for all the pulses to be counted. *Maximum Gap* is the maximum amount of time allowed between pulses. This new definition improves the reliability of pulse detection.

How it Works

The *Pulse Counting Cycle* starts at the leading edge of the first *Pulse*. If the pulse is longer than the *Minimum Duration* programmed, it is counted. The controller then times the *Maximum Gap* and waits for an additional pulse if less than the maximum value. The process continues until a pulse is less than the *Minimum Duration* or exceeds the *Maximum Gap*. The programmed *COR Pulse-Triggered Macro* for that number of pulses will be executed upon completion of the *Cycle*.

Pulses are created by monitoring only the COR input signals and are not affected by the repeater access mode or other COR filtering commands.

Examples:

To execute macro 1234 for RX1 if 3 COR pulses of at least 0.30 seconds each are detected with a maximum gap of 2.50 seconds. Enter these two commands:

```
(PW) 09 0110 30 *

(PW) 09 0111 250 *
```

("30" = 30 x 10mS = 300mS and "250" = 250 x 10mS = 2500mS = 2.5 seconds)

Chapter 11

Transmitter Commands

Transmitter Key-Up Sequence

When a transmitter is first keyed, a *Transmitter Turn-On Delay* timer runs. This timer doesn't affect the timing of the PTT. Instead, this timer is used by the *Message Handler* (see chapter 6, *Messages*) to delay any messages that are queued to be played until the transmitter comes up to full power and any user's CTCSS decoder has unmuted his local audio.

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 below.

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 *Path Timeout Timer* is reset. (See chapter 9, *Paths,* for configuration of the *Timeout Timer.*) The purpose of the courtesy message is to inform the next station that he/she may now transmit for the full duration of the path timeout timer. The courtesy delay encourages stations to allow a short break in their transmissions, allowing other stations to break in.

Note: a unique *Courtesy Message* can be programmed for each receiver-to-transmitter *Path*. See chapter 9, *Paths,* page 9-19.

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*.)

PathTimeout Timer and Path Timeout Message

If a station transmits for a longer period than set by the *Path Timeout Timer*, the *Path Timeout Message* will be sent and the path will be disabled, unkeying the transmitter. If a station can override the offending station and enter the *Reset Path Timeout Timer* command (on page 9-12), 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 the *Timeout Penalty Time* (and no one has reset the timer for the offending station), the *Timeout-End Message* will be sent to inform him/her that part of their transmission may have been lost.

Note: the *Path Timeout Timer, Path Penalty Timer, Path Timeout Message* and *Path Timeout-End Message* can be programmed for each receiver-to-transmitter path. See chapter 9, *Paths*.

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, for example, to disable a CTCSS encoder before the transmitter is unkeyed (see page 11-10).

All the above delays and messages—as well as the path timeout timer—are fully programmable by the trustee. If, for example, you do not wish to have any courtesy delay or courtesy message, you may delete both. In such case, the timer used for path timeout timer will reset immediately upon the user dropping his carrier.

Figure 2 represents the *Transmitter Tail sequence.*
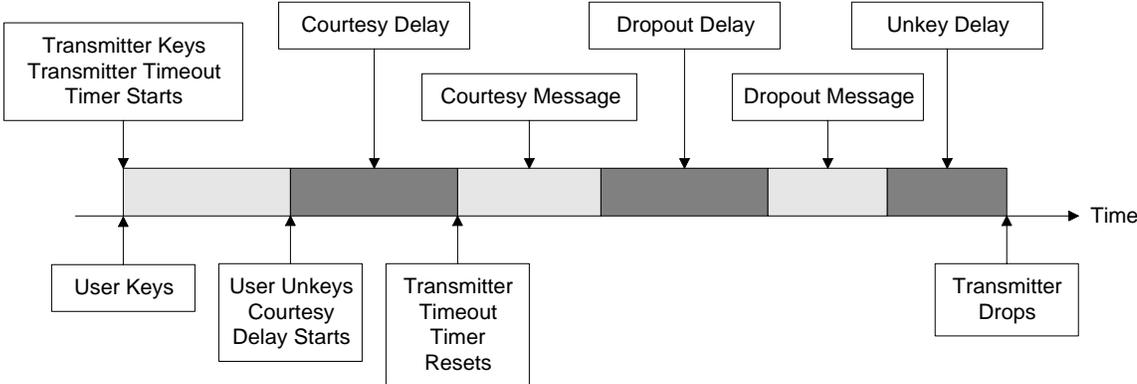
Figure 2

Select Transmitter Turn-On Delay

Programs the Transmitter Turn-On time used to delay messages.

- The *Transmitter Turn-On Delay* time is the delay from the transmitter PTT keying until messages from the *Message Handler* are allowed to be played to this transmitter.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select Transmitter Turn-On Delay for TX1	(PW) 09 0103 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Transmitter Turn-On Delay for TX2	(PW) 09 0203 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Transmitter Turn-On Delay for TX3	(PW) 09 0303 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Turn-On Delay is 0.25 seconds

Select Courtesy Delay

Programs the Courtesy Delay time.

- The *Courtesy Delay* time is the delay from path drop (user unkeys) to when the *Path Timeout Timer* resets and the courtesy message begins. See *Figure 2* on page 11-3.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select Courtesy Delay for TX1	(PW) 09 0100 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Courtesy Delay for TX2	(PW) 09 0200 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Courtesy Delay for TX3	(PW) 09 0300 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Courtesy Delay is 0.50 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 *Path 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 1.40 seconds, for example, enter this command:

```
(PW) 09 0100 140 *
```

Some repeater groups prefer no courtesy time; that is, the path timeout timer resets as soon as the path drops (user unkeys). The courtesy message may also be erased.

To program the courtesy delay for zero delay, enter this command:

```
(PW) 09 0100 0 *
```

Assign Courtesy Delay Violation Event-Triggered Macros

You can have a macro execute when a user keys up before the Courtesy Delay expires. Use this to warn your users they are keying up too quickly.

- You can have a macro execute when a path goes active and the *Courtesy Delay* has not expired.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Courtesy Timer Violation Macro to TX1	(PW) 26 0119 (macro name) *
Assign Courtesy Timer Violation Macro to TX2	(PW) 26 0219 (macro name) *
Assign Courtesy Timer Violation Macro to TX3	(PW) 26 0319 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macros assigned.

Select Dropout Delay

Sets the Dropout Delay time.

- The *Dropout Delay* time is the interval from the end of the *Courtesy Delay* (and *Reset Path Timeout Timer*) to the moment the transmitter is unkeyed. See *Figure 2* on page 11-3.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.353 seconds.

Command Form:

Command	Form	Data Digit
Select Dropout Delay for TX1	(PW) 09 0101 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Dropout Delay for TX2	(PW) 09 0201 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Dropout Delay for TX3	(PW) 09 0301 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

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 2.10 seconds for Receiver #1, for example, enter this command:

```
(PW) 09 0101 210 *
```

To program the dropout delay for maximum time for Receiver #1, enter the following:

```
(PW) 09 0101 500 *
```

Select/Review Dropout Messages

Changes or reviews the dropout messages sent by the controller.

- To change a message: enter the password, the 2-digit root number and 4-digit message 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 speech words, and so on.
- To delete a message, enter the password, the 2-digit root number, the 4-digit message number, and the (*) (do not enter any message).
- To review a message: enter the password, the 2-digit root number, and the 4-digit message number shown.

Command Form:

Command	Form	Default
Select Dropout Message for TX1	(PW) 31 0112 (message) *	No message
Select Dropout Message for TX2	(PW) 31 0212 (message) *	No message
Select Dropout Message for TX3	(PW) 31 0312 (message) *	No message
Review Dropout Message for TX1	(PW) 34 0112 *	No message
Review Dropout Message for TX2	(PW) 34 0212 *	No message
Review Dropout Message for TX3	(PW) 34 0312 *	No message

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See default column of table.

Select Dropout Event-Triggered Macros

Allows the programmer to execute macros based on the *Transmitter Dropout Delay*.

- Macros can be executed based on the *Transmitter Dropout Delay*.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Dropout Macro to TX1	(PW) 26 0104 (macro name) *
Assign Dropout Macro to TX2	(PW) 26 0204 (macro name) *
Assign Dropout Macro to TX3	(PW) 26 0304 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macros assigned.

Select Transmitter PTT Minimum Unkey Delay

Programs the minimum amount of time for a transmitter PTT to unkey.

- The *Unkey Delay* time is the interval from the end of the *Dropout Delay* time to the moment the transmitter PTT is unkeyed. See *Figure 2* on page 11-3.
- Used by the *Select CTCSS Encode Mode* command (see page 13-2) when mode 1 is selected.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0.00 through 655.35 seconds.
- To disable the *Unkey Delay*, set the timer to zero.

Command Form:

Command	Form	Data Digit
Select TX1 Minimum Unkey Delay	(PW) 09 0102 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select TX2 Minimum Unkey Delay	(PW) 09 0202 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select TX3 Minimum Unkey Delay	(PW) 09 0302 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered
? err 2	invalid timer or seconds parameter

Default Condition: *Unkey Delay* is 0.10 second.

Example:

To set the Transmitter 1 Minimum Unkey Delay to 0.40 second, enter the command:

```
(PW) 09 0102 40 *
```

To set the Transmitter 2 Minimum Unkey Delay to 5.00 seconds, enter the command:

```
(PW) 09 0202 500 *
```

Select Transmitter PTT-Triggered Macros

Allows the programmer to execute macros based on transmitter PTT keying.

- Each transmitter has its own *PTT Inactive-to-Active Macro*, *PTT Active-to-Inactive Before Unkey Delay Macro*, and *PTT Active-to-Inactive After Unkey Delay Macro*.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to Tx1 PTT Inactive-to-Active	(PW) 26 0105 (macro name) *
Assign Macro to Tx1 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 0106 (macro name) *
Assign Macro to Tx1 PTT Active-to-Inactive After Unkey Delay	(PW) 26 0107 (macro name) *
Assign Macro to Tx2 PTT Inactive-to-Active	(PW) 26 0205 (macro name) *
Assign Macro to Tx2 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 0206 (macro name) *
Assign Macro to Tx2 PTT Active-to-Inactive After Unkey Delay	(PW) 26 0207 (macro name) *
Assign Macro to Tx3 PTT Inactive-to-Active	(PW) 26 0305 (macro name) *
Assign Macro to Tx3 PTT Active-to-Inactive Before Unkey Delay	(PW) 26 0306 (macro name) *
Assign Macro to Tx3 PTT Active-to-Inactive After Unkey Delay	(PW) 26 0307 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macros assigned.
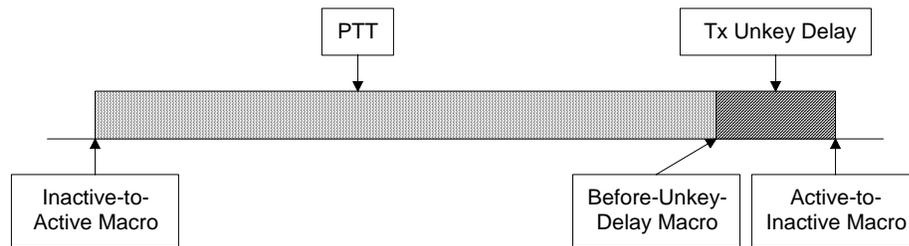
Example 1:

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 After Unkey Delay* 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.

<mark>Need a different example, since there's a better CTCSS solution in the 7330.</mark>

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 Port #1 CTCSS Logic Output to enable the CTCSS encoder, enter the following:

```
(PW) 20 9107 (PW) 70 09 *
```

To create a macro that turns off Port #1 CTCSS Logic Output to disable the CTCSS encoder, enter the following:

```
(PW) 20 9108 (PW) 71 09 *
```

To assign these macros to the PTT-triggered events, enter the following:

```
(PW) 26 0105 9107 *
(PW) 26 0106 9108 *
```

To adjust the amount of time that the transmitter stays keyed after the tone encoder is disabled, set the *Transmitter PTT Minimum Unkey Delay* (see page 11-10). For example, to set the *TX1 Minimum Unkey Delay* to 0.40 seconds, enter the following:

```
(PW) 09 0102 40 *
```

Note: an alternate way to control a CTCSS tone on Transmitter 1 is to use the controller's dedicated CTCSS Encoder or CTCSS Encode Logic Output (see page 13-2). When enabled in *CTCSS Encode Mode 1*, CTCSS Encoder generates a CTCSS tone 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.

Select Transmitter End-of-Activity Counter/Timer

Allows the programmer to execute macros based on the long-term activity of the transmitter.

Sets the *Transmitter End-of-Activity Counter* and *Timer* (both the Event Count and the Duration).

- Select the *Transmitter End-of-Activity Counter (Event Count)*. Enter the password, the 2-digit root number, the 4-digit counter number, and the 1 to 5 digit count. Setting the counter to 0 (zero) means that the *End-of-Activity Macro* will execute each activity cycle. Setting the counter to 1 means that the end-of-activity-triggered macro will execute every other activity cycle, and so on. Setting the counter to 9, therefore, means that the end-of-activity-triggered macro will execute every 10th cycle.
- Select the *Transmitter End-of-Activity Timer (Duration)* by entering the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits representing the delay.

Command Form:

Command	Form	Data Digit
Select TX1 End-of-Activity Counter	(PW) 45 0100 xxxxx *	x = (event count) = (0–65535)
Select TX1 End-of-Activity Timer	(PW) 09 2110 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select TX2 End-of-Activity Counter	(PW) 45 0200 xxxxx *	x = (event count) = (0–65535)
Select TX2 End-of-Activity Timer	(PW) 09 2210 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds
Select TX3 End-of-Activity Counter	(PW) 45 0300 xxxxx *	x = (event count) = (0–65535)
Select TX3 End-of-Activity Timer	(PW) 09 2310 xxxxx*	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default: End-of-Activity Counter is 0; Duration is 1.0 minutes (60 seconds)

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 *Select Transmitter End-of-Activity Macros* commands (see page 11-16) allow the programmer to execute macros based on long-term transmitter 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 end-of-activity counter/timer allows the programmer to select how often to execute the macro.

The *Transmitter 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 *Transmitter End-of-Activity-Triggered Macro* is executed. The end-of-activity counter/timer, which watches the number of activity cycles, is programmable in duration from 0–65535 seconds and from 0–65535 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 end-of-activity macro was actually executed (it may have been waiting for the proper activity count).

Note: The *Transmitter End-of-Activity Counter/Timer* starts when the dropout delay is completed.

Select Transmitter Start-of-Activity and Transmitter End-of-Activity Macros

Allows the programmer to execute macros based on the long-term activity of the transmitter.

- Macros can be executed based on long-term transmitter activity.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select TX1 Start-of-Activity Macro	(PW) 26 0113 (macro name) *
Select TX1 End-of-Activity Macro	(PW) 26 0114 (macro name) *
Select TX2 Start-of-Activity Macro	(PW) 26 0213 (macro name) *
Select TX2 End-of-Activity Macro	(PW) 26 0214 (macro name) *
Select TX3 Start-of-Activity Macro	(PW) 26 0313 (macro name) *
Select TX3 End-of-Activity Macro	(PW) 26 0314 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default: No Macros are assigned

Enable/Disable Transmitter PTT

Enables or disables the specified Transmitter PTT while not affecting other transmitter functions.

- Disabling the transmitter PTT is like cutting the PTT wire.
- The receiver will still be able to send commands to the controller, but the transmitter PTT will not be keyed. All other controller operations are unaffected.
- When the transmitter PTT is disabled, the front panel LED blinks as a reminder whenever the transmitter PTT should be keyed.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable PTT 1	(PW) 63 0112 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable PTT 2	(PW) 63 0212 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable PTT 3	(PW) 63 0312 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All Transmitter PTTs are ON (enabled)

Key Transmitter (Timed)

Keys the specified Transmitter for a timed period.

- The specified transmitter will not key under this command if it has been disabled using the *Enable/Disable Transmitter PTT* command on page 11-17.
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits, 0-65535 for 0 through 65535 seconds.
- To disable, enter the password, the 2-digit root number, the 4-digit timer number, and the digit "0".

Command Form:

Command	Form	Data Digit
Key Transmitter 1 (Timed)	(PW) 09 2108 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Key Transmitter 2 (Timed)	(PW) 09 2208 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Key Transmitter 3 (Timed)	(PW) 09 2308 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Transmitters are not requested to key

Key Transmitter (Untimed)

Keys the specified transmitter until canceled.

- The specified transmitter will not key under these commands if it has been disabled using the *Enable/Disable Transmitter PTT* command on page 11-17.
- The transmitter will remain keyed indefinitely, until canceled.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Key Transmitter 1 (Untimed)	(PW) 63 0113 x *	1 = key 0 = cancel key
Key Transmitter 2 (Untimed)	(PW) 63 0213 x *	1 = key 0 = cancel key
Key Transmitter 3 (Untimed)	(PW) 63 0313 x *	1 = key 0 = cancel key

Acknowledgment: Sends *OK* message

Errors:

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

Default Conditions: Transmitters are not requested to key

Select Path-to-Transmitter-Triggered Macros

Allows the programmer to execute macros based on path-to-transmitter activity.

- Macros can be executed based on path-to-transmitter activity.
- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to Any-Path-Active to Tx1	(PW) 26 0102 (macro name) *
Assign Macro to All-Paths-Inactive to Tx1	(PW) 26 0103 (macro name) *
Assign Macro to Any-Path-Active to Tx2	(PW) 26 0202 (macro name) *
Assign Macro to All-Paths-Inactive to Tx2	(PW) 26 0203 (macro name) *
Assign Macro to Any-Path-Active to Tx3	(PW) 26 0302 (macro name) *
Assign Macro to All-Paths-Inactive to Tx3	(PW) 26 0303 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No macros assigned.

Chapter 12
Identifier

The *7330 Controller* supports separate *Identifiers* (ID) for each of the three transmitters. 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 three commands that are similar: *Select Initial ID Message* for Tx1, and *Select Initial ID Message* for Tx2, and *Select Initial ID Message* for Tx3. Therefore, users should be careful to choose the proper command form on the command pages.

The 7330 supports two different types of ID depending upon when the ID is sent during the course of a transmission. When a transmitter is keyed up after a period of silence and a transmission is underway, the first ID to be sent is called the "Initial ID". Thereafter, in this transmission each subsequent ID is a "Normal ID". After the transmission is over and the final ID is sent, then the ID cycle starts all over again.

The 7330 also supports the concept of a "polite" ID, meaning that the ID won't interrupt a transmission underway. At a specified time before an ID timeout expires (see *ID Pending Interval* below), the ID can be set up to be sent if the signal disappears.

Lastly, the 7330 also provides two types of Macros that are triggered after an ID depending upon whether the polite or impolite ID has been triggered. These are accordingly the polite and impolite ID macros.

Identifier Sequence

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* command (see page 12-3) sets the *maximum* interval between identifications. The *Select ID Pending Interval* command (see page 12-4) 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 12-5.

- 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 Identifier Message Interval

Programs the maximum interval at which Identifier Messages occur.

- Because of the polite nature of the identifier, an ID may be earlier if there is a recent carrier drop. (*Select Identifier Pending Interval* on page 12-4.)
- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits from 0 to 65535 to set the *Identifier Message Interval* to 0 to 65535 seconds.
- Transmitters in US amateur service must identify at least every 10 minutes.

Command Form:

Command	Form	Data Digit
Select Identifier Message Interval for TX1	(PW) 09 2106 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Identifier Message Interval for TX2	(PW) 09 2206 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Identifier Message Interval for TX3	(PW) 09 2306 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Identifier Message Interval is 180 seconds (3.0 minutes)

Examples:
To change the Identifier Message Interval for Transmitter 2 to 4.5 minutes (270 seconds), enter the following command:

```
(PW) 09 2206 270 *
```

To change the Identifier Message Interval for Transmitter 1 to 9.5 minutes (570 seconds), enter the following command:

```
(PW) 09 2106 570 *
```

Select Identifier Pending Interval

Programs the amount of time the controller "looks ahead" to send a polite ID.

- The *Identifier Pending Interval* is the amount of time before the end of the *Identifier Message Interval* (see page 12-3) that the controller looks for the transmitter'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 the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits from 0 to 65535 to set the *ID Pending Interval* to 0 to 65535 seconds.

Command Form:

Command	Form	Data Digits
Select Identifier Pending Interval for Tx1	(PW) 09 2107 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Identifier Pending Interval for Tx2	(PW) 09 2207 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds
Select Identifier Pending Interval for Tx3	(PW) 09 2307 xxxxx *	xxxxx = (0-65535) = (0-65535) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: The Identifier Pending Interval is 30 seconds.

Example:

To select an Identifier Pending Interval for Transmitter 3 of 2 minutes (120 seconds), enter the following:

```
(PW) 09 2307 120 *
```

Select/Review Identifier Messages

Define the Initial ID, Normal ID, and Impolite ID Messages for each transmitter.

- To change a message: enter the password, the 2-digit root number and 4-digit message number shown, followed by the desired message.
- 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 *Initial ID Message* is not programmed, the *Normal ID Message* is sent.
- If an *Impolite ID Message* is not programmed, the *Normal ID Message* is sent.
- If the *Initial, Normal,* and *Impolite* messages for a transmitter are all deleted, the Identifier is disabled for that transmitter.

Command Form:

Command	Form	Default
Select Initial ID Message for TX1	(PW) 31 0109 (message) *	ID in CW, 587 Hz
Select Normal ID Message for TX1	(PW) 31 0110 (message) *	ID in CW, 587 Hz
Select Impolite ID Message for TX1	(PW) 31 0111 (message) *	none
Select Initial ID Message for TX2	(PW) 31 0209 (message) *	ID in CW, 698 Hz
Select Normal ID Message for TX2	(PW) 31 0210 (message) *	ID in CW, 698 Hz
Select Impolite ID Message for TX2	(PW) 31 0211 (message) *	none
Select Initial ID Message for TX3	(PW) 31 0309 (message) *	ID in CW, 1046 Hz
Select Normal ID Message for TX3	(PW) 31 0310 (message) *	ID in CW, 1046 Hz
Select Impolite ID Message for TX3	(PW) 31 0311 (message) *	none
Review Initial ID Message for TX1	(PW) 34 0109*	none
Review Normal ID Message for TX1	(PW) 34 0110 *	none
Review Impolite ID Message for TX1	(PW) 34 0111 *	none
Review Initial ID Message for TX2	(PW) 34 0209 *	none
Review Normal ID Message for TX2	(PW) 34 0210 *	none
Review Impolite ID Message for TX2	(PW) 34 0211 *	none
Review Initial ID Message for TX3	(PW) 34 0309 *	none
Review Normal ID Message for TX3	(PW) 34 0310 *	none
Review Impolite ID Message for TX3	(PW) 34 0311 *	none

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: See table above.

Select Identifier-Triggered Macros

Assigns macros to be triggered at the appropriate Identifier events.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Select Initial ID Macro for TX1	(PW) 26 0108 (macro name) *
Select Polite ID Macro for TX1	(PW) 26 0109 (macro name) *
Select Impolite ID Macro for TX1	(PW) 26 0110 (macro name) *
Select Initial ID Macro for TX2	(PW) 26 0208 (macro name) *
Select Polite ID Macro for TX2	(PW) 26 0209 (macro name) *
Select Impolite ID Macro for TX2	(PW) 26 0210 (macro name) *
Select Initial ID Macro for TX3	(PW) 26 0308 (macro name) *
Select Polite ID Macro for TX3	(PW) 26 0309 (macro name) *
Select Impolite ID Macro for TX3	(PW) 26 0310 (macro name) *

Acknowledgment: Sends *OK* message

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 0108 1234 *
```

Send Initial ID Message

Forces the identifier to send the Initial ID Message, along with any ID Tail Message that may be selected.

- Resets the *ID Timer,* sends the *Initial ID Message* and any *ID Tail Message*.
- Enter the password, the 2-digit root number, the 4-digit timer number, and the digit "1".

Command Form:

Command	Form
Send Initial ID Message for TX1	(PW) 63 0114 1 *
Send Initial ID Message for TX2	(PW) 63 0214 1 *
Send Initial ID Message for TX3	(PW) 63 0314 1 *

Acknowledgment: Sends *ID* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered

Default: None

Send Normal ID Message

Forces the identifier to send the Normal ID Message, along with any ID Tail Message that may be selected.

- Resets the *ID Timer,* sends the *Normal ID Message* and any *ID Tail Message*.
- Enter the password, the 2-digit root number, the 4-digit timer number, and the digit "1".

Command Form:

Command	Form
Send Normal ID Message for TX1	(PW) 63 0115 1 *
Send Normal ID Message for TX2	(PW) 63 0215 1 *
Send Normal ID Message for TX3	(PW) 63 0315 1 *

Acknowledgment: Sends *ID* message

Errors:

Error	Meaning
? err 1	wrong number of digits entered

Default: None

Select Initial and Normal ID
Tail Messages

Defines the Initial and Normal ID Tail Messages.

- *Tail Messages* are programmable messages that can be appended to an Identifier Message.
- *User Messages* are used to define *Tail Messages*. This command accepts a message number of the *User Message* to be associated with an ID. (See *Select User Messages* command on page 6-56.)
- Enter the command with no *Tail Number* to disable the *Tail Message*.

Command Form:

Command	Form
Select Initial ID Tail Message for TX1	(PW) 50 00 xxxx *
Select Normal ID Tail Message for TX1	(PW) 50 01 xxxx *
Select Initial ID Tail Message for TX2	(PW) 50 02 xxxx *
Select Normal ID Tail Message for TX2	(PW) 50 03 xxxx *
Select Initial ID Tail Message for TX3	(PW) 50 04 xxxx *
Select Normal ID Tail Message for TX3	(PW) 50 05 xxxx *

Acknowledgment: Sends *OK* message

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 User Message #1 (message number 0015) as an Initial ID Tail Message for TX1, enter the command:

    (PW) 50 00 0015 *

Chapter 13
CTCSS Encoders

The 7330 has three built-in CTCSS encoders, one for each transmitter. These encoders are very flexible and operate independently of each other. You can select the tone frequency, the mode of operation, the timing, and the type of end-of-transmission phase reversal for each encoder using the commands in this chapter.

A push-on jumper allows you to select whether a CTCSS tone generator or a CTCSS logic output drives the CTCSS output pin on the radio port connector. The CTCSS logic outputs are separate from the 7330's eight general-purpose logic outputs.

If you configure a CTCSS output pin as a logic output and interface it properly to an external encoder, you can use the *Control CTCSS Encoder* command to control the external encoder with the same modes as the internal encoder.

If you don't need a CTCSS encoder for a given transmitter, you can use the CTCSS logic output to control other circuitry (see *Select Logic Outputs* command, page 15-3).

Add Timing Diagram Here.

Control CTCSS Encoder

Selects the CTCSS Encoder operating mode

- Use the push-on jumper to connect either the CTCSS tone generator or the CTCSS logic output to pin 8 of the radio port connector (see *Installation* chapter for details). All six modes control either the internal tone encoder or the logic output.
- In Mode 3, the encoder turns ON at PTT key-up and stays ON for an adjustable amount of time. It turns OFF when the timer expires.
- In Mode 4, the encoder turns ON when any path keys the transmitter and stays ON as long as the path is active. When all paths go inactive, the timer keeps the encoder ON until it expires.
- Program the Mode 3 and Mode 4 timers with the *Select CTCSS ON Time* command on page 13-7.
- Reverse Burst can be enabled in one of two phase shift angles, or disabled. A reverse burst signal can help to eliminate squelch tails by causing the receiver to unsquelch more quickly due to the sudden change in phase. The reverse burst is usually short (see the *Select CTCSS Reverse Burst Time* command on page 13-8).

Command Form:

Command	Form	Data Digit
Control CTCSS Encoder	(PW) 02 w x y *	w = transmitter (1-3) x = Mode, see table y = Reverse Burst, see table

Modes:

Mode	Meaning
0	OFF
1	Follows transmitter PTT, but turns OFF before the Minimum Unkey Delay period
2	Follows transmitter PTT
3	Turns ON when transmitter PTT is keyed and OFF at the end of the CTCSS ON Time (ON time is programmable)
4	Turns ON when Any Path is Active to a selected transmitter, then a timer starts when All Paths are Inactive to that transmitter. When the timer expires the encoder is turned OFF (ON time is programmable).
5	Always ON

Reverse Burst Options:

Mode	Meaning
0	OFF
1	120-degree Reverse Burst
2	180-degree Reverse Burst

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: CTCSS encoder is OFF (disabled, Mode 0).

Example 1: Use Mode 2 to encode at the same time as PTT

The CTCSS encode signal is used to open and close the squelch on receivers listening to the transmitter.

In this example, we'll program the transmitter #2 CTCSS encoder to be ON whenever the transmitter #2 PTT is active. Enter:

```
(PW) 02 2 2 0 *
```

If your users' radios support reverse burst, you can enable 120-degree reverse burst by changing the command to this:

```
(PW) 02 2 2 1 *
```

Example 2: Use Mode 1 to eliminate the annoying end-of-transmission squelch burst

Mode 1 is similar to Mode 2 but the CTCSS encode tone is turned off shortly before the transmitter PTT unkeys, at the beginning of the *Transmitter Minimum Unkey Delay* (see Figure 2 on page 11-3). This gives the user's CTCSS decoder time to close the user's squelch before the repeater transmitter unkeys, preventing a brief noise crash. The technique is sometimes called "chicken burst" because it's simpler to implement than the phase-reversal "reverse burst"; however, the 7330 supports both methods.

To turn off the CTCSS encoder at the beginning of the *Transmitter Minimum Unkey Delay* on transmitter #2, enter:

```
(PW) 02 2 1 0 *
```

Remember to set the *Transmitter Minimum Unkey Delay* time (see page 11-9). You may want to experiment with different unkey delay values and see which best minimizes the annoying squelch burst signals.

Example 3: Allow brief monitoring of QSOs in progress

Mode 3, the Timed ON mode, can be used if stations wish to monitor just the beginnings of QSOs to find out who's on the air and not the rest of the conversation. To put the CTCSS encoder for transmitter #1 into timed ON mode for for the length of the CTCSS ON Time, enter the following:

```
(PW) 02 1 3 0 *
```

The monitoring stations would set their CTCSS decoders to the same tone frequency as generated by the controller CTCSS encoder.

Example 4: Encode on COR

When a port is used as a link (sometimes to an IRLP node), it's common to turn off the CTCSS as soon as all paths to that transmitter are inactive. This prevents the Courtesy Beep, the Identifier Message, and any other messages from being heard over the link. This is also sometimes referred to as "CTCSS follows COR". Mode 4 is used for this case because the encoder follows path activity. The CTCSS ON Time is set to 0.

To turn off the CTCSS when all paths are inactive to transmitter #3, enter:

```
(PW) 02 3 4 0 *
```

Remember also to set the *CTCSS ON Time* to zero:

```
(PW) 09 0315 0 *
```

Example 5: Variation of example 4 to include a portion of the transmitter tail

Some users like to hear the first half second of the tail where the Courtesy Beep is normally heard. To program the CTCSS encoder for transmitter #1 into this mode and use a 180 degree reverse burst, enter the following:

```
(PW) 02 1 4 2*
```

Remember also to set the *CTCSS ON Time* for a half second (0.50 second):

```
(PW) 09 0315 50 *
```

You may want to experiment with different CTCSS ON Time values and see which best minimizes the annoying squelch burst signals.

Example 6: Macro control of CTCSS encoder

You can have complete time control of the CTCSS encoders by using macros to turn them ON and OFF (Mode 5 turns the CTCSS encoder ON and Mode 0 turns it OFF).

For example, to turn the transmitter #3 CTCSS encoder ON, enter:

```
(PW) 02 3 5 0 *
```

To turn the transmitter #3 CTCSS encoder OFF, enter:

```
(PW) 02 3 0 0 *
```

Select Frequency of CTCSS Encoder

Selects the tone frequency of the built-in CTCSS encoder

- Use this command to set the frequency of the CTCSS encoder for a particular transmitter.
- Enter "1", "2", or "3" to specify the transmitter number.
- In the *CTCSS Tone Numbers Table* which follows, the decimal numbers 0–63 represent the 64 possible tone frequencies. Enter a 1- or 2-digit tone number to select the frequency.
- Use the *Control CTCSS Encoder* command to choose the mode of operation of the encoder.

Command Form:

Command	Form	Data Digit
Select Frequency of CTCSS Encoder	(PW) 03 x yy *	x = transmitter = (1-3) yy = tone number (see CTCSS Tone Numbers Table)

Acknowledgment: Sends *OK* message

Errors:

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

Default: 100 Hz

CTCSS Tone Numbers

Tone #	Freq Hz	EIA Code	Tone #	Freq Hz	EIA Code
0	33.0	*	32	123.0	3Z
1	35.4	*	33	127.3	3A
2	36.6	*	34	131.8	3B
3	37.9	*	35	136.5	4Z
4	39.6	*	36	141.3	4A
5	44.4	*	37	146.2	4B
6	47.5	*	38	151.4	5Z
7	49.2	*	39	156.7	5A
8	51.2	*	40	159.8	*
9	53.0	*	41	162.2	5B
10	54.9	*	42	165.5	*
11	56.8	*	43	167.9	6Z
12	58.8	*	44	171.3	*
13	63.0	*	45	173.8	6A
14	67.0	XZ	46	177.3	*
15	69.4	*	47	179.9	6B
16	71.9	XA	48	183.5	*
17	74.4	WA	49	186.2	7Z
18	77.0	XB	50	189.9	*
19	79.7	SP	51	192.8	7A
20	82.5	YZ	52	196.6	*
21	85.4	YA	53	199.5	*
22	88.5	YB	54	203.5	M1
23	91.5	ZZ	55	206.5	*
24	94.8	ZA	56	210.7	*
25	97.4	ZB	57	218.1	*
26	100.0	1Z	58	225.7	*
27	103.5	1A	59	229.1	*
28	107.2	1B	60	233.6	*
29	110.9	2Z	61	241.8	*
30	114.8	2A	62	250.3	*
31	118.8	2B	63	254.1	*

* = not a standard code

Select CTCSS ON Time

Programs the CTCSS Encoder ON Time

- Program the CTCSS Encode ON Time for use with one of the CTCSS Control Timed Modes.
- Enter the the 2-digit root number, the 4-digit timer number, and the delay time.
- For the time, enter 1-5 digits, 0 thru 65535, representing 0.00 to 655.35 seconds.
- Entering a time of 0 will disable the timer.

Command Form:

Command	Form	Data Digit
Select CTCSS Encoder ON Time for TX1	(PW) 09 0115 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Encoder ON Time for TX2	(PW) 09 0215 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Encoder ON Time for TX3	(PW) 09 0315 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: 1.00 second.

Examples:

To set the CTCSS Encode ON Time to 6.00 seconds for transmitter #1, enter the following command:

```
(PW) 09 0115 600 *
```

Select CTCSS Reverse Burst Time

Programs the CTCSS Reverse Burst Timer

- Programs the CTCSS Reverse Burst Timer used when Reverse Burst is enabled in the *Control CTCSS Encoder* command.
- The timer starts at PTT drop time and holds PTT active until it expires.
- The industry standard EIA/TIA-603 lists two formats for CTCSS Reverse Burst: The format used by Motorola is 120 degree phase shift for 180 milliseconds, while the format used by all other manufacturers as well as by aftermarket tone equipment makers is 180 degree phase shift for 150 milliseconds.
- Enter the 2-digit root number, the 4-digit timer number and the reverse burst time.
- Enter 1-5 digits, 0 thru 65535, representing 0.00 to 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select CTCSS Reverse Burst Time for TX1	(PW) 09 0116 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Reverse Burst Time for TX2	(PW) 09 0216 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds
Select CTCSS Reverse Burst Time for TX3	(PW) 09 0316 xxxxx*	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: 0.15 seconds

Examples:
To set the CTCSS Reverse Burst Time to 0.18 seconds for transmitter #2, enter the following command:

```
(PW) 09 0216 18 *
```

Select CTCSS Encoder-Triggered Macros

Assigns macros to be triggered when the CTCSS encoder turns ON and OFF

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- To un-assign a macro that was previously assigned, enter the command but omit the macro name.

Command Form:

Command	Form
Select CTCSS Encoder Inactive-to-Active Macro for TX1	(PW) 26 0111 (macro name) *
Select CTCSS Encoder Active-to-Inactive Macro for TX1	(PW) 26 0112 (macro name) *
Select CTCSS Encoder Inactive-to-Active Macro for TX2	(PW) 26 0211 (macro name) *
Select CTCSS Encoder Active-to-Inactive Macro for TX2	(PW) 26 0212 (macro name) *
Select CTCSS Encoder Inactive-to-Active Macro for TX3	(PW) 26 0311 (macro name) *
Select CTCSS Encoder Active-to-Inactive Macro for TX3	(PW) 26 0312 (macro name) *

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: No CTCSS Encoder Triggered Macros are assigned

Enable/Disable CTCSS Encoder Controls CTCSS Logic Output

Separates the operation of the CTCSS Logic Output from the CTCSS Encoder.

- Most applications either use the CTCSS Logic Output for control of an external CTCSS Encoder or use the 7330 CTCSS Encoder wired to the radio port. A special application might want to use these CTCSS Logic Output signals separately within the controller. This command enables that ability.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable CTCSS Encoder #1 Controls CTCSS Logic Output #1	(PW) 63 0117 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable CTCSS Encoder #2 Controls CTCSS Logic Output #2	(PW) 63 0217 x *	0 = OFF (disabled) 1 = ON (enabled)
Enable/Disable CTCSS Encoder #3 Controls CTCSS Logic Output #3	(PW) 63 0317 x *	0 = OFF (disabled) 1 = ON (enabled)

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All CTCSS Logic Outputs are controlled by CTCSS Encoders (ON, enabled)

Chapter 14

Logic Inputs

The *7330 Controller* supports four uncommitted *Logic Inputs* for detecting changes in conditions from sensors at the repeater site. In addition, the three COR inputs and the three CTCSS inputs are capable of acting as logic inputs in addition to their normal duties or when they are not otherwise required as receiver inputs.

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 may be held high with pullup resistors and must be pulled down by the input device. (See the *Installation Appendix* for details on the hardware configuration.)

Assign Macro To Logic Input

Assigns a macro to be executed by the transition shown.

- Enter the password, the 2-digit root number, the 4-digit event-triggered macro number, and the 4-digit macro name desired. Use leading zeros if needed.
- If you wish to unassign a previously assigned macro, enter just the password, the 2-digit root number, the 4-digit event-triggered macro number, and the (*).

Command Form:

Command	Form
Assign Macro to Logic Input 1 Hi-to-Lo	(PW) 26 0061 (macro name) *
Assign Macro to Logic Input 1 Lo-to-Hi	(PW) 26 0062 (macro name) *
Assign Macro to Logic Input 2 Hi-to-Lo	(PW) 26 0063 (macro name) *
Assign Macro to Logic Input 2 Lo-to-Hi	(PW) 26 0064 (macro name) *
Assign Macro to Logic Input 3 Hi-to-Lo	(PW) 26 0065 (macro name) *
Assign Macro to Logic Input 3 Lo-to-Hi	(PW) 26 0066 (macro name) *
Assign Macro to Logic Input 4 Hi-to-Lo	(PW) 26 0067 (macro name) *
Assign Macro to Logic Input 4 Lo-to-Hi	(PW) 26 0068 (macro name) *
Assign Macro to COR Input 1 Hi-to-Lo	(PW) 26 0115 (macro name) *
Assign Macro to COR Input 1 Lo-to-Hi	(PW) 26 0116 (macro name) *
Assign Macro to COR Input 2 Hi-to-Lo	(PW) 26 0215 (macro name) *
Assign Macro to COR Input 2 Lo-to-Hi	(PW) 26 0216 (macro name) *
Assign Macro to COR Input 3 Hi-to-Lo	(PW) 26 0315 (macro name) *
Assign Macro to COR Input 3 Lo-to-Hi	(PW) 26 0316 (macro name) *
Assign Macro to CTCSS Input 1 Hi-to-Lo	(PW) 26 0117 (macro name) *
Assign Macro to CTCSS Input 1 Lo-to-Hi	(PW) 26 0118 (macro name) *
Assign Macro to CTCSS Input 2 Hi-to-Lo	(PW) 26 0217 (macro name) *
Assign Macro to CTCSS Input 2 Lo-to-Hi	(PW) 26 0218 (macro name) *
Assign Macro to CTCSS Input 3 Hi-to-Lo	(PW) 26 0317 (macro name) *
Assign Macro to CTCSS Input 3 Lo-to-Hi	(PW) 26 0318 (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 0062 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 0062 0701 * (removes message).


(PW) 26 0061 0700 * (programs message).
```

Notes:

Chapter 15
Logic Outputs

The controller has eight *Logic Outputs* that are available for your use in operating auxiliary devices at the repeater site (the three transmitter PTT outputs are not included in the eight logic outputs). In addition, when the *CTCSS Encoder* is not being used, the *CTCSS Logic Output* to each radio port can be controlled. (See *Installation* appendix for configuration details.) These outputs can be latched ON or OFF, or can be momentarily pulsed ON or OFF. LEDs on the Front Panel are lit when the output is in the ON state and off when the output is in the OFF state.

The sense of each logic output can be configured using the *Select Logic Output Inversion* command.

> When *Normal*, "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).

> When *Inverted*, "ON" refers to the state of an output when it is open (floating); "OFF" refers to the state of an output when it is sinking current to ground.

The Momentary commands behave as follows:

<u>ON Delay</u>: If the Logic Output is OFF when a Momentary-OFF command is entered, the output will remain OFF for the duration of the timer and then go ON when it expires.

<u>OFF Delay</u>: If the Logic Output is ON when a Momentary-ON command is entered, the output will remain ON for the duration of the timer and then go OFF when it expires.

<u>ON Interval</u>: If the Logic Output is OFF when a Momentary-ON command is entered, the output will go ON, wait for the timer to expire, then go OFF.

<u>OFF Interval</u>: If the Logic Output is ON when a Momentary-OFF command is entered, the output will go OFF, wait for the timer to expire, then go ON.

The Momentary timers are <u>retriggerable</u>, which means that entering a Momentary ON command while a Momentary-ON timer is running restarts the timer. Likewise, entering a Momentary-OFF command while a Momentary-OFF timer is running restarts the timer.

If you enter a Momentary-ON command while a Momentary-OFF timer is running, the Momentary-OFF function will stop and the Momentary-ON function will start. If you enter a Momentary-OFF command while a Momentary-ON timer is running, the Momentary-ON function will stop and the Momentary-OFF function will start.

A Momentary timer can be canceled by entering an ON or OFF command, which causes the output to latch.

To sum up, the Logic Outputs always obey the last command entered.

The *Logic Output Momentary Timer* can be set for each logic output.

Select Logic Outputs

Controls the specified Logic Outputs.

• List the outputs to be controlled by entering one or more pairs of digits describing the outputs to be controlled.

Command Form:

Command	Form
Select Logic Outputs Latched ON	(PW) 70 (list the outputs) *
Select Logic Outputs Latched OFF	(PW) 71 (list the outputs) *
Select Logic Outputs Momentary ON	(PW) 72 (list the outputs) *
Select Logic Outputs Momentary OFF	(PW) 73 (list the outputs) *

Acknowledgment: Sends *OK* message

Outputs:

Command	Form
Logic Output #1	01
Logic Output #2	02
Logic Output #3	03
Logic Output #4	04
Logic Output #5	05
Logic Output #6	06
Logit Output #7	07
Logic Output #8	08
Port #1 CTCSS Logic Output	09
Port #2 CTCSS Logic Output	10
Port #3 CTCSS Logic Output	11

Note: The CTCSS Logic outputs must be specifically enabled for use, see *Installation Appendix* for details.

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 01 *
```

To turn ON logic output 2, enter:

```
(PW) 70 02 * (Logic output 1 is still ON.)
```

To turn OFF both logic outputs, enter:

```
(PW) 71 01 02 *
```

To momentarily turn ON logic output 1, enter:

```
(PW) 72 01 *
```

To momentarily turn ON both logic outputs, enter:

```
(PW) 72 01 02 *
```

If logic output 2 is ON, you may momentarily turn it OFF by entering:

```
(PW) 73 02 *
```

Select Logic Output Momentary Timer

Programs the momentary time for each logic output.

- Enter the password, the 2-digit root number, the 4-digit timer number, and 1 to 5 digits from 0 to 65535 to set the momentary timer to 0 to 655.35 seconds.

Command Form:

Command	Form	Data Digit
Select Logic Output #1 Momentary Timer	(PW) 09 0000 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #2 Momentary Timer	(PW) 09 0001 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #3 Momentary Timer	(PW) 09 0002 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #4 Momentary Timer	(PW) 09 0003 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #5 Momentary Timer	(PW) 09 0004 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #6 Momentary Timer	(PW) 09 0005 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #7 Momentary Timer	(PW) 09 0006 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Logic Output #8 Momentary Timer	(PW) 09 0007 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Port #1 CTCSS Logic Output Momentary Timer	(PW) 09 0008 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Port #2 CTCSS Logic Output Momentary Timer	(PW) 09 0009 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds
Select Port #3 CTCSS Logic Output Momentary Timer	(PW) 09 0010 xxxxx *	xxxxx = (0-65535) = (0-655.35) seconds

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: Momentary Timer is 0.50 seconds

Select Logic Output Inversion

Controls the inversion of the Logic Outputs.

- When Normal (the default), ON refers to the state of the output when it is sinking current to ground; OFF refers to the state of the output when it is open (floating).
- When Inverted, ON refers to the state of the output when it is open (floating); OFF refers to the state of the output when it is sinking current to ground.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for Normal, 1 for Inverted.

Command Form:

Command	Form	Data Digit
Logic Output #1	(PW) 63 0011 x *	0 = Normal 1 = Inverted
Logic Output #2	(PW) 63 0012 x *	0 = Normal 1 = Inverted
Logic Output #3	(PW) 63 0013 x *	0 = Normal 1 = Inverted
Logic Output #4	(PW) 63 0014 x *	0 = Normal 1 = Inverted
Logic Output #5	(PW) 63 0015 x *	0 = Normal 1 = Inverted
Logic Output #6	(PW) 63 0016 x *	0 = Normal 1 = Inverted
Logic Output #7	(PW) 63 0017 x *	0 = Normal 1 = Inverted
Logic Output #8	(PW) 63 0018 x *	0 = Normal 1 = Inverted
Port #1 CTCSS Logic Output	(PW) 63 0019 x *	0 = Normal 1 = Inverted
Port #2 CTCSS Logic Output	(PW) 63 0020 x *	0 = Normal 1 = Inverted
Port #3 CTCSS Logic Output	(PW) 63 0021 x *	0 = Normal 1 = Inverted

Acknowledgment: Sends *OK* message

Errors:

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

Default Condition: All Logic Outputs are Normal (no inversion).

Notes:

Chapter 16
A-toD Converter Commands

Coming soon!

Notes:

Chapter 17

Software Switches

Overview

Software Switches are one of the basic *datatypes* used within the 7330 controller. Software switches store only two values:

- ON or Enabled or "1"
- OFF or Disabled or "0"

Software switches are used for a variety of configuration and control functions within the controller.

Software Switch Numbering

All Software Switch commands accept a Software Switch Number. The format of the Software Switch Number is:

0pxx

Where:

- *0* is always zero
- *p* is the Port number, 0 = general, not associated with a port, 1 = Port #1, 2 = Port #2, 3 = Port #3.
- *xx* is a software switch number for that port.

For example, software switch 0153 has the following meaning:

- "0" – this digit is always zero
- "1" – this software switch is associated with port 1
- "53" – this is the specific software switch.

Looking this up in the Software Switch Table in Appendix A, you'll see that this Software Switch Number defines the Receiver #3-to-Transmitter #1 Path DTMF Mute Enable described on page 7-16.

Setting and Clearing Software Switches

All software switch commands use this format:

(PW) 63 (switch number) (value) *.

The Root Number for all Software Switch commands is 63.

The Switch Number follows the Root Number and is always a four-digit number as described above.

The Switch Value is a single digit, either 0/OFF/Disabled or 1/ON/Enabled.

Note: Details of each Software Switch are described in the command chapters. A Software Switch Table listing all Software Switches by number is located in Appendix A.

Chapter 18
Counters

Overview

Counters are one of the basic *datatypes* used within the 7330 controller. Counters keep track of various resources in the controller and can have values of 0 thru 65535. In addition, for each counter, there is a *Counter Reload Value* that is used to define an action that should occur at that value.

Counter Numbering

All Counter commands accept a Counter Number. The format of the Counter Number is:

0pxx

Where:

- *0* is always zero
- *p* is the Port number, 0 = general, not associated with a port, 1 = Port #1, 2 = Port #2, 3 = Port #3.
- *xx* is a counter number for that port.

For example, counter number 0302 has the following meaning:

- "0" – this digit is always zero
- "3" – this counter is associated with port 3
- "02" – this is the specific counter.

Looking this up in the Counter Table in Appendix A, you'll see that this Counter Number defines the Receiver #2-to-Transmitter #3 Path End-of-Activity Counter described on page 9-22.

Selecting a Counter Reload Value

All counter reload commands have this format:

(PW) 45 (Counter Number) (Counter Reload Value) *

The Counter Number identifies a specific counter. It is always a four-digit number in the range of 0000 through 9999.

The Counter Reload Value is a one- to five-digit number in the range of 0 through 65535. Entering no value is the same as entering zero.

Chapter 19

Timers

Overview

Timers are one of the basic *datatypes* used within the 7330 controller. There are three types of timers in the 7330, grouped according to resolution:

- 0.01 seconds (10 milliseconds) for high resolution, short timing jobs;
- 0.1 seconds (100 milliseconds) for medium resolution, medium timing jobs; and
- 1 second for low resolution, long timing jobs.

Timer Numbering

All Timer commands accept a Timer Number. The format of the Timer Number is:

rpxx

Where:

- *r* is the resolution digit, 0 = 10ms, 1 = 100ms, 2 = 1sec.
- *p* is the Port number, 0 = general, not associated with a port, 1 = Port #1, 2 = Port #2, 3 = Port #3.
- *xx* is a timer number for that port at that resolution, 00 thru 99.

Timer numbers beginning with 0 have increments of 0.01 seconds (10 milliseconds). They're for short jobs, like timing DTMF digits and Courtesy Delays. Their range is 0 to 655.35 seconds (65535 counts x 0.01 seconds/count). That's a maximum of 10 minutes and 55.35 seconds.

Timer numbers beginning with 1 have increments of 0.1 seconds (100 milliseconds). They're for medium jobs, like the DTMF Long Tone Timer. Their range is 0 to 6553.5 seconds (65535 counts x 0.1 seconds/count). That's a maximum of 109 minutes and 13.5 seconds.

Timer numbers beginning with 2 have increments of 1 second (1000 milliseconds). They're for long jobs, like repeater timeout. Their range is 0 to 65535 seconds (65535 counts x 1 second/count). That's a maximum of 1,092 minutes and 15 seconds, or a little over 18 hours.

For example, timer 2306 has the following meaning:

- "2" – this is a timer with 1 second resolution
- "3" – this timer is associated with port 3
- "06" – this is the specific timer.

Looking this up in the Timer Table in Appendix A, you'll see that this Timer Number defines the Transmitter #3 Identifier Message Interval Timer described on page 12-3.

Exceptions to Range

Since it's possible to create serious system problems by entering values that are too large or too small into certain timers, some Timers have upper and/or lower limits.

For example, you might accidentally enter a value of "1" into a timer that has 10-mS increments, perhaps thinking it had 1-second increments. That won't be much of a problem if it's a courtesy delay timer.

But if it's a DTMF Decoder Interdigit Timer (which sets the maximum allowable time between digits), then setting it to "1" (only 10 milliseconds) would make it impossible for the DTMF decoder to work, so a higher minimum value is enforced by the controller for this specific timer.

For this reason, the timer command won't accept values above or below specific limits for some timers and will send an error message instead. If a timer has these limits, they will be indicated in the timer's description in the manual.

Selecting a Time Value

All timer commands use this format:

(PW) 09 xxxx (time value) *

where xxxx is a four-digit Timer Number as described above.

Note: Details of each Timer are described in the command chapters. A Timer Table listing all Timers by number is located in Appendix A.

Here's an example of a timer command:

(PW) 09 0105 (0.00-655.35 sec.) *

The Root Number for all timer commands is 09.

The Timer Number, 0105 in this example, follows the Root Number and is always a four-digit number.

The Time Value follows the Timer Number and indicates how many time increments we want. The Timer Command allows a variable number of Timer Value digits. One to five digits may be entered.

In this example, the timer has 0.01-second (10 millisecond) increments because the timer number begins with 0. Also, the time value shows two digits to the right of the decimal point.

We can figure out the number of increments we need by dividing the desired time value by the size of the increment. For example, if we want 2.5 seconds, we can divide 2.5 seconds by the increment (0.01 seconds) to get 250 increments. You can do the same thing by moving the decimal point two places to the right. The command would be:

(PW) 09 0105 250 *

Timer commands do not use a "decimal point" character.

Notes:

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:
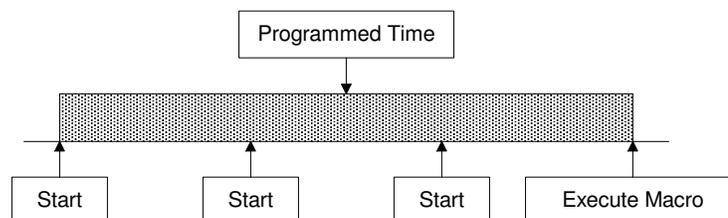
- *Retriggerable* timers are timers that are started and can be restarted during their programmed time. When retriggerable timers do time out, the time period will be the full programmed time from the last restart command:
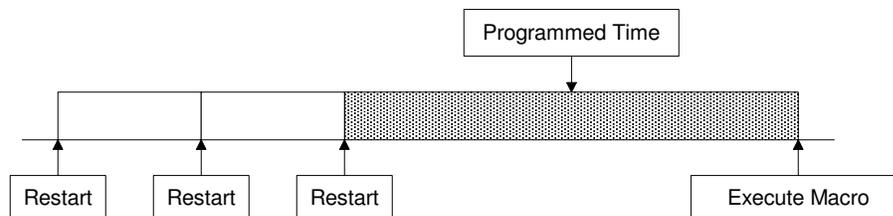
Select Timeout Value

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
Clock and Calendar

The *Controller* features a 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 6-54 for more information.) The clock is also used with the scheduler to execute macros based on the calendar and time. Please see chapter 22*, Scheduler,* for more information on this powerful capability.

The clock and calendar circuit is accurate to ±1 minute per year. 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.* Seconds are optional.
- 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 if not entered.

Command Form:

Command	Form	Data Digit
Set Clock and Calendar	(PW) 25 (year, month, day-of-month, day-of-week, hour, minute, second)*	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
00-59	second (optional)

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 or second greater than 59.

Default Condition: 00:00:00 on Sunday, January 1, 2006. Note that the clock and calendar are only reset if not running during a *Cold Init.*

Example:

Let's set the clock to 6:02 PM on Monday, October 22, 2007.

The year is 07, the month is 10, the day-of-month is 22, the day-of-week is 1, the hour is 18, and the minute is 02. The seconds default to 00. The entire command is:

```
(PW) 25 07 10 22 1 18 02 *
```

Adjust Daylight Saving Time

Forces the clock to add, or subtract, 1-hour.

- For the United States Daylight Saving Time program, see the *Enable/Disable Automatic Daylight Saving Time Adjustment* command on page 21-9.
- This command simplifies the semi-annual job of resetting the clock for customers affected by Daylight Saving 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 Saving 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 22, *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 22, *Scheduler*, for more information on setting a *Scheduler* setpoint.

Select Automatic Daylight Saving Time Adjustment

Enable this option to automatically adjust the clock for Daylight Saving Time in the United States.

- The clock is set forward 1 hour at 2 AM on the second Sunday in March.
- The clock is set back 1 hour at 2 AM on the first Sunday in November.
- For other Daylight Saving Time adjustment dates, see the *Adjust Daylight Saving Time* command on page 21-4.
- Enter the password, the 2-digit root number, the 4-digit software switch number, and one digit, 0 for OFF (disabled), 1 for ON (enabled).

Command Form:

Command	Form	Data Digit
Enable/Disable Automatic Daylight Saving Time Adjustment	(PW) 63 0002 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: OFF (disabled).

Notes:

Chapter 22

Scheduler

The *7330 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.

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 *day* parameter.)

Data Digits	Explanation
00-99	setpoint number, two digits
xxxx	macro, 4 digits
01-12 or 99	month, 2 digits or *wildcard*
01-82 or 99	day, 2 digits (see Day Code Table, page 22-3.)
00-23 or 99	hour, 2 digits or *wildcard*
00-59 or 99	minute, 2 digits or *wildcard*

Scheduler Day Code Table

Day Code	Explanation	Day Code	Explanation
01-31	calendar day-of-month	58	3rd Wednesday of month
32	weekdays (Mon-Fri)	59	3rd Thursday of month
33	weekends (Sat-Sun)	60	3rd Friday of month
34	Sundays	61	3rd Saturday of month
35	Mondays	62	4th Sunday of month
36	Tuesdays	63	4th Monday of month
37	Wednesdays	64	4th Tuesday of month
38	Thursdays	65	4th Wednesday of month
39	Fridays	66	4th Thursday of month
40	Saturdays	67	4th Friday of month
41	1st Sunday of month	68	4th Saturday of month
42	1st Monday of month	69	5th Sunday of month
43	1st Tuesday of month	70	5th Monday of month
44	1st Wednesday of month	71	5th Tuesday of month
45	1st Thursday of month	72	5th Wednesday of month
46	1st Friday of month	73	5th Thursday of month
47	1st Saturday of month	74	5th Friday of month
48	2nd Sunday of month	75	5th Saturday of month
49	2nd Monday of month	76	Last Sunday of month
50	2nd Tuesday of month	77	Last Monday of month
51	2nd Wednesday of month	78	Last Tuesday of month
52	2nd Thursday of month	79	Last Wednesday of month
53	2nd Friday of month	80	Last Thursday of month
54	2nd Saturday of month	81	Last Friday of month
55	3rd Sunday of month	82	Last Saturday of month
56	3rd Monday of month	99	every day (*wild card*)
57	3rd Tuesday of month		

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)
```

To execute macro 1234 at 2:00 AM (02:00) on the last Sunday of October, enter the following:

```
(PW) 28 17 1234 10 76 02 00 *  (Setpoint 17)
```

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).

- Change from standard time to daylight savings time.

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 0001 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 0001 0 *
```

To enable the scheduler, enter the following:

```
(PW) 63 0001 1 *
```

Notes:

Appendix A

Programming Tables

The tables in this section are used to program the controller. Additionally, the *Command Quick Reference* on page A-38 contains a summary of each command.

Message Level Table

Message Levels									
(PW) 10 <message type> <level> * (see page 6-7)									
Level	Value dB	Level	Value dB	Level	Value dB	Level	Value dB	Level	Value dB
00	0.0	20	-10.0	40	-20.0	60	-30.0	80	-40.0
01	-0.5	21	-10.5	41	-20.5	61	-30.5	81	-40.5
02	-1.0	22	-11.0	42	-21.0	62	-31.0	82	-41.0
03	-1.5	23	-11.5	43	-21.5	63	-31.5	83	-41.5
04	-2.0	24	-12.0	44	-22.0	64	-32.0	84	-42.0
05	-2.5	25	-12.5	45	-22.5	65	-32.5	85	-42.5
06	-3.0	26	-13.0	46	-23.0	66	-33.0	86	-43.0
07	-3.5	27	-13.5	47	-23.5	67	-33.5	87	-43.5
08	-4.0	28	-14.0	48	-24.0	68	-34.0	88	-44.0
09	-4.5	29	-14.5	49	-24.5	69	-34.5	89	-44.5
10	-5.0	30	-15.0	50	-25.0	70	-35.0	90	-45.0
11	-5.5	31	-15.5	51	-25.5	71	-35.5	91	-45.5
12	-6.0	32	-16.0	52	-26.0	72	-36.0	92	-46.0
13	-6.5	33	-16.5	53	-26.5	73	-36.5	93	-46.5
14	-7.0	34	-17.0	54	-27.0	74	-37.0	94	-47.0
15	-7.5	35	-17.5	55	-27.5	75	-37.5	95	-47.5
16	-8.0	36	-18.0	56	-28.0	76	-38.0	96	-48.0
17	-8.5	37	-18.5	57	-28.5	77	-38.5	97	-48.5
18	-9.0	38	-19.0	58	-29.0	78	-39.0	98	-49.0
19	-9.5	39	-19.5	59	-29.5	79	-39.5		

Message Control Characters

Message Control Characters		
Control Character	**Definition**	**Page**
9900	CW characters follow	6-10
9901	CW Primary characters follow	6-10
9902	CW Secondary characters follow	6-10
9903	CW Speed Change characters follow	6-12
9904	CW Frequency Change characters follow	6-12
9905	CW Message Level characters follow	6-11
9910	Beep characters follow	6-19
9911	Beep Primary characters follow	6-19
9912	Beep Secondary characters follow	6-19
9913	Beep Message Level characters follow	6-20
9915	Dual-Tone Beep characters follow	6-29
9916	Dual-Tone Beep Primary characters follow	6-29
9917	Dual-Tone Beep Secondary characters follow	6-29
9918	Dual-Tone Beep Message Level characters follow	6-30
9920	Single-Tone page follows	6-36
9930	Two-Tone Sequential page follows	6-38
9940	5/6-tone page follows	6-40
9950	DTMF page follows	6-41
9955	SELCAL page follow	6-49
9960	Speech characters follow	6-51
9961	Speech Primary characters follow	6-51
9962	Speech Secondary characters follow	6-51
9963	Speech Message Level characters follow	6-52
9991	Mixed Audio Allowed	6-4
9992	Non-Mixed Audio Only	6-4
9993	Pause characters follow	6-5
9999	Execute the macro that follows	6-6

CW Character Set Tables

CW Alphanumeric Characters			
Control Character 9900/9901/9902			
Character	Code	Character	Code
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 Speed Change	
Control Character 9900/9901/9902/9903	
Change	Code
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

CW Punctuation and Related Characters

Control Character 9900/9901/9902

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
at-symbol	@	54

CW Frequency Change

Control Character 9900/9901/9902/9904

Change	Code
Frequency	59xxxx *(xxxx = tone code)*

CW Message Level Change

Change	Code
Message Level	9905xx *(xx = Msg Level)*

Beep Character Set Tables

Factory-Fixed Frequency Beeps								
Control Character 9910/9901/9902								
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		
Control Character 9910/9911/9912		
Beep	**Owner-Fixed Frequency (Fill-In)**	**Default Condition**
48		500Hz
49		750Hz
50		1000Hz
51		1250Hz
52		1500Hz
53		1750Hz

Beep Message Level Change

Change	Code
Message Level	9913xx *(xx = Msg Level)*

Beep Gap Change Characters

Control Character 9910/9911/9912	
Beep Gap Change	**Code**
10mS	60
20mS	61
30mS	62
40mS	63
60mS	64
80mS	65
120mS	66
160mS	67
240mS	68
320mS	69

Beep Duration Change Characters

Control Character 9910/9911/9912	
Beep Duration Change	**Code**
10mS	70
20mS	71
30mS	72
40mS	73
60mS	74
80mS	75
120mS	76
160mS	77
240mS	78
320mS	79

Beep Parameters (General)	
Control Character 9910/9911/9912	
Beep Parameter	**Code**
custom beep	57xxxxyy
custom beep delay	58xx
automatic beep gap OFF	55
automatic beep gap ON	56

Dual-Tone Beep Character Set Tables

Factory-Fixed Frequency Beeps								
Control Character 9915/9916/9917								
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

Dual-Tone Beep Parameters	
Control Character 9915/9916/9917	
Beep Parameter	**Code**
custom dual-tone beep	57xxxxyyyyzz
custom beep delay	58xx
automatic beep gap OFF	55
automatic beep gap ON	56

Dual-Tone Beep Gap Change Characters

| Control Character 9915/9916/9917 ||
Beep Gap Change	Code
10mS	60
20mS	61
30mS	62
40mS	63
60mS	64
80mS	65
120mS	66
160mS	67
240mS	68
320mS	69

Dual-Tone Beep Duration Change Characters

| Control Character 9915/9916/9917 ||
Beep Duration Change	Code
10mS	70
20mS	71
30mS	72
40mS	73
60mS	74
80mS	75
120mS	76
160mS	77
240mS	78
320mS	79

Dual-Tone Beep Message Level Change

Change	Code
Message Level	9918xx *(xx = Msg Level)*

DTMF Character Set Tables

DTMF Characters			
Control Character 9950			
DTMF Character	Code	DTMF Character	Code
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	
Control Character 9950	
DTMF Duration Change	Code
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 (10-990mS)	50xx	0199 x 10mS
custom DTMF duration change (100-9900mS)	51xx	0199 x 100mS
custom DTMF gap change (10-990mS)	52xx	0199 x 10mS
custom DTMF gap change (100-9900mS)	53xx	0199 x 100mS
custom DTMF pause (10-990mS)	54xx	0199 x 10mS
custom DTMF pause (100-9900mS)	55xx	0199 x 100mS
to ignore each custom DTMF change code		enter 00 for xx in any of above codes

SELCAL Character Set Tables

SELCAL Characters		
Designation	**Frequency Hz**	**Digit Code**
Red A	312.6	00
Red B	346.7	01
Red C	384.6	02
Red D	426.6	03
Red E	473.2	04
Red F	524.8	05
Red G	582.1	06
Red H	645.7	07
Red J	716.1	08
Red K	794.3	09
Red L	881	10
Red M	977.2	11
Red P	1083.9	12
Red Q	1202.3	13
Red R	1333.5	14
Red S	1479.1	15

Speech Character Set Tables

Speech Message Level Change	
Change	**Code**
Message Level	9963xx *(xx = Msg Level)*

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Synthesized Speech Vocabulary

Control Character 9960/9961/9962

Numbers

Word	Code	Word	Code	Word	Code	Word	Code
zero	0000	sixth	0012	twelve	0023	twentieth	0034
one	0001	seven	0013	twelfth	0024	thirty	0035
first	0002	seventh	0014	thirteen	0025	forty	0036
two	0003	eight	0015	fourteen	0026	fifty	0037
second	0004	eighth	0016	fifteen	0027	sixty	0038
three	0005	nine	0017	sixteen	0028	seventy	0039
third	0006	niner	0018	sixteenth	0029	eighty	0040
four	0007	ninth	0019	seventeen	0030	ninety	0041
fourth	0008	ten	0020	eighteen	0031	hundred	0042
five	0009	tenth	0021	nineteen	0032	thousand	0043
fifth	0010	eleven	0022	twenty	0033	million	0044
six	0011						

Letters

Word	Code	Word	Code	Word	Code	Word	Code
A	0045	H	0052	O	0059	U	0065
B	0046	I	0053	P	0060	V	0066
C	0047	J	0054	Q	0061	W	0067
D	0048	K	0055	R	0062	X	0068
E	0049	L	0056	S	0063	Y	0069
F	0050	M	0057	T	0064	Z	0070
G	0051	N	0058				

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Synthesized Speech Vocabulary

Control Character 9960/9961/9962

Calendar

Word	Code	Word	Code	Word	Code	Word	Code
January	0071	Sunday	0083	day	0096	today	0109
February	0072	Monday	0084	days	0097	tomorrow	0110
March	0073	Tuesday	0085	hour	0098	tonight	0111
April	0074	Wednesday	0086	hours	0099	yesterday	0112
May	0075	Thursday	0087	minute	0100	weekday	0113
June	0076	Friday	0088	minutes	0101	weekend	0114
July	0077	Saturday	0089	second	0102	weekly	0115
August	0078	date	0090	seconds	0103	AM	0116
September	0079	time	0091	week	0104	PM	0117
October	0080	year	0092	morning	0105	noon	0118
November	0081	yearly	0093	afternoon	0106	oclock	0119
December	0082	month	0094	evening	0107	zulu	0120
		monthly	0095	night	0108		

Measurements

Word	Code	Word	Code	Word	Code	Word	Code
feet	0121	micro	0129	point	0137	Hertz	0145
meter	0122	milli	0130	Amps	0138	ohm	0146
meters	0123	kilo	0131	byte	0139	percent	0147
inch	0124	mega	0132	Celsius	0140	power	0148
mile	0125	minus	0133	current	0141	voltage	0149
miles	0126	plus	0134	degree	0142	volts	0150
pico	0127	decimal	0135	degrees	0143	watt	0151
nano	0128	dot	0136	Farenheit	0144	watts	0152

Places

Word	Code	Word	Code	Word	Code	Word	Code
Colorado	153	conifer	154	Denver	155		

Synthesized Speech Vocabulary

Control Character 9960/9961/9962

Miscellaneous

Word	Code	Word	Code	Word	Code	Word	Code
activated	0201	club	0236	good_bye	0271	net	0307
activating	0202	code	0237	ham	0272	new	0308
active	0203	com	0238	hamfest	0273	next	0309
alarm	0204	complete	0239	have	0274	no	0310
alert	0205	contact	0240	hello	0275	not	0311
all	0206	control	0241	help	0276	number	0312
amateur	0207	controller	0242	high	0277	of	0313
amateurs	0208	CTCSS	0243	hold	0278	off	0314
amplifier	0209	decrease	0244	http_www	0279	on	0315
an	0210	decreasing	0245	identifier	0280	open	0316
analog	0211	dialing	0246	idle	0281	operator	0317
and	0212	disable	0247	if	0282	other	0318
antenna	0213	disabled	0248	in	0283	ouch	0319
are	0214	door	0249	increase	0284	our	0320
as	0215	doors	0250	information	0286	out	0321
Ares	0216	down	0251	is	0287	over	0322
ask	0217	DTMF	0252	it	0288	page	0323
association	0218	duhhhh	0253	key	0289	partially	0324
at	0219	enable	0254	less_than	0290	pass	0325
audio	0220	enabled	0255	light	0291	passed	0326
auto	0221	enter	0256	lights	0292	patch	0327
autopatch	0222	email	0257	line	0293	path	0328
band	0223	equal	0258	link	0294	per	0329
base	0224	erase	0259	list	0295	phone	0330
battery	0225	erased	0260	low	0296	please	0331
beer	0226	error	0261	lower	0297	police	0332
brew	0227	exit	0262	machine	0298	pound	0333
busy	0228	failure	0263	man	0299	priority	0334
call	0229	for	0264	manual	0300	radio	0335
calling	0230	frequency	0265	meet	0301	radios	0336
cancel	0231	from	0266	meeting	0302	ready	0337
change	0232	full	0267	messages	0303	receive	0338
check	0233	gate	0268	mobile	0304	receiver	0339
clock	0234	get	0269	more_than	0305	remote	0340
closed	0235	go	0270	negative	0306	repeat	0341

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Synthesized Speech Vocabulary

Control Character 9960/9961/9962

Miscellaneous

Word	Code	Word	Code	Word	Code	Word	Code
repeater	0342	telephone	0353	transmit	0364	way	0375
road	0343	temperature	0354	transmitter	0365	we	0376
select	0344	test	0355	under	0366	weather	0377
service	0345	the	0356	until	0367	welcome	0378
set	0346	the2	0357	up	0368	will	0379
star	0347	this	0358	use	0369	windows	0380
start	0348	this_is	0359	use2	0370	with	0381
stop	0349	timer	0360	verify	0371	wrong	0382
switch	0350	times	0361	wait	0372	you	0383
system	0351	too	0362	warning	0373	your	0384
teen	0352	tool	0363	watch	0374	you_ve	0385

Message Run-Time Variables

Run-Time Variable	Meaning	Example
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, speech	two forty-five
9821	AM/PM, speech	PM
9824	hour & minute, 24-hr format, speech	14 hours, 45 minutes
9825	same as 9824 without "hours" & "minutes"	fourteen forty-five
9826	day of week, speech	Wednesday
9827	cardinal day-of-month, speech	One
9828	ordinal day-of-month, speech	First
9829	month, speech	January
9831	"morning/afternoon/evening", speech	Afternoon
9832	Seconds, speech	Twenty-seven
98XX	Analog Inputs	NOT IN BETA
9896	Call Count, CW	105
9897	Call Count, speech	One zero five
9898	Software Version, CW	300
9899	Software Version, speech	Three point zero zero

Scheduler Day Code Table

Day Code	Explanation	Day Code	Explanation
01-31	calendar day-of-month	58	3rd Wednesday of month
32	weekdays (Mon-Fri)	59	3rd Thursday of month
33	weekends (Sat-Sun)	60	3rd Friday of month
34	Sundays	61	3rd Saturday of month
35	Mondays	62	4th Sunday of month
36	Tuesdays	63	4th Monday of month
37	Wednesdays	64	4th Tuesday of month
38	Thursdays	65	4th Wednesday of month
39	Fridays	66	4th Thursday of month
40	Saturdays	67	4th Friday of month
41	1st Sunday of month	68	4th Saturday of month
42	1st Monday of month	69	5th Sunday of month
43	1st Tuesday of month	70	5th Monday of month
44	1st Wednesday of month	71	5th Tuesday of month
45	1st Thursday of month	72	5th Wednesday of month
46	1st Friday of month	73	5th Thursday of month
47	1st Saturday of month	74	5th Friday of month
48	2nd Sunday of month	75	5th Saturday of month
49	2nd Monday of month	76	Last Sunday of month
50	2nd Tuesday of month	77	Last Monday of month
51	2nd Wednesday of month	78	Last Tuesday of month
52	2nd Thursday of month	79	Last Wednesday of month
53	2nd Friday of month	80	Last Thursday of month
54	2nd Saturday of month	81	Last Friday of month
55	3rd Sunday of month	82	Last Saturday of month
56	3rd Monday of month	99	every day (*wild card*)
57	3rd Tuesday of month		

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Tone Code Table

Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code
260	0000	460	0040	660	0080	860	0120	1060	0160	1260	0200
265	0001	465	0041	665	0081	865	0121	1065	0161	1265	0201
270	0002	470	0042	670	0082	870	0122	1070	0162	1270	0202
275	0003	475	0043	675	0083	875	0123	1075	0163	1275	0203
280	0004	480	0044	680	0084	880	0124	1080	0164	1280	0204
285	0005	485	0045	685	0085	885	0125	1085	0165	1285	0205
290	0006	490	0046	690	0086	890	0126	1090	0166	1290	0206
295	0007	495	0047	695	0087	895	0127	1095	0167	1295	0207
300	0008	500	0048	700	0088	900	0128	1100	0168	1300	0208
305	0009	505	0049	705	0089	905	0129	1105	0169	1305	0209
310	0010	510	0050	710	0090	910	0130	1110	0170	1310	0210
315	0011	515	0051	715	0091	915	0131	1115	0171	1315	0211
320	0012	520	0052	720	0092	920	0132	1120	0172	1320	0212
325	0013	525	0053	725	0093	925	0133	1125	0173	1325	0213
330	0014	530	0054	730	0094	930	0134	1130	0174	1330	0214
335	0015	535	0055	735	0095	935	0135	1135	0175	1335	0215
340	0016	540	0056	740	0096	940	0136	1140	0176	1340	0216
345	0017	545	0057	745	0097	945	0137	1145	0177	1345	0217
350	0018	550	0058	750	0098	950	0138	1150	0178	1350	0218
355	0019	555	0059	755	0099	955	0139	1155	0179	1355	0219
360	0020	560	0060	760	0100	960	0140	1160	0180	1360	0220
365	0021	565	0061	765	0101	965	0141	1165	0181	1365	0221
370	0022	570	0062	770	0102	970	0142	1170	0182	1370	0222
375	0023	575	0063	775	0103	975	0143	1175	0183	1375	0223
380	0024	580	0064	780	0104	980	0144	1180	0184	1380	0224
385	0025	585	0065	785	0105	985	0145	1185	0185	1385	0225
390	0026	590	0066	790	0106	990	0146	1190	0186	1390	0226
395	0027	595	0067	795	0107	995	0147	1195	0187	1395	0227
400	0028	600	0068	800	0108	1000	0148	1200	0188	1400	0228
405	0029	605	0069	805	0109	1005	0149	1205	0189	1405	0229
410	0030	610	0070	810	0110	1010	0150	1210	0190	1410	0230
415	0031	615	0071	815	0111	1015	0151	1215	0191	1415	0231
420	0032	620	0072	820	0112	1020	0152	1220	0192	1420	0232
425	0033	625	0073	825	0113	1025	0153	1225	0193	1425	0233
430	0034	630	0074	830	0114	1030	0154	1230	0194	1430	0234
435	0035	635	0075	835	0115	1035	0155	1235	0195	1435	0235
440	0036	640	0076	840	0116	1040	0156	1240	0196	1440	0236
445	0037	645	0077	845	0117	1045	0157	1245	0197	1445	0237
450	0038	650	0078	850	0118	1050	0158	1250	0198	1450	0238
455	0039	655	0079	855	0119	1055	0159	1255	0199	1455	0239

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Tone Code Table

Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code
1460	0240	1660	0280	1860	0320	2060	0360	2260	0400	2460	0440
1465	0241	1665	0281	1865	0321	2065	0361	2265	0401	2465	0441
1470	0242	1670	0282	1870	0322	2070	0362	2270	0402	2470	0442
1475	0243	1675	0283	1875	0323	2075	0363	2275	0403	2475	0443
1480	0244	1680	0284	1880	0324	2080	0364	2280	0404	2480	0444
1485	0245	1685	0285	1885	0325	2085	0365	2285	0405	2485	0445
1490	0246	1690	0286	1890	0326	2090	0366	2290	0406	2490	0446
1495	0247	1695	0287	1895	0327	2095	0367	2295	0407	2495	0447
1500	0248	1700	0288	1900	0328	2100	0368	2300	0408	2500	0448
1505	0249	1705	0289	1905	0329	2105	0369	2305	0409	2505	0449
1510	0250	1710	0290	1910	0330	2110	0370	2310	0410	2510	0450
1515	0251	1715	0291	1915	0331	2115	0371	2315	0411	2515	0451
1520	0252	1720	0292	1920	0332	2120	0372	2320	0412	2520	0452
1525	0253	1725	0293	1925	0333	2125	0373	2325	0413	2525	0453
1530	0254	1730	0294	1930	0334	2130	0374	2330	0414	2530	0454
1535	0255	1735	0295	1935	0335	2135	0375	2335	0415	2535	0455
1540	0256	1740	0296	1940	0336	2140	0376	2340	0416	2540	0456
1545	0257	1745	0297	1945	0337	2145	0377	2345	0417	2545	0457
1550	0258	1750	0298	1950	0338	2150	0378	2350	0418	2550	0458
1555	0259	1755	0299	1955	0339	2155	0379	2355	0419	2555	0459
1560	0260	1760	0300	1960	0340	2160	0380	2360	0420	2560	0460
1565	0261	1765	0301	1965	0341	2165	0381	2365	0421	2565	0461
1570	0262	1770	0302	1970	0342	2170	0382	2370	0422	2570	0462
1575	0263	1775	0303	1975	0343	2175	0383	2375	0423	2575	0463
1580	0264	1780	0304	1980	0344	2180	0384	2380	0424	2580	0464
1585	0265	1785	0305	1985	0345	2185	0385	2385	0425	2585	0465
1590	0266	1790	0306	1990	0346	2190	0386	2390	0426	2590	0466
1595	0267	1795	0307	1995	0347	2195	0387	2395	0427	2595	0467
1600	0268	1800	0308	2000	0348	2200	0388	2400	0428	2600	0468
1605	0269	1805	0309	2005	0349	2205	0389	2405	0429	2605	0469
1610	0270	1810	0310	2010	0350	2210	0390	2410	0430	2610	0470
1615	0271	1815	0311	2015	0351	2215	0391	2415	0431	2615	0471
1620	0272	1820	0312	2020	0352	2220	0392	2420	0432	2620	0472
1625	0273	1825	0313	2025	0353	2225	0393	2425	0433	2625	0473
1630	0274	1830	0314	2030	0354	2230	0394	2430	0434	2630	0474
1635	0275	1835	0315	2035	0355	2235	0395	2435	0435	2635	0475
1640	0276	1840	0316	2040	0356	2240	0396	2440	0436	2640	0476
1645	0277	1845	0317	2045	0357	2245	0397	2445	0437	2645	0477
1650	0278	1850	0318	2050	0358	2250	0398	2450	0438	2650	0478
1655	0279	1855	0319	2055	0359	2255	0399	2455	0439	2655	0479

Tone Code Table

Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code	Freq	Code
2660	0480	2720	0492	2780	0504	2840	0516	2900	0528	2960	0540
2665	0481	2725	0493	2785	0505	2845	0517	2905	0529	2965	0541
2670	0482	2730	0494	2790	0506	2850	0518	2910	0530	2970	0542
2675	0483	2735	0495	2795	0507	2855	0519	2915	0531	2975	0543
2680	0484	2740	0496	2800	0508	2860	0520	2920	0532	2980	0544
2685	0485	2745	0497	2805	0509	2865	0521	2925	0533	2985	0545
2690	0486	2750	0498	2810	0510	2870	0522	2930	0534	2990	0546
2695	0487	2755	0499	2815	0511	2875	0523	2935	0535	2995	0547
2700	0488	2760	0500	2820	0512	2880	0524	2940	0536	3000	0548
2705	0489	2765	0501	2825	0513	2885	0525	2945	0537		
2710	0490	2770	0502	2830	0514	2890	0526	2950	0538		
2715	0491	2775	0503	2835	0515	2895	0527	2955	0539		

Root Numbers (Commands) by Number

Number	Page	Description
02		Control CTCSS Encoder
03		Select Frequency of CTCSS Encoder
06		Select Frequency of CW and Beeps
08		Set Beep Durations and Gap Defaults
09		Set Timer Value
10		Select Messaging Level
12		Select CW Speed
15		Send Message
16		Stop Speech In Progress
20		Create New Macro
21		Erase Macro
22		Erase All Macros
23		Assign Autopatch Password
24		Remove Last Command From Macro
25		Set Clock and Calendar
26		Set Event-Triggered Macro *(See table page A-24.)*
27		Rename Macro
28		Create Scheduler Setpoint
29		Append to Macro
31		Select Message *(See table page A-27.)*
33		List Macro in CW
34		Review Message *(See table page A-27.)*
35		List Macro in Speech
39 02		Assign Remote Base Password
39 90		Select *RBI-1* Number of User Function Outputs in Group
39 91		Reset *RBI-1*
45		Set Counter Value
48		Adjust Daylight Savings Time
49		Select and Control User Timers
50		Select Identifier Tail Message
57		Select Path *(See table page A-29.)*
60		Select Autopatch Call Types
61		Select Autopatch Dialing Mode
63		Enable/Disable Software Switches *(See page A-30.)*
64		Select Phone Line Answer Mode
65		Select Autopatch Timeout Timer
67		Enter/Clear Autopatch Reject Number Table
68		Enter/Clear Autopatch Accepted Number Table
69		Clear Autopatch Call Counter
70		Select Logic Outputs Latched ON
71		Select Logic Outputs Latched OFF
72		Select Logic Outputs Momentary ON
73		Select Logic Outputs Momentary OFF

Root Numbers (Commands) by Number		
Number	**Page**	**Description**
76		If-Then-Else
79		Select Phone Line Off-Hook Timer
81		Reset Autopatch Timeout Timer
83		Dump Autopatch Using A Code
83 1		Landline Hookflash
83 2		Autopatch Go Off-Hook
83 3		Autopatch Go Off-Hook, Ignore Busy Logic Input
83 10		Select/Delete Autopatch Dialing Prefix
84		Autopatch Redial Last Number
85		Clear Autopatch Redialer
86		Send Autopatch Call Count in CW
87		Trigger Reverse Patch
88		Answer Reverse Patch
90		Select Path Priority
91		Select Command Response Message Routing
92		Assign Control Operator Password
93		Assign Master Password
94		Assign Control Operator Privilege level

Event Macros By Number		
Assign with (PW) 26 (number) (macro name) * Erase with (PW) 26 (number) *		
General Event Macros		
Number	**Page**	**Description**
0000	5-23	Power-On Reset Macro
0001	TBD	Battery Good-to-Not-Good Macro
0010	TBD	Any-Receiver-Active-to-Autopatch-Triggered Macro
0011	TBD	All-Receiver-Inactive-to-Autopatch-Triggered Macro
0012	TBD	Autopatch Access-Triggered Macro
0013	TBD	Autopatch Down-Triggered Macro
0014	TBD	Phone Line Answer Macro
0015	TBD	Star/Pound Talkout
0016	TBD	LL, Start of each Ring Detection
0017	TBD	Control Line Dump Macro
0021	TBD	Autopatch Access-From-Rx1-Triggered Macro
0022	TBD	Autopatch Access-From-Rx2-Triggered Macro
0023	TBD	Autopatch Access-From-Rx3-Triggered Macro
0030	TBD	activated by Doug Hall Remote Base PW 0 *
0031	TBD	activated by Doug Hall Remote Base PW 1 *
0032	TBD	used by Doug Hall Remote Base
0033	TBD	used by Doug Hall Remote Base
0034	TBD	used by Doug Hall Remote Base
0035	TBD	used by Doug Hall Remote Base
0036	TBD	used by Doug Hall Remote Base
0037	TBD	used by Doug Hall Remote Base
0038	TBD	used by Doug Hall Remote Base
0039	TBD	used by Doug Hall Remote Base
0061	14-2	Logic Input 1 Hi-to-Lo Macro
0062	14-2	Logic Input 1 Lo-to-Hi Macro
0063	14-2	Logic Input 2 Hi-to-Lo Macro
0064	14-2	Logic Input 2 Lo-to-Hi Macro
0065	14-2	Logic Input 3 Hi-to-Lo Macro
0066	14-2	Logic Input 3 Lo-to-Hi Macro
0067	14-2	Logic Input 4 Hi-to-Lo Macro
0068	14-2	Logic Input 4 Lo-to-Hi Macro

Event Macros By Number		
Assign with (PW) 26 (number) (macro name) * Erase with (PW) 26 (number) *		
Port-Specific Event Macros Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number		
Number	**Page**	**Description**
0x00	7-24	DTMF Decoder Any Long Tone Macro
0x01	7-25	DTMF Decoder Digit-Decoded Macro
0x02	11-20	Any-Path-Active To TXx Macro
0x03	11-20	All-Paths-Inactive To TXx Macro
0x04	11-9	TXx Dropout Macro
0x05	11-11	PTT Inactive-to-Active Macro
0x06	11-11	PTT Active-to-Inactive Before Unkey Delay Macro
0x07	11-11	PTT Active-to-Inactive After Unkey Delay Macro
0x08	12-7	Initial ID Macro
0x09	12-7	Polite ID Macro
0x10	12-7	Impolite ID Macro
0x11	13-9	CTCSS Encoder Inactive-to-Active Macro
0x12	13-9	CTCSS Encoder Active-to-Inactive Macro
0x13	11-16	TX Start-of-Activity Macro
0x14	11-16	TX End-of-Activity Macro
0x15	10-14	COR Input Hi-to-Lo Macro
0x16	10-14	COR Input Lo-to-Hi Macro
0x17	10-15	CTCSS Input Hi-to-Lo Macro
0x18	10-15	CTCSS Input Lo-to-Hi Macro
0x19	11-6	Courtesy Delay Violation Macro for TX
0x22	9-21	Courtesy Macro for Path RX1-to-TX
0x23	9-21	Courtesy Macro for Path RX2-to-TX
0x24	9-21	Courtesy Macro for Path RX3-to-TX
0x30	9-17	Timeout Macro for Path RX1-to-TX
0x31	9-17	Timeout Macro for Path RX2-to-TX
0x32	9-17	Timeout Macro for Path RX3-to-TX
0x38	9-18	Timeout-End Macro for Path RX1-to-TX
0x39	9-18	Timeout-End Macro for Path RX2-to-TX
0x40	9-18	Timeout-End Macro for Path RX3-to-TX
0x46	9-25	Start-of-Activity Macro for Path RX1-to-TX
0x47	9-25	Start-of-Activity Macro for Path RX2-to-TX
0x48	9-25	Start-of-Activity Macro for Path RX3-to-TX
0x54	9-25	End-of-Activity Macro for Path RX1-to-TX
0x55	9-25	End-of-Activity Macro for Path RX2-to-TX
0x56	9-25	End-of-Activity Macro for Path RX3-to-TX
0x71	10-17	COR Pulse-Triggered Macro for 1 Pulse for RX
0x72	10-17	COR Pulse-Triggered Macro for 2 Pulse for RX
0x73	10-17	COR Pulse-Triggered Macro for 3 Pulse for RX
0x74	10-17	COR Pulse-Triggered Macro for 4 Pulse for RX

Event Macros By Number		
Assign with (PW) 26 (number) (macro name) * Erase with (PW) 26 (number) *		
Port-Specific Event Macros Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number		
Number	**Page**	**Description**
0x75	10-17	COR Pulse-Triggered Macro for 5 Pulse for RX
0x76	10-17	COR Pulse-Triggered Macro for 6 Pulse for RX
0x77	10-17	COR Pulse-Triggered Macro for 7 Pulse for RX
0x78	10-17	COR Pulse-Triggered Macro for 8 Pulse for RX
0x79	10-17	COR Pulse-Triggered Macro for 9 Pulse for RX
0x84	7-22	DTMF Decoder Long Tone 0 Macro
0x85	7-22	DTMF Decoder Long Tone 1 Macro
0x86	7-22	DTMF Decoder Long Tone 1 Macro
0x87	7-22	DTMF Decoder Long Tone 3 Macro
0x88	7-22	DTMF Decoder Long Tone 4 Macro
0x89	7-22	DTMF Decoder Long Tone 5 Macro
0x90	7-22	DTMF Decoder Long Tone 6 Macro
0x91	7-22	DTMF Decoder Long Tone 7 Macro
0x92	7-22	DTMF Decoder Long Tone 8 Macro
0x93	7-22	DTMF Decoder Long Tone 9 Macro
0x94	7-22	DTMF Decoder Long Tone A Macro
0x95	7-22	DTMF Decoder Long Tone B Macro
0x96	7-22	DTMF Decoder Long Tone C Macro
0x97	7-22	DTMF Decoder Long Tone D Macro
0x98	7-22	DTMF Decoder Long Tone * Macro
0x99	7-22	DTMF Decoder Long Tone # Macro

Messages By Number				
Assign with (PW) 31 (number) (message contents) * Review with (PW) 34 (number) *				
Page	**Number**	**Description**		**Default**
General Purpose Messages				
6-61	0000	Reset message		?RES in CW
7-6	0001	OK message		OK in CW
7-6	0002	Error 1 (Digit Count Error) message		?ERR1 in CW
7-6	0003	Error 2 (Data Error) message		?ERR2 in CW
TBD	0004	Autopatch Dialing Message		TBD
TBD	0005	Autopatch Timeout Warning Message		TBD
TBD	0006	Landline Busy Message		TBD
TBD	0007	Autopatch/RP Dump Message		TBD
TBD	0008	Autopatch/RP Off Message		TBD
TBD	0009	Autopatch/RP Error Message		TBD
TBD	0010	Autopatch/RP Error1 Message		TBD
TBD	0011	Autopatch Redialer Clear Message		TBD
TBD	0012	Landline answer message		TBD
TBD	0013	Landline ringout message		TBD
TBD	0014	Doug Hall "OFF" Message		TBD
6-56	0015	User Message #1		None
6-56	0016	User Message #2		None
6-56	0017	User Message #3		None
6-56	0018	User Message #4		None
6-56	0019	User Message #5		None
6-56	0020	User Message #6		None
6-56	0021	User Message #7		None
6-56	0022	User Message #8		None
6-56	0023	User Message #9		None
6-56	0024	User Message #10		None

Messages By Number			
Assign with (PW) 31 (number) (message contents) * Review with (PW) 34 (number) *			
Page	**Number**	**Description**	**Default**
Port-Specific Messages Replace the "x" with the Port/Rx/Tx Number			
9-19	0x00	Path 1x (RX1-TXx) Courtesy Message	Beep
9-19	0x01	Path 2x (RX2-TXx) Courtesy Message	Beep
9-19	0x02	Path 3x (RX3-TXx) Courtesy Message	Beep
9-13	0x03	Path 1x (RX1-TXx) Timeout Message	TO in CW
9-13	0x04	Path 2x (RX2-TXx) Timeout Message	TO in CW
9-13	0x05	Path 3x (RX3-TXx) Timeout Message	TO in CW
9-15	0x06	Path 1x (RX1-TXx) Timeout End Message	TO in CW
9-15	0x07	Path 2x (RX2-TXx) Timeout End Message	TO in CW
9-15	0x08	Path 3x (RX3-TXx) Timeout End Message	TO in CW
12-5	0x09	TXx Initial ID Message	ID in CW
12-5	0x10	TXx Normal ID Message	ID in CW
12-5	0x11	TXx Impolite ID Message	ID in CW
11-8	0x12	TXx Dropout Message	None

10ms Timers By Number		
Assign with (PW) 09 (number) (value) *		
General Purpose Timers		
Number	**Page**	**Description**
0000	15-5	Logic Output #1 Momentary time
0001	15-5	Logic Output #2 Momentary time
0002	15-5	Logic Output #3 Momentary time
0003	15-5	Logic Output #4 Momentary time
0004	15-5	Logic Output #5 Momentary time
0005	15-5	Logic Output #6 Momentary time
0006	15-5	Logic Output #7 Momentary time
0007	15-5	Logic Output #8 Momentary time
0008	15-5	CTCSS #1 Logic Output Momentary time
0009	15-5	CTCSS #2 Logic Output Momentary time
0010	15-5	CTCSS #3 Logic Output Momentary time

10ms Timers By Number

Assign with (PW) 09 (number) (value) *

Port-Specific Timers
Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number

Number	Page	Description
0x00	11-5	TXx Courtesy Delay
0x01	11-7	TXx Dropout Delay
0x02	11-10	TXx PTT Minimum Unkey Delay
0x03	11-4	TXx Turn-On Delay Value
0x04	7-13	DTMF Decoder Interdigit Time
0x05	7-18	DTMF Decoder Mute Hang Time, First Digit
0x06	7-19	DTMF Decoder Mute Hang Time, Other Digits
0x07	7-11	DTMF Decoder Disconnect Time
0x08	7-9	DTMF Decoder AntiFalsing Time
0x09	10-11	CORx Antikerchunk Key-Up Delay
0x10	10-19	COR Pulse-Triggered Macro Minimum
0x11	10-19	COR Pulse-Triggered Macro Maximum Gap
0x12	10-6	COR Filtering Delay
0x13	10-7	CTCSS Filtering Delay
0x14	6-33	Message Handler End-of-Page Delay Value
0x15	13-7	CTCSS Encoder Time Value
0x16	13-8	CTCSS Encoder Reverse Burst Time Value
0x17	10-9	RXx Audio Gate Delay Timer Value
0x18	10-8	RXx Flutter Filter Timer Value

100ms Timers By Number		
Assign with (PW) 09 (number) (value) *		
Port-Specific Timers Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number		
Number	**Page**	**Description**
1x00	9-10	Path 1x (RX1-TXx) Timeout Penalty Value
1x01	9-10	Path 2x (RX2-TXx) Timeout Penalty Value
1x02	9-10	Path 3x (RX3-TXx) Timeout Penalty Value
1x03	7-21	DTMF Decoder Long Tone Timer

1 Second Timers By Number

Assign with (PW) 09 (number) (value) *

Port-Specific Timers
Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number

Number	Page	Description
2x00	9-8	Path 1x (RX1-TXx) Timeout
2x01	9-8	Path 2x (RX2-TXx) Timeout
2x02	9-8	Path 3x (RX3-TXx) Timeout
2x03	9-22	Path 1x End-of-Activity Time Value
2x04	9-22	Path 2x End-of-Activity Time Value
2x05	9-22	Path 3x End-of-Activity Time Value
2x06	12-3	TXx ID Interval Time Value
2x07	12-4	TXx ID Pending Time Value
2x08	11-18	TXx Timed Key
2x09	10-12	CORx Antikerchunk Re-Arm Delay
2x10	11-14	TXx End-of-Activity Time Value

Path Access Mode by Number

(PW) 57 (number) (mode) *

Number	Page	Description
Receiver-to-DTMF Decoder Path Access Mode		
1	7-7	Rx1-to-DTMF Decoder #1 Access Mode
2	7-7	Rx2-to-DTMF Decoder #2 Access Mode
3	7-7	Rx3-to-DTMF Decoder #3 Access Mode
Receiver-to-Transmitter Path Access Mode		
11	9-2	Rx1-to-Tx1 Access Mode (Path1)
21	9-2	Rx2-to-Tx1 Access Mode (Path2)
32	9-2	Rx3-to-Tx1 Access Mode (Path3)
12	9-2	Rx1-to-Tx2 Access Mode (Path4)
22	9-2	Rx2-to-Tx2 Access Mode (Path5)
32	9-2	Rx3-to-Tx2 Access Mode (Path6)
13	9-2	Rx1-to-Tx2 Access Mode (Path4)
23	9-2	Rx2-to-Tx2 Access Mode (Path5)
33	9-2	Rx3-to-Tx2 Access Mode (Path6)

Software Switches By Number		
Assign with (PW) 63 (number) (1/0) *		
General Purpose Switches		
Number	**Page**	**Description**
0000	4-6	Front Panel Enable
0001	22-7	Scheduler Enable
0011	15-6	Logic Output Inversion 1
0012	15-6	Logic Output Inversion 2
0013	15-6	Logic Output Inversion 3
0014	15-6	Logic Output Inversion 4
0015	15-6	Logic Output Inversion 5
0016	15-6	Logic Output Inversion 6
0017	15-6	Logic Output Inversion 7
0018	15-6	Logic Output Inversion 8
0019	15-6	CTCSS Logic Output Inversion 1
0020	15-6	CTCSS Logic Output Inversion 2
0021	15-6	CTCSS Logic Output Inversion 3
0090	5-20	User Switch 90
0091	5-20	User Switch 91
0092	5-20	User Switch 92
0093	5-20	User Switch 93
0094	5-20	User Switch 94
0095	5-20	User Switch 95
0096	5-20	User Switch 96
0097	5-20	User Switch 97
0098	5-20	User Switch 98
0099	5-20	User Switch 99

Software Switches By Number		
Assign with (PW) 63 (number) (1/0) *		
Port-Specific Switches Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number		
Number	**Page**	**Description**
0x00	7-3	Command Response Enable
0x01	7-4	OK Command Response Enable
0x02	7-5	Error Command Response Enable
0x03	7-15	Command Execution on End of Transmission
0x04	7-12	Command Execution on Interdigit Timer
0x05	7-10	DTMF Disconnect Timer Enable
0x06	7-20	DTMF Long Tone Enable
0x07	7-14	Command Execution on 4th Digit
0x08	10-5	CORx Simulate Req
0x09	10-5	CTCSSx Simulate Req
0x10	10-10	Anti-Kerchunker Enable
0x11	10-13	Anti-Kerchunk No Hangtime Mode
0x12	11-17	PTTx Enable
0x13	11-19	PTTx Untimed Key Request
0x14	12-8	TXx Send Initial ID Message
0x15	12-9	TXx Send Normal ID Message
0x16	6-30	Message Handler Beep Gap On/Off Default
0x17	13-10	CTCSS Encode Controls Logic Out
0x51	7-16	Path 1x DTMF Mute Enable
0x52	7-16	Path 2x DTMF Mute Enable
0x53	7-16	Path 3x DTMF Mute Enable
0x61	9-7	Path 1x Timeout Timer Enable
0x62	9-7	Path 2x Timeout Timer Enable
0x63	9-7	Path 3x Timeout Timer Enable
0x71	9-12	Path 1x Timeout Timer Reset
0x72	9-12	Path 2x Timeout Timer Reset
0x73	9-12	Path 3x Timeout Timer Reset
0x90	5-20	User Switch x90
0x91	5-20	User Switch x91
0x92	5-20	User Switch x92
0x93	5-20	User Switch x93
0x94	5-20	User Switch x94
0x95	5-20	User Switch x95
0x96	5-20	User Switch x96
0x97	5-20	User Switch x97
0x98	5-20	User Switch x98
0x99	5-20	User Switch x99

Counters By Number		
Assign with (PW) 45 (number) (reload value) *		
Port-Specific Counters Replace the "x" with the Port/Rx/Tx/DTMF Decoder Number		
Number	**Page**	**Description**
0x00	11-14	TXx End-of-Activity Counter
0x01	9-22	Path 1x End-of-Activity Counter
0x02	9-22	Path 2x End-of-Activity Counter
0x03	9-22	Path 3x End-of-Activity Counter

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.

Command Quick Reference			
Page	**Command Name**	**Form and Data Digit**	**Default**
4-1	**Security**		
4-2	Assign Master Password	(PW) 93 (new master PW) *	99
4-3	Assign Control Operator Password	(PW) 92 (new control operator PW) *	no password

4-4	Assign Control Operator Privilege Level	(PW) 94 (root number, x) *
		  0 = master and control operator
		  1 = master only
			all commands accessible

4-5	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

4-6	Enable/Disable Front Panel Display	(PW) 63 0000 x *
		  0 = OFF (disabled)
		  1 = ON (enabled)
			ON
			enabled

5-1	**Macros**		
5-7	Create New Macro	(PW) 20 (macro name, command) *	no macros
5-9	Append to Macro	(PW) 29 (macro name, command) *	none
5-11	Remove Last Command from Macro	(PW) 24 (macro name) *	none
5-12	List Macro in CW	(PW) 33 (macro name) *	none
5-12	List Macro in Speech	(PW) 35 (macro name) *	none
5-14	Erase Macro	(PW) 21 (macro name) *	none
5-15	Erase All Macros	(PW) 22 00 *	none
5-16	Rename Macro	(PW) 27 (old, new) *	none
5-18	If-Then-Else	(PW) 76 (type, value, true macro name, false macro name) *	none

5-16	Enable/Disable User Switch	(PW) 63 (switch number, x) *
		  0 = OFF (disabled)
		  1 = ON (enabled)	

5-23	Select Power ON-Triggered Macro	(PW) 26 0000 (macro name) *	none

Command Quick Reference			
Page	Command Name	Form and Data Digit	Default
6-1	**Messages**		
6-8	Set Default Message Level	(PW) 10 0t0y (level) * t = Tx Number 1, 2, 3 y = Message Type *See Message Level Table on page A-2.*	
6-16	Select Frequency of CW	(PW) 06 00 (tone code) * *See Tone Code Table on page A-20.*	1500 Hz
6-17	Select CW Speed	(PW) 12 t0 y * t = Tx Number 1, 2, 3 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
6-26	Select Frequency of Beep 48	(PW) 06 01 (tone code) * *See Tone Code Table on page A-20.*	500 Hz
6-26	Select Frequency of Beep 49	(PW) 06 02 (tone code) * *See Tone Code Table on page A-20.*	750 Hz
6-26	Select Frequency of Beep 50	(PW) 06 03 (tone code) * *See Tone Code Table on page A-20.*	1000 Hz
6-26	Select Frequency of Beep 51	(PW) 06 04 (tone code) * *See Tone Code Table on page A-20.*	1250 Hz
6-26	Select Frequency of Beep 52	(PW) 06 05 (tone code) * *See Tone Code Table on page A-20.*	1500 Hz
6-26	Select Frequency of Beep 53	(PW) 06 06 (tone code) * *See Tone Code Table on page A-20.*	1750 Hz
6-27	Set Default Beep Duration and Beep Gap Duration	(PW) 08 0x yy * x = port and type yy = Duration 01-99, 10ms to 990ms	Duration = 60ms Gap = 20ms
6-28	Enable/Disable Beep Gap Default	(PW) 63 0t16 y * t = Tx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
6-37	Select Inter-Page Delay	(PW) 09 0t14 yyyy * t = Tx Number 1, 2, 3 yyyy=0-65535 (0-655.35 seconds)	1.0 second
6-48	Set Default DTMF Durations	(PW) 08 xx yy * xx = port and type yy = Duration 01-99, 10ms to 990ms	
6-56	Select User Messages	(PW) 31 xxxx (message) * xxxx = 0015-0024	none
6-56	Review User Messages	(PW) 34 xxxx *	none

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
		xxxx = 0015-0024	
6-58	Send Message	(PW) 15 (message) *	none
6-60	Copy Message	(PW) xx (src msg, dest msg) *	none
6-61	Select Warm Reset Message	(PW) 31 0000 (message) *	?RES in CW
6-61	Review Warm Reset Message	(PW) 34 0000 *	none
7-1	**DTMF Decoder**		
7-3	Enable/Disable Command Response Messages	(PW) 63 0r00 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
7-4	Enable/Disable OK Command Response Messages	(PW) 63 0r01 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
7-5	Enable/Disable Error Command Response Messages	(PW) 63 0r02 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
7-6	Select OK Command Response Message	(PW) 31 0001 (message) *	OK in CW
7-6	Review OK Command Response Message	(PW) 34 0001 *	none
7-6	Select Keystroke Error Command Response Message	(PW) 31 0002 (message) *	?ERR1 in CW
7-6	Review Keystroke Error Command Response Message	(PW) 34 0002 *	none
7-6	Select Data Error Command Response Message	(PW) 31 0003 (message) *	?ERR2 in CW
7-6	Review Data Error Command Response Message	(PW) 34 0003 *	none
7-7	Select RX-to-DTMF Decoder Access Mode	(PW) 57 r y * r = Rx Number 1, 2, 3 0 = no access 1 = carrier access 2 = CTCSS access 3 = And-CTCSS access 4 = Or-CTCSS access 5 = Anti-CTCSS access 6 = Always access	1, Carrier Access
7-9	Select DTMF Decoder Anti-Falsing Timer	(PW) 09 0r08 yyyyy * x = Port Number 1, 2, 3 yyyy=0-65535 (0-655.35 seconds)	0 seconds
7-10	Enable/Disable DTMF Decoder	(PW) 63 0r05 y *	OFF, disabled

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
	Disconnect Timer	r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	
7-11	Select DTMF Decoder Disconnect Timer	(PW) 09 0r07 yyyy * r = Rx Number 1, 2, 3 yyyy=0-65535 (0-655.35 seconds)	5.0 seconds
7-12	Enable/Disable Command Execution on Interdigit Timer	(PW) 63 0r04 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
7-13	Select DTMF Decoder Interdigit Timer	(PW) 09 0r04 yyyyy * r = Rx Number 1, 2, 3 yyyy=2-99 = 0.20-9.90 seconds	5.0 seconds
7-14	Enable/Disable Execute Command on 4th Digit	(PW) 63 0r5y z * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
7-15	Enable/Disable End of Transmission Command Execution	(PW) 63 0r03 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
7-15	Enable/Disable DTMF Decoder Mute for each Path	(PW) 63 0t5r z * t = Tx Number 1, 2, 3 r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
7-18	Select DTMF Decoder Mute Hang Time for First Digit, * or #	(PW) 09 0r05 yyyyy * r = Rx Number 1, 2, 3 yyyyy=0-200 = 0.00-2.00 seconds	0.5 seconds
7-19	Select DTMF Decoder Mute Delay for Other Digits	(PW) 09 0r06 yyyyy * r = Rx Number 1, 2, 3 yyyyy=0-200 = 0.00-2.00 seconds	0.5 seconds
7-20	Enable/Disable DTMF Long Tones	(PW) 63 0r06 y * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
7-21	Select DTMF Long Tone Timer	(PW) 09 1r03 yyyyy * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-6553.5 seconds)	3.0 seconds
7-22	Assign Macro to Long Tone Zero	(PW) 26 0r84 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone One	(PW) 26 0r85 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Two	(PW) 26 0r86 (macro name) *	none

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
		r = Rx Number 1, 2, 3	
7-22	Assign Macro to Long Tone Three	(PW) 26 0r87 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Four	(PW) 26 0r88 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Five	(PW) 26 0r89 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Six	(PW) 26 0r90 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Seven	(PW) 26 0r91 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Eight	(PW) 26 0r92 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Nine	(PW) 26 0r93 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone A	(PW) 26 0r94 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone B	(PW) 26 0r95 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone C	(PW) 26 0r96 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone D	(PW) 26 0r97 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Star (*)	(PW) 26 0r98 (macro name) * r = Rx Number 1, 2, 3	none
7-22	Assign Macro to Long Tone Pound (#)	(PW) 26 0r99 (macro name) * r = Rx Number 1, 2, 3	none
7-24	Select DTMF Any Long Tone Macro	(PW) 26 0r00 (macro name) * r = Rx Number 1, 2, 3	none
7-25	Select DTMF Digit Decoded Macro	(PW) 26 0r01 (macro name) * r = Rx Number 1, 2, 3	none
9-1	**Paths**		
9-2	Select Path Access Mode	(PW) 57 rt x * r = Rx Number 1, 2, 3 t = Tx Number 1, 2, 3 0 = no access 1 = carrier access 2 = CTCSS access 3 = And-CTCSS access 4 = Or-CTCSS access 5 = Anti-CTCSS access 6 = Always access	1 carrier access
9-5	Select Rx-to-Tx Audio Routing Priority	(PW) 90 t r r r *	Routing Priorities:

Command Quick Reference			
Page	**Command Name**	**Form and Data Digit**	**Default**
		t = Tx Number 1, 2, 3 r = Rx Number 1, 2, 3	Rx1, Rx2, Rx3
9-7	Enable/Disable Path Timeout Timer	(PW) 63 0t6r x * r = Rx Number 1, 2, 3 t = Tx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled carrier access
9-8	Select Path Timeout Timer	(PW) 09 2t0r yyyyy * r = Rx Number 1, 2, 3 t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	3.0 minutes (180 seconds)
9-10	Select Path Timeout Penalty Timer	(PW) 09 1t0r yyyyy * r = Rx Number 1, 2, 3 t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-6553.5 seconds)	5.0 seconds
9-12	Reset Path Timeout Timer	(PW) 63 0t7r 1 * r = Rx Number 1, 2, 3 t = Tx Number 1, 2, 3	none
9-13	Select Path Rx1-to-Tx Timeout Messages	(PW) 31 0t03 (message) * t = Tx Number 1, 2, 3	none
9-13	Select Path Rx2-to-Tx Timeout Messages	(PW) 31 0t04 (message) * t = Tx Number 1, 2, 3	none
9-13	Select Path Rx3-to-Tx Timeout Messages	(PW) 31 0t05 (message) * t = Tx Number 1, 2, 3	none
9-13	Review Path Rx1-to-Tx Timeout Messages	(PW) 34 0t03 * t = Tx Number 1, 2, 3	none
9-13	Review Path Rx2-to-Tx Timeout Messages	(PW) 34 0t04 * t = Tx Number 1, 2, 3	none
9-13	Review Path Rx3-to-Tx Timeout Messages	(PW) 34 0t05 * t = Tx Number 1, 2, 3	none
9-15	Select Path Rx1-to-Tx Timeout End Messages	(PW) 31 0t06 (message) * t = Tx Number 1, 2, 3	none
9-15	Select Path Rx2-to-Tx Timeout End Messages	(PW) 31 0t07 (message) * t = Tx Number 1, 2, 3	none
9-15	Select Path Rx3-to-Tx Timeout End Messages	(PW) 31 0t08 (message) * t = Tx Number 1, 2, 3	none
9-15	Review Path Rx1-to-Tx Timeout End Messages	(PW) 34 0t06 * t = Tx Number 1, 2, 3	none
9-15	Review Path Rx2-to-Tx Timeout End Messages	(PW) 34 0t07 * t = Tx Number 1, 2, 3	none
9-15	Review Path Rx3-to-Tx Timeout End Messages	(PW) 34 0t08 * t = Tx Number 1, 2, 3	none
9-17	Select Path Rx1-to-Tx Timeout Macro	(PW) 26 0t30 (macro name) *	none

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
		t = Tx Number 1, 2, 3	
9-17	Select Path Rx2-to-Tx Timeout Macro	(PW) 26 0t31 (macro name) * t = Tx Number 1, 2, 3	none
9-17	Select Path Rx3-to-Tx Timeout Macro	(PW) 26 0t32 (macro name) * t = Tx Number 1, 2, 3	none
9-18	Select Path Rx1-to-Tx Timeout End Macro	(PW) 26 0t38 (macro name) * t = Tx Number 1, 2, 3	none
9-18	Select Path Rx2-to-Tx Timeout End Macro	(PW) 26 0t39 (macro name) * t = Tx Number 1, 2, 3	none
9-18	Select Path Rx3-to-Tx Timeout End Macro	(PW) 26 0t40 (macro name) * t = Tx Number 1, 2, 3	none
9-19	Select Path Rx1-to-Tx Courtesy Messages	(PW) 31 0t00 (message) * t = Tx Number 1, 2, 3	none
9-19	Select Path Rx2-to-Tx Courtesy Messages	(PW) 31 0t01 (message) * t = Tx Number 1, 2, 3	none
9-19	Select Path Rx3-to-Tx Courtesy Messages	(PW) 31 0t02 (message) * t = Tx Number 1, 2, 3	none
9-19	Review Path Rx1-to-Tx Courtesy Messages	(PW) 34 0t00 * t = Tx Number 1, 2, 3	none
9-19	Review Path Rx2-to-Tx Courtesy Messages	(PW) 34 0t01 * t = Tx Number 1, 2, 3	none
9-19	Review Path Rx3-to-Tx Courtesy Messages	(PW) 34 0t02 * t = Tx Number 1, 2, 3	none
9-21	Select Path Rx1-to-Tx Courtesy Macro	(PW) 26 0t22 (macro name) * t = Tx Number 1, 2, 3	none
9-21	Select Path Rx2-to-Tx Courtesy Macro	(PW) 26 0t23 (macro name) * t = Tx Number 1, 2, 3	none
9-21	Select Path Rx3-to-Tx Courtesy Macro	(PW) 26 0t24 (macro name) * t = Tx Number 1, 2, 3	none
9-22	Select Path Rx1-to-Tx End-of-Activity Counter	(PW) 45 0t01 xxxxx * x = event counter 0-65535 0 = each time 1 = every other time ... etc.	0 event count
9-22	Select Path Rx2-to-Tx End-of-Activity Counter	(PW) 45 0t02 xxxxx * x = event counter 0-65535 0 = each time 1 = every other time ... etc.	0 event count
9-22	Select Path Rx3-to-Tx End-of-Activity Counter	(PW) 45 0t03 xxxxx * x = event counter 0-65535 0 = each time 1 = every other time ... etc.	0 event count

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
9-22	Select Path Rx1-to-Tx End-of-Activity Timer	(PW) 09 2t03 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	60 seconds
9-22	Select Path Rx2-to-Tx End-of-Activity Timer	(PW) 09 2t04 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	60 seconds
9-22	Select Path Rx3-to-Tx End-of-Activity Timer	(PW) 09 2t05 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	60 seconds
9-25	Select Path Rx1-to-Tx Start-of-Activity Macro	(PW) 26 0x46 (macro name) * t = Tx Number 1, 2, 3	none
9-25	Select Path Rx2-to-Tx Start-of-Activity Macro	(PW) 26 0x47 (macro name) * t = Tx Number 1, 2, 3	none
9-25	Select Path Rx3-to-Tx Start-of-Activity Macro	(PW) 26 0x48 (macro name) * t = Tx Number 1, 2, 3	none
9-25	Select Path Rx1-to-Tx End-of-Activity Macro	(PW) 26 0x54 (macro name) * t = Tx Number 1, 2, 3	none
9-25	Select Path Rx2-to-Tx End-of-Activity Macro	(PW) 26 0x55 (macro name) * t = Tx Number 1, 2, 3	none
9-25	Select Path Rx3-to-Tx End-of-Activity Macro	(PW) 26 0x56 (macro name) * t = Tx Number 1, 2, 3	none
10-1	**Receiver**		
10-5	Enable/Disable Simulate COR Active	(PW) 63 0r08 x * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
10-5	Enable/Disable Simulate CTCSS Active	(PW) 63 0r09 x * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
10-6	Select COR Filtering Delay	(PW) 09 2r12 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.00 seconds
10-7	Select CTCSS Filtering Delay	(PW) 09 2r13 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.00 seconds

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
10-8	Select Flutter Filter Timer	(PW) 09 2r18 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-100 (0-1.00 seconds)	0.00 seconds
10-9	Select Audio Gate Delay Timer	(PW) 09 2r17 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-100 (0-1.00 seconds)	0.00 seconds
10-10	Enable/Disable Anti-Kerchunker	(PW) 63 0r10 x * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF, disabled
10-11	Select Anti-Kerchunk Key-Up Delay	(PW) 09 0r09 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	1.00 seconds
10-12	Select Anti-Kerchunk Re-Arm Delay	(PW) 09 2r09 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	60 seconds
10-13	Enable/Disable Anti-Kerchunk No Hangtime Mode	(PW) 63 0r11 x * r = Rx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	OFF disabled
10-14	Assign Macro to COR Input Hi-to-Lo	(PW) 26 0r15 (macro name) * r = Rx Number 1, 2, 3	none
10-14	Assign Macro to COR Input Lo-to-Hi	(PW) 26 0r16 (macro name) * r = Rx Number 1, 2, 3	none
10-15	Assign Macro to CTCSS Input Hi-to-Lo	(PW) 26 0r17 (macro name) * r = Rx Number 1, 2, 3	none
10-15	Assign Macro to CTCSS Input Lo-to-Hi	(PW) 26 0r18 (macro name) * r = Rx Number 1, 2, 3	none
10-17	Select COR Pulse-Triggered Macros	(PW) 26 0r7p (macro name) * r = Rx Number 1, 2, 3 p = Pulse Number 1-9	none
10-19	Select COR Pulse-Triggered Macro Minimum Duration	(PW) 09 0r10 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.25 second
10-19	Select COR Pulse-Triggered Macro Maximum Gap	(PW) 09 0r11 xxxxx * r = Rx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	2.00 second

**Command Quick Reference**			
Page	**Command Name**	**Form and Data Digit**	**Default**
11-1	**Transmitter**		
11-4	Select Transmitter Turn-On Delay	(PW) 09 0t03 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.25 second
11-5	Select Courtesy Delay	(PW) 09 0t00 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.50 second
11-6	Select Courtesy Delay Violation Event-Triggered Macros	(PW) 26 0t019 (macro name) * t = Tx Number 1, 2, 3	none
11-7	Select Dropout Delay	(PW) 09 0t01 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	3.00 seconds
11-8	Select Dropout Messages	(PW) 31 0t12 (message) * t = Tx Number 1, 2, 3	none
11-8	Review Dropout Messages	(PW) 34 0t12 * t = Tx Number 1, 2, 3	none
11-9	Select Dropout Event-Triggered Macros	(PW) 26 0t04 (macro name) * t = Tx Number 1, 2, 3	none
11-10	Select Transmitter PTT Minimum Unkey Delay	(PW) 09 0t02 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-655.35 seconds)	0.10 second
11-11	Assign Macro to Tx PTT Inactive-to-Active	(PW) 26 0t05 (macro name) * t = Tx Number 1, 2, 3	none
11-11	Assign Macro to Tx PTT Active-to-Inactive Before Unkey Delay	(PW) 26 0t06 (macro name) * t = Tx Number 1, 2, 3	none
11-11	Assign Macro to Tx PTT Active-to-Inactive After Unkey Delay	(PW) 26 0t07 (macro name) * t = Tx Number 1, 2, 3	none
11-14	Select Transmitter End-of-Activity Counter	(PW) 45 0t00 xxxxx * x = *event counter* 0-65535 0 = each time 1 = every other time ... etc.	0 event count
11-14	Select Transmitter End-of-Activity Timer	(PW) 09 2t10 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	60 seconds
11-16	Select Transmitter Start-of-Activity Macro	(PW) 26 0x13 (macro name) * t = Tx Number 1, 2, 3	none
11-16	Select Transmitter End-of-Activity Macro	(PW) 26 0x14 (macro name) * t = Tx Number 1, 2, 3	none
11-17	Enable/Disable Transmitter PTT	(PW) 63 0t12 x * t = Tx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
11-18	Key Transmitter (Timed)	(PW) 09 2t08 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	No key request
11-19	Key Transmitter (Untimed)	(PW) 63 0t13 x * t = Tx Number 1, 2, 3 0 = cancel tx key 1 = keyed	No key request
11-20	Assign Macro to Any-Path-Active to Tx	(PW) 26 0x02 (macro name) * t = Tx Number 1, 2, 3	none
11-20	Assign Macro to All-Paths-Inactive to Tx	(PW) 26 0x03 (macro name) * t = Tx Number 1, 2, 3	none
12-1	**Identifier**		
12-3	Select ID Message Interval	(PW) 09 2t06 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	3.0 minutes (180 seconds)
12-4	Select ID Pending Interval	(PW) 09 2t06 xxxxx * t = Tx Number 1, 2, 3 yyyyy=0-65535 (0-65535 seconds)	30.0 seconds
12-5	Select Initial ID Message for Tx	(PW) 31 0t09 (message) * t = Tx Number 1, 2, 3	ID in CW
12-5	Select Normal ID Message for Tx	(PW) 31 0t10 (message) * t = Tx Number 1, 2, 3	ID in CW
12-5	Select Impolite ID Message for Tx	(PW) 31 0t11 (message) * t = Tx Number 1, 2, 3	ID in CW
12-5	Review Initial ID Message for Tx	(PW) 34 0t09 * t = Tx Number 1, 2, 3	none
12-5	Review Normal ID Message for Tx	(PW) 34 0t10 * t = Tx Number 1, 2, 3	none
12-5	Review Impolite ID Message for Tx	(PW) 34 0t11 * t = Tx Number 1, 2, 3	none
12-7	Select Initial ID Macro for Tx	(PW) 26 0t08 (macro name) * t = Tx Number 1, 2, 3	none
12-7	Select Polite ID Macro for Tx	(PW) 26 0t09 (macro name) * t = Tx Number 1, 2, 3	none
12-7	Select Impolite ID Macro for Tx	(PW) 26 0t10 (macro name) * t = Tx Number 1, 2, 3	none
12-8	Send Initial ID Message for Tx	(PW) 63 0t14 1 * t = Tx Number 1, 2, 3	none
12-9	Send Normal ID Message for Tx	(PW) 63 0t15 1 * t = Tx Number 1, 2, 3	none

Command Quick Reference			
Page	**Command Name**	**Form and Data Digit**	**Default**

12-10	Select Initial ID Tail Message for Tx	(PW) 50 xx yyyy *
		
		  xx=Tail Number, Tx1=00, Tx2=02, Tx4=04
		  yyyy=User Message Number 0015-0024
			none

12-10	Select Normal ID Tail Message for Tx	(PW) 50 xx yyyy *
		
		  xx=Tail Number, Tx1=01, Tx2=03, Tx4=05
		  yyyy=User Message Number 0015-0024
			none

13-1	**CTCSS Functions**		

13-2	Control CTCSS Encoder	(PW) 02 w x y *
		
		  w = Tx Number 1, 2, 3
		
		  x = Mode
		
		    0 = off
		
		    1 = follow PTT, off before unkey delay
		
		    2 = follow PTT
		
		    3 = on with PTT, off when timer times out
		    4 = on with Any-Path-Active, timer after inactive
		    5 = always on
		
		  y = Reverse Burst
		
		    0 = off
		
		    1 = 120-degree
		
		    2 = 180 degree
			OFF, disabled

13-5	Select Frequency of CTCSS	(PW) 03 x yy *
		  x = Tx Number 1, 2, 3
		
		  yy = CTCSS Tone Number (00-63)
		See TS-64 Programming, page 13-6.
			100Hz

13-7	Select CTCSS On Time	(PW) 09 0t15 xxxxx *
		  t = Tx Number 1, 2, 3
		  yyyyy=0-65535 (0-655.35 seconds)
			1.00 second

13-8	Select CTCSS Reverse Burst Time	(PW) 09 0t16 xxxxx *
		  t = Tx Number 1, 2, 3
		  yyyyy=0-65535 (0-655.35 seconds)
			0.15 second

Command Quick Reference

Page	Command Name	Form and Data Digit	Default
13-9	Select CTCSS Encoder Inactive-to-Active Macro	(PW) 26 0t11 (macro name) * t = Tx Number 1, 2, 3	none
13-9	Select CTCSS Encoder Active-to-Inactive Macro	(PW) 26 0t12 (macro name) * t = Tx Number 1, 2, 3	none
13-10	Enable/Disable CTCSS Encoder Controls CTCSS Logic Output	(PW) 63 0t17 x * t = Tx Number 1, 2, 3 0 = OFF (disabled) 1 = ON (enabled)	ON, enabled
14-1	**Logic Inputs**		
14-2	Assign Macro to Logic Input 1 Hi-to-Lo	(PW) 26 0061 (macro name) *	none
14-2	Assign Macro to Logic Input 1 Lo-to-Hi	(PW) 26 0062 (macro name) *	none
14-2	Assign Macro to Logic Input 2 Hi-to-Lo	(PW) 26 0063 (macro name) *	none
14-2	Assign Macro to Logic Input 2 Lo-to-Hi	(PW) 26 0064 (macro name) *	none
14-2	Assign Macro to Logic Input 3 Hi-to-Lo	(PW) 26 0065 (macro name) *	none
14-2	Assign Macro to Logic Input 3 Lo-to-Hi	(PW) 26 0066 (macro name) *	none
14-2	Assign Macro to Logic Input 4 Hi-to-Lo	(PW) 26 0067 (macro name) *	none
14-2	Assign Macro to Logic Input 4 Lo-to-Hi	(PW) 26 0068 (macro name) *	none
10-14	Assign Macro to COR Input Hi-to-Lo	(PW) 26 0r15 (macro name) * r = Rx Number 1, 2, 3	none
10-14	Assign Macro to COR Input Lo-to-Hi	(PW) 26 0r16 (macro name) * r = Rx Number 1, 2, 3	none
10-15	Assign Macro to CTCSS Input Hi-to-Lo	(PW) 26 0r17 (macro name) * r = Rx Number 1, 2, 3	none
10-15	Assign Macro to CTCSS Input Lo-to-Hi	(PW) 26 0r18 (macro name) * r = Rx Number 1, 2, 3	none
15-1	**Logic Outputs**		
15-3	Select Logic Outputs Latched ON	(PW) 70 (list of outputs 01-11) *	all OFF disabled
15-3	Select Logic Outputs Latched OFF	(PW) 71 (list of outputs 01-11) *	all OFF disabled
15-3	Select Logic Outputs Momentary ON	(PW) 72 (list of outputs 01-11) *	all OFF disabled
15-3	Select Logic Outputs Momentary OFF	(PW) 73 (list of outputs 01-11) *	all OFF disabled
15-5	Select Logic Output Momentary Timer	(PW) 09 00xx yyyyy * xx = Logic Output 1-11 (00-10) yyyyy=0-65535 (0-655.35 seconds)	0.50 second
15-6	Select Logic Output Inversion	(PW) 63 00xx y * xx = Logic Output 1-11 (11-21) 0 = normal 1 = inverted	Normal

Command Quick Reference			
Page	**Command Name**	**Form and Data Digit**	**Default**
20-1	**User Timers**		
20-2	Select Timeout Value	(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	**Clock and Calendar**		
21-2	Set Clock and Calendar	(PW) 25 (year, month, day-of-month, day-of-week, hour, minute, second) * 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 second = 00-59 (optional)	00:00:00, Sun, Jan 1, 2006
21-4	Adjust Daylight Savings Time	(PW) 48 x * 0 = *fall back* (subtract 1 from hours) 1 = *spring ahead* (add 1 to hours) 2 = *fall back* (subtract 1 from hours, inhibited for 61 minutes.)	none
21-6	Reset Clock Seconds	(PW) 48 3 *	none
21-7	Add Clock Seconds	(PW) 48 4 (seconds) * seconds = 01-30	none
21-7	Subtract Clock Seconds	(PW) 48 5 (seconds) * seconds = 01-30	none
21-7	Subtract Clock Seconds, Inhibited for 2 Minutes	(PW) 48 6 (seconds) * seconds = 01-30 (Inhibited for 2 minutes)	none

Command Quick Reference		
Page	**Command Name**	**Form and Data Digit**	**Default**
22-1	**Scheduler**		

22-2	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-19.
		  hour = 00-23 or 99, 2 digits
		  minute = 00-59 or 99, 2 digits
		  (Note: 99 is the *wild card*)
			no setpoints

22-6	Delete One Setpoint	(PW) 28 (setpoint) * setpoint = 00-99, 2 digits	none
22-6	Delete Range of Setpoints	(PW) 28 (first setpoint) (last setpoint) * setpoint = 00-99, 2 digits	none

22-7	Enable/Disable Scheduler	(PW) 63 0001 x *
		  0 = OFF (disabled)
		  1 = ON (enabled)
			ON
			enabled

Notes:

Appendix B

Installation

Introduction

The information in this section will help you to properly interface the 7330 to your repeater system. It describes the 7330's LED indicators, inputs, outputs, jumpers, and potentiometers, and suggests simple measurements to test the results.

You'll find that the 7330's flexible audio and logic interfaces make it *installer-friendly*, and that minimum external hardware is needed to complete the installation.

Note: To disable transmitters, mute DTMF digits, etc., the 7330 must have full control over all PTT and audio circuits. When installing the 7330, remove pre-existing connections that bypass its inputs and outputs.

Front Panel LEDs

In the following sections, the Front Panel LEDs will be referenced for each port:

- COR – lights when the COR input for this port is active.
- CTCSS – lights when the CTCSS input for this port is active.
- DTMF – lights when the DTMF decoder is decoding a digit for this port.
- PTT – lights when the transmitter PTT for this port is active.
- ENC – lights when the CTCSS encoder for this port is active.
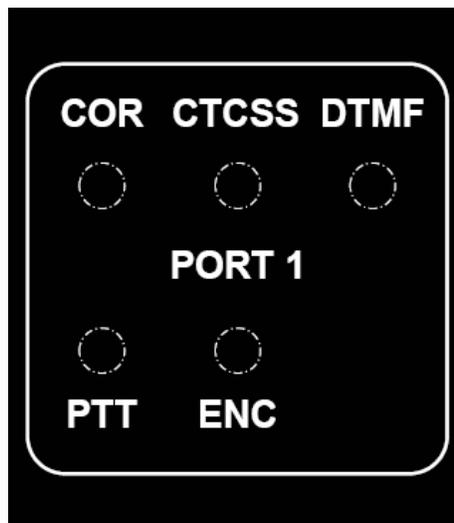
Cables

You will need to prepare several cables for the 7330 controller:

- A DC power cable
- A radio cable for each port
- An auxiliary cable for logic inputs, logic outputs, and A/D converter inputs

Note: To avoid crosstalk, use individually-shielded wires (not single-shield multiconductor cable) for receiver audio, transmitter audio, and CTCSS encode audio. Keep the wiring short, especially for high impedance circuits such as discriminator outputs and microphone inputs. The high capacitance of a long shielded cable can cause high frequencies to be rolled off.

The following section explains how to properly connect the 7330 to your equipment.

Receiver COR

Since the controller needs to know when carrier signals are present, you'll need to connect each receiver's COR (Carrier Operated Relay) or COS (Carrier Operated Switch) output to pin 2 of its 7330 port connector.

(COR or COS is a logical (high/low) output driven by the receiver's noise-operated squelch circuit. The signal from a "channel busy" LED indicator will also work.)

For now, it doesn't matter whether the COR signal is low-active or high-active. You'll be using the controller's sense-reversal jumpers to select the correct action.

The following explanation of the controller's COR input circuit will help you configure it properly.

Each COR input circuit consists of a 4.7K pullup resistor (that can be connected or disconnected with a push-on jumper), two voltage divider resistors, and an NPN transistor.

Installing the jumper connects the 4.7K pullup resistor between the COR input and the controller's +5V supply. This resistor supplies input current to the NPN transistor when the receiver's COR driver is an open-collector transistor (or a relay contact to ground) and is in the OFF state.

The pullup is not needed if the driver is a voltage source such as a logic gate, op amp, or squelch IC. In fact, certain ICs won't pull the COR input down far enough if the pullup is present. If that happens, remove the jumper.

The pullup resistor jumpers are located directly behind their port connectors and are labeled COR1 PULLUP, COR2 PULLUP, and COR3 PULLUP.

The purpose of the voltage divider is to raise the input threshold from about 0.7 V to about 2 V. Without the divider, COR drivers with high saturation voltages (such as Darlington transistors) would exceed the threshold and look logically HIGH all of the time.

To check your installation:

- Make the COR connection. (If your receiver's COR output is a pair of relay contacts, use one for COR and ground the other.)

- With the controller and the receiver powered up, measure the voltage at the controller's COR input pin.

- The voltage should swing above and below 2 V as an incoming carrier is applied and removed.

- Locate J31, a 2x8-pin header with positions for eight inversion jumpers (the jumpers we're interested in are COR1, COR2, and COR3). If applying a carrier to the receiver causes the front panel COR LED to light, the jumper is in the correct position. If the carrier and COR LED act opposite each other, install or remove the jumper as needed. (Installing the jumper

configures the COR input to be low active; removing the jumper configures the input to be high active.)

Receiver CTCSS

CTCSS, or Continuous Tone-Controlled Squelch System, is a convenient problem solver for repeaters in crowded bands. The controller also allows CTCSS to be used to qualify DTMF commands to increase security.

Well-known tradenames for CTCSS include *PL* or *Private Line*™ (Motorola), *Channel Guard*™ (General Electric), and *Call Guard*™ (Johnson).

If your repeater doesn't have a built-in CTCSS decoder, you can install an aftermarket unit. The TS-64 from Communications Specialists, Inc., Orange, CA, 1-800-854-0547, http://www.com-spec.com, is a good example. The TS-64 is crystal-controlled for stability and decodes one of 64 CTCSS tone frequencies. If you purchase an aftermarket CTCSS decoder, be sure to follow the instructions provided by the manufacturer when installing it in your receiver.

Regardless of the type of CTCSS decoder, the controller needs to know when CTCSS is present. Connect each CTCSS decoder output to pin 3 of its 7330 port connector.

The decoder's detect/no detect output driver is probably an open-collector transistor. For now, it doesn't matter whether the output signal is low-active or high-active. You'll be using the controller's sense-reversal jumpers to select the correct action.

The design of the controller's CTCSS decoder input circuit is exactly the same as the COR input circuit, so we won't repeat the hardware description.

The pullup resistor jumpers are located directly behind their port connectors and are labeled CTCSS1 PULLUP, CTCSS2 PULLUP, and CTCSS3 PULLUP.

To check your installation:

- Make the CTCSS decoder connection.

- With the controller, receiver, and CTCSS decoder powered up, measure the voltage at the controller's RXn CTCSS input pin.

- The voltage should swing above and below 2 V as an incoming CTCSS signal is applied and removed.

- Locate J31, a 2x8-pin header with positions for eight inversion jumpers (the jumpers we're interested in are CTCSS1, CTCSS2, and CTCSS3). If applying a CTCSS tone to the receiver causes the front panel CTCSS LED to light, the jumper is in the correct position. If the tone and CTCSS LED act opposite each other, install or remove the jumper as needed. (Installing the jumper configures the CTCSS input to be low-active; removing the jumper configures the input to be high-active.)

Transmitter PTT

Each transmitter has a logical (high/low) input called PTT (Push-To-Talk). The transmitter will key (transmit) when its PTT is active. Connect each transmitter's PTT input to pin 4 of its 7330 port connector.

For now, it doesn't matter whether the PTT signal needs to be low-active or high-active. You'll be using the controller's sense-reversal jumpers to select the correct action.

The following explanation of the controller's PTT output circuit will help you configure it properly.

The PTT driver, U43, is a TPIC6B596N 8-bit shift register with open-drain power MOSFET outputs. It's a 20-pin DIP and is socketed for easy replacement.

Each output can sink 150 mA when ON and withstand 45 V when OFF. Its low ON resistance (5 ohms) allows it to control a wide range of PTT circuit types, from TTL logic to large DC relay coils.

Some transmitters, including models made by Hamtronics, Maggiore, and RCA (500-and 700-series), have PTT inputs that cannot be keyed by an open-drain driver. They are keyed and unkeyed by applying and removing a positive voltage source into their PTT inputs. The current requirement can be substantial. A simple outboard circuit, described as follows, can be placed between the controller's PTT output and the transmitter's PTT input to satisfy these requirements:

- Connect a large PNP transistor so that its emitter goes to the transmitter's +12 V 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 PTT current (500 mA or less), you can use a 2N2904.

- If the transmitter PTT draws 1 A or less, use a TIP30.

- When using this outboard circuit, set the PTT for active-low operation.

To check your installation:

- Make the PTT connection.

- Locate J33, a 2x6-pin header with positions for six inversion jumpers (the jumpers we're interested in are PTT1, PTT2, and PTT3). If the jumper is in the correct position, the PTT LED is lit while the transmitter is keyed. If the transmitter and PTT LED act opposite each other, install or remove the jumper as needed. (Installing the jumper configures the PTT output to be low-active; removing the jumper configures the output to be high-active.)

Receiver Audio

Since the controller needs audio from the receivers, you'll need to connect an audio point in each receiver to pin 1 of its 7330 port connector.

The following explanation of the controller's Receiver Audio Input circuit will help you configure it properly.

Each of the three receiver audio input circuits is identical and consists of an input level pot, a first op amp stage with a response jumper arrangement, and a second op amp stage with a gain jumper arrangement.

The level pots are labeled RX1 for receiver #1, RX2 for receiver #2, and RX3 for receiver #3. The pot is connected across the audio input and sets the level going into the first op amp stage. The impedance at the audio input pin varies with the position of this pot and is 25K ohms or greater.

Locate the 2x6 headers used for receiver audio jumpers:

Receiver	2x6 Jumper Block
1	J10
2	J11
3	J3

The first jumper is labeled DE-EMP and the second jumper is labeled FLAT.

If you are using discriminator (pre-emphasized) audio, remove the FLAT jumper and install the DE-EMP jumper to configure the first stage for de-emphasis and extra gain. The corner frequency is approximately 200 Hz.

If you are using flat (de-emphasized) audio, remove the DE-EMP jumper and install the FLAT jumper to configure the first stage as a unity gain buffer.

The third jumper is labeled HIGH and the fourth jumper is labeled NORM.

Remove the NORM jumper and install the HIGH jumper for a gain of 6.3. Remove the HIGH jumper and install a NORM jumper for a gain of 2. (Note that the audio going into the first stage is halved if the pot is in the 50% position. The gain in the second stage, then, results in an overall gain of 1 (NORM) or 3.1 (HIGH) when the pot is set at 50%.)

The reason for having separate stages for response and gain is to allow easier modifications for special applications when necessary.

A good source of de-emphasized audio is the output of the receiver's first audio preamplifier stage (usually directly after the discriminator). This point is often the "high" end of the volume control pot and comes from a low-impedance driver such as an op amp or emitter-follower stage.

Note: Don't use the receiver's volume control wiper as the audio source because accidental movement of the control will affect the repeat level. Avoid using speaker audio because the distortion is higher at the speaker than at earlier stages.

Digital audio delay is built into all three receiver interfaces. To add audio delay, locate the 2x6 headers again. The fifth jumper is labeled DLY and the sixth jumper is labeled NODLY.

If you want audio delay, remove the NODLY jumper and install the DLY jumper. The amount of delay is adjustable from about 30 to 250 mS via the DELAY1 (RX1), DELAY2 (RX2) and DELAY3 (RX3) pots.

If you don't want audio delay, remove the DLY jumper and install the NODLY jumper.

To check your installation:

Feed the receiver with a fully-deviated 1 KHz sine wave tone from a service monitor.

Adjust the receive level pot in the 7330 (and move the gain jumper, if necessary) so that an audio level of 1 V peak-to-peak (354 mV rms) is seen at test point TP9 (for receiver #1), TP10 (for receiver #2), and TP11 (for receiver #3). An oscilloscope is the best instrument for this measurement.

Receiver	Test Point	Adjust Pot	Set To
1	TP9	RX1	
2	TP10	RX2	1 V p-p (354 mV rms)
3	TP11	RX3	

We recommend 1 V p-p because it matches the on-board tone and digital audio generators and is the best level for driving the DTMF decoders.

Transmitter Audio

Since the controller needs to send audio to the transmitters, you'll need to connect an audio input in each transmitter to pin 5 of its 7330 port connector.

The following explanation of the controller's Transmit Audio Output circuit will help you configure it properly.

Each of the three transmitter audio output circuits is identical and consists of an audio gating circuit, an op amp summer (mixer), a level pot, and a driver stage with an attenuator jumper arrangement.

The audio gates connect one or more receivers to the summing amplifier. The summing amplifier output can be measured at TP25 (for transmitter #1), TP26 (for transmitter #2), and TP31 (for transmitter #3).

Each summing amplifier feeds a level pot. The three pots are labeled TX1, TX2, and TX3.

The pot, in turn, feeds a driver stage. The driver stage has an output impedance of 600 ohms and is AC coupled to the transmitter audio output pin with a 10 uF nonpolarized capacitor.

The audio output level depends upon the load impedance presented to the transmitter audio output and the position of the driver stage's attenuation jumper. Attenuation is needed if you are driving a transmitter with a sensitive audio input, such as a microphone input.

Locate the 3-pin headers near the transmitter level pots:

Transmitter	Jumper
1	J34
2	J35
3	J36

Each header has two jumper positions, LOW and NORM.

With the jumper in the NORM position:

- If the controller is driving a load of 10K ohms or greater, the output level can be adjusted from zero to 2 V p-p (700 mV rms).

- If the controller is driving a 600-ohm load, the output level can be adjusted from zero to 1 V p-p (350 mV rms).

With the jumper in the LOW position:

- If the controller is driving a load of 10K ohms or greater, the output level can be adjusted from zero to 0.5 V p-p (175 mV rms).

- If the controller is driving a 600-ohm load, the output level can be adjusted from zero to 0.25 V p-p (88 mV rms).

The 7330 provides very good audio quality; see the Specifications chapter for figures.

To check your installation:

Feed the receiver pathed to the transmitter you want to adjust with a fully-deviated 1 KHz sine wave tone from a service monitor. Verify that the transmitter is being keyed by that receiver.

Adjust the transmit level pot in the 7330 (and move the gain jumper, if necessary) so for a fully deviated signal on the service monitor monitoring the transmitter output.

Transmitter	Adjust Pot	Set To
1	TX1	
2	TX2	Fully deviated
3	TX3	

For example, for NBFM, feeding a receiver with a 1 kHz tone deviated at 4.5 kHz should be transmitted at 4.5 kHz deviation. Note that different types of devices attached to the controller ports may require different levels, e.g., IRLP or P25.

CTCSS Encoder

The 7330 has three built-in CTCSS encoders designed to generate well-filtered sine wave. You can command a phase reversal of 120 degrees, 180 degrees, or none.

If you want to use the 7330's built-in CTCSS encoder, connect the transmitter's modulator audio input to pin 8 of its 7330 port connector.

If you want to use an outboard encoder, the 7330 can still assist you. Pin 8 of each port connector can be driven by an extra logic output instead of the encoder.

You'll find three three-pin headers, J37 (for transmitter #1), J38 (for transmitter #2), and J39 (for transmitter #3), near the receiver #1 audio pot. Each header has two jumper positions, LOGIC and CTCSS. With the push-on jumper in the LOGIC position, an extra logic output (separate from the eight general-purpose logic outputs) drives pin 8. With the jumper in the CTCSS position, the internal CTCSS encoder drives pin 8. Each of these three extra logic outputs has the same specifications as the PTT and general-purpose logic outputs.

The following explanation of the controller's CTCSS Encoder circuit will help you configure it properly.

Each of the three encoder circuits is identical and consists of a DAC (digital-to-analog converter), a 5th-order lowpass filter, a level pot, and a driver stage.

The filtered CTCSS tone can be measured ahead of the level pot at TP18 (encoder #1), TP20 (encoder #2), and TP15 (encoder #3).

The level pots are labeled CTCSS1, CTCSS2, and CTCSS3.

Transmitter	Adjust Pot	Set To
1	CTCSS1	
2	CTCSS2	600 Hz deviation
3	CTCSS3	

The driver stage has an output impedance of 2K ohms and is AC coupled to the CTCSS audio output pin with a 10 uF nonpolarized capacitor.

The audio output level when driving a high-impedance load (>20K) is zero to 2 V p-p (700 mV rms).

Tone/Speech Levels

The CW, tone, and speech levels can be set by command. You can set them when the controller is installed or you can set them later. See the *Message Levels* section on page 6-7 for details.

Control Receiver

A control receiver is a wise addition to your site because it allows you to control your site on a frequency other than a repeater input.

The connections for a control receiver are the same as for other types of receivers and have been described previously.

DC Power Requirements

The 7330 operates from +9 to +36 volts DC. It consumes about 1.7 watts when all front panel LEDs are on, and about 1.5 watts when all LEDs are off.

The 7330's power consumption is relatively constant over the supply voltage range. You can find the current drain at a given supply voltage by dividing 1.7 watts by the supply voltage. For example, the current drain from a 13.8 V supply is 1.7 W/13.8 V = 123 mA.

The graph below assumes a power consumption of 1.7 watts and provides a quick estimate of current drain for various supply voltages.
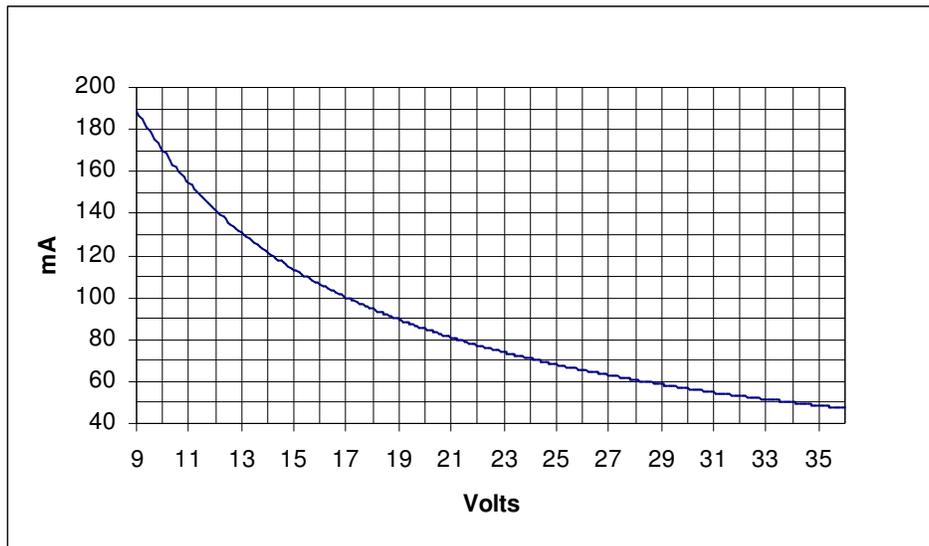
The power connector is a locking Phoenix screw terminal plug (supplied). The (+) and (-) connections are silkscreened on the rear of the chassis. The controller has an internal series diode for reverse polarity protection.

Don't use a very small power supply with a low current limit. The supply must provide capacitor inrush current at power on.

If your site has a backup power source, be sure the controller is connected to it so you'll have control during power outages.

The 7330 has nonvolatile memory and does not need external power to maintain stored data.

Logic Inputs

The 7330 can monitor four logical (ON/OFF) devices at the repeater site with its logic inputs. Any of the three receiver COR inputs and the three CTCSS decoder inputs may be used as additional logic inputs.

The design of the Logic Input Circuit is exactly the same as the COR input circuit, so we won't repeat its hardware details here.

The pullup resistor jumpers are located on a header, J4, near the 25-pin D-sub connector and are labeled IN1 through IN4.

The controller can sense a low-to-high transition and a high-to-low transition on each logic input. Since they detect both edges, logic inputs don't require inversion jumpers.

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 a macro command upon sensing a change, the owner can choose the action that will be taken. (This is a big improvement over controllers that take a fixed action when an input is tripped, such as appending an alarm CW message to the tail.)

The states of the logic inputs are shown on the front panel LEDs:
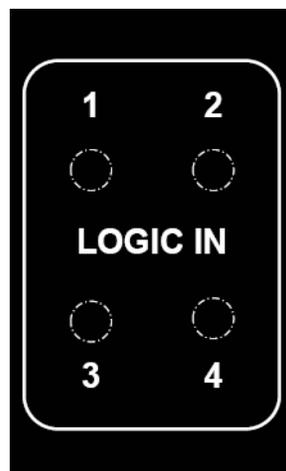
Logic Outputs

The 7330 can control eight logical (ON/OFF) devices at the repeater site with its logic outputs.

Each logic output has a hardware interface that is similar to the transmitter PTT output. Refer to the previously described transmitter PTT explanation for details on the design of the output circuit.

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, connect 3KΩ pullup resistors from the desired outputs to the +5 V 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.

Note: When using logic outputs to drive large inductive loads (such as large relay coils), connect a diode across the load in the non-conducting direction.

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.

The states of the logic outputs are shown on the front panel LEDs:
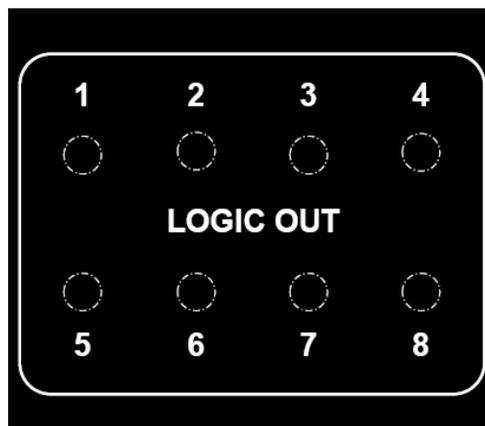
Radio Port Connectors

The 7330 has three 9-pin D-subminiature female connectors for interfacing to the three radios. Use the mating male connectors (supplied). (This pin layout surrounds the RX and TX audio pins with low impedance signals to better isolate them.)

Pin	Name	Type
1	Receiver Audio	Audio Input
2	Receiver COR	Logic Input
3	Receiver CTCSS Decode	Logic Input
4	Transmitter PTT	Logic Output
5	Transmitter Audio	Audio Output
6	Ground for Receiver Audio	Ground
7	Ground for CTCSS Audio	Ground
8	Transmitter CTCSS Audio or CTCSS Logic Output	Analog Output or Logic Output
9	Ground for Transmitter Audio	Ground

I/O Connector

The 7330 has a 25-pin D-subminiature female connector for interfacing to its eight logic outputs, four logic inputs, and three A/D (analog-to-digital) inputs. Use the mating male connector (supplied).

Pin	Name
1	Logic Output 1
2	Logic Output 2
3	Logic Output 3
4	Logic Output 4
5	Logic Output 5
6	Logic Output 6
7	A/D Input 3
8	A/D Input 2
9	A/D Input 1
10	Logic Input 1
11	Logic Input 2
12	Logic Input 3
13	Logic Input 4
14	Logic Output 7
15	Logic Output 8
16	Ground
17	Ground
18	Ground
19	Ground
20	Ground
21	Ground
22	Ground
23	Ground
24	Ground
25	Ground

RS-232 Connectors

The 7330 supports two RS-232 ports.

Serial Port 1 is set up for DTE (Data Terminal Equipment) with modem support. It uses J7, a 9-pin D-subminiature male connector. A mating connector is supplied.

Serial Port 1 (DTE)		
Pin	**Name**	**Notes**
1	DCD	
2	RXD	
3	TXD	
4	DTR	Internally connected to DSR
5	GND	
6	DSR	Internally connected to DTR
7	RTS	
8	CTS	
9	RI	N/C

Serial Port 2 is set up for DCE (Data Communications Equipment) with no modem support. It uses J8, a 9-pin D-subminiature female conector. A mating connector is supplied.

Serial Port 2 (DCE)		
Pin	**Name**	**Notes**
1	DCD	N/C
2	RXD	
3	TXD	
4	DTR	Internally connected to DSR
5	GND	
6	DSR	Internally connected to DTR
7	RTS	Internally connected to CTS
8	CTS	Internally connected to RTS
9	RI	N/C

Potentiometers

Audio delays and receiver, transmitter, and CTCSS encoder levels are adjusted with mechanical potentiometers. Turn pots clockwise to increase delay or level, counter-clockwise to decrease.

Name	Pot #	Description
RX1	R30	Adjusts level from Receiver 1
RX2	R38	Adjusts level from Receiver 2
RX3	R262	Adjusts level from Receiver 3
TX1	R109	Adjusts level to Transmitter 1
TX2	R115	Adjusts level to Transmitter 2
TX3	R275	Adjusts level to Transmitter 3
DELAY1	R220	Adjusts RX1 audio delay
DELAY2	R234	Adjusts RX2 audio delay
DELAY3	R327	Adjusts RX3 audio delay
CTCSS1	R90	Adjusts output level of CTCSS Encoder 1
CTCSS2	R98	Adjusts output level of CTCSS Encoder 2
CTCSS3	R274	Adjusts output level of CTCSS Encoder 3

Jumpers

Name	Description	Jumper IN	Jumper OUT
J10 DE-EMP	RX1 De-emphasis	Accepts discriminator audio	(Install one only)
J10 FLAT	RX1 Flat	Accepts flat audio	
J10 HIGH	RX1 High Gain	Gain of 6.3	(Install one only)
J10 NORM	RX1 Normal Gain	Gain of 2	
J10 DLY	RX1 Audio Delay	Audio Delay Enabled	(Install one only)
J10 NODLY	RX1 No Delay	Audio Delay Disabled	
J11 DE-EMP	RX2 De-emphasis	Accepts discriminator audio	(Install one only)
J11 FLAT	RX2 Flat	Accepts flat audio	
J11 HIGH	RX2 High Gain	Gain of 6.3	(Install one only)
J11 NORM	RX2 Normal Gain	Gain of 2	
J11 DLY	RX2 Audio Delay	Audio Delay Enabled	(Install one only)
J11 NODLY	RX2 No Delay	Audio Delay Disabled	
J3 DE-EMP	RX3 De-emphasis	Accepts discriminator audio	(Install one only)
J3 FLAT	RX3 Flat	Accepts flat audio	
J3 HIGH	RX3 High Gain	Gain of 6.3	(Install one only)
J3 NORM	RX3 Normal Gain	Gain of 2	
J3 DLY	RX3 Audio Delay	Audio Delay Enabled	(Install one only)
J3 NODLY	RX3 No Delay	Audio Delay Disabled	
J34 LOW	TX1 Low Drive	Gain of 0.5	(Install one only)
J34 NORM	TX1 Normal Drive	Gain of 2	
J35 LOW	TX1 Low Drive	Gain of 0.5	(Install one only)
J35 NORM	TX1 Normal Drive	Gain of 2	
J36 LOW	TX1 Low Drive	Gain of 0.5	(Install one only)
J36 NORM	TX1 Normal Drive	Gain of 2	
J37 LOGIC	TX1 Pin 8 Logic	Pin 8 fed by Logic Output	(Install one only)
J37 CTCSS	TX1 Pin 8 Tone	Pin 8 fed by CTCSS Encoder	
J38 LOGIC	TX2 Pin 8 Logic	Pin 8 fed by Logic Output	(Install one only)
J38 CTCSS	TX2 Pin 8 Tone	Pin 8 fed by CTCSS Encoder	
J39 LOGIC	TX3 Pin 8 Logic	Pin 8 fed by Logic Output	(Install one only)
J39 CTCSS	TX3 Pin 8 Tone	Pin 8 fed by CTCSS Encoder	
J25 COR1 PULLUP	RX1 COR Pullup	Pullup Enabled	Pullup Disabled
J27 COR2 PULLUP	RX2 COR Pullup	Pullup Enabled	Pullup Disabled
J29 COR3 PULLUP	RX3 COR Pullup	Pullup Enabled	Pullup Disabled
J26 CTCSS1 PULLUP	RX1 CTCSS Pullup	Pullup Enabled	Pullup Disabled
J28 CTCSS2 PULLUP	RX2 CTCSS Pullup	Pullup Enabled	Pullup Disabled
J30 CTCSS3 PULLUP	RX3 CTCSS Pullup	Pullup Enabled	Pullup Disabled

Name	Description	Jumper IN	Jumper OUT
J4 IN1	Logic Input 1 Pullup	Pullup Enabled	Pullup Disabled
J4 IN2	Logic Input 2 Pullup	Pullup Enabled	Pullup Disabled
J4 IN3	Logic Input 3 Pullup	Pullup Enabled	Pullup Disabled
J4 IN4	Logic Input 4 Pullup	Pullup Enabled	Pullup Disabled
J31 COR1	Inverts RX 1 COR	Low Active	High Active
J31 COR2	Inverts RX 2 COR	Low Active	High Active
J31 COR3	Inverts RX 3 COR	Low Active	High Active
J31 CTCSS1	Inverts RX 1 CTCSS	Low Active	High Active
J31 CTCSS2	Inverts RX 2 CTCSS	Low Active	High Active
J31 CTCSS3	Inverts RX 3 CTCSS	Low Active	High Active
J33 PTT1	Inverts TX 1 PTT	Low Active	High Active
J33 PTT2	Inverts TX 2 PTT	Low Active	High Active
J33 PTT3	Inverts TX 3 PTT	Low Active	High Active
J13	ADC Input 1 Range	0 – 25 V	0 – 5 V
J14	ADC Input 2 Range	0 – 25 V	0 – 5 V
J15	ADC Input 3 Range	0 – 25 V	0 – 5 V
J33 AUX1	Reserved		
J33 AUX2	Reserved		
J33 AUX3	Reserved		
J31 AUX4	Reserved		
J31 AUX5	Reserved		
J12	Reserved		

Test Points

Name	Description	Normal Reading
TP1	Lithium battery (+) terminal	+3 VDC
TP17	Watchdog strobe	
TP29	Power supply reference	+1.2 VDC
TP14	Bias Supply for audio section	+2.5 VDC
TP9	RX1 audio	1 V p-p audio on +2.5 VDC bias
TP10	RX2 audio	1 V p-p audio on +2.5 VDC bias
TP11	RX3 audio	1 V p-p audio on +2.5 VDC bias
TP22	TX1 tone & digital audio (before digital pot)	1 V p-p audio on +2.5 VDC bias
TP23	TX2 tone & digital audio (before digital pot)	1 V p-p audio on +2.5 VDC bias
TP24	TX3 tone & digital audio (before digital pot)	1 V p-p audio on +2.5 VDC bias
TP12	TX1 tone & digital audio (after digital pot)	Depends on pot setting, +2.5 VDC bias
TP13	TX2 tone & digital audio (after digital pot)	Depends on pot setting, +2.5 VDC bias
TP32	TX3 tone & digital audio (after digital pot)	Depends on pot setting, +2.5 VDC bias
TP18	TX1 CTCSS tone (before pot)	1 V p-p audio on +2.5 VDC bias
TP20	TX2 CTCSS tone (before pot)	1 V p-p audio on +2.5 VDC bias
TP15	TX3 CTCSS tone (before pot)	1 V p-p audio on +2.5 VDC bias
TP19	TX1 CTCSS tone (at output)	Depends on pot setting, 0 V bias
TP21	TX2 CTCSS tone (at output)	Depends on pot setting, 0 V bias
TP16	TX3 CTCSS tone (at output)	Depends on pot setting, 0 V bias
TP25	TX1 audio (before pot)	1 V p-p audio on +2.5 VDC bias
TP26	TX2 audio (before pot)	1 V p-p audio on +2.5 VDC bias
TP31	TX3 audio (before pot)	1 V p-p audio on +2.5 VDC bias
TP27	TX1 audio (at output)	Depends on pot setting, 0 V bias
TP28	TX2 audio (at output)	Depends on pot setting, 0 V bias
TP33	TX3 audio (at output)	Depends on pot setting, 0 V bias

Testing the Transmitter Interface

Apply power to the controller and the repeater while monitoring the transmitter output with an extra receiver. When power is applied, the transmitter should key and send the reset CW message. The blue PTT indicator for the correct port should light on the 7330's front panel.

If the transmitter does not key at all:

- Be sure both the controller and the repeater are powered up. The green ON indicator on the 7330's front panel should be lit.
- Check the wiring, particularly the connection between the controller's PTT output and the transmitter's PTT input.

If the transmitter is acting "upside down" (unkeying during the message but keying afterwards), install or remove the PTT inversion jumper as needed.

If the transmitter is keying properly but no CW message is heard, check the wiring from the correct 7330 transmitter audio output to the transmitter's audio input.

The CW level can be adjusted via command. See the *Messages* chapter on page 6-1.

If the CW message is too loud with the level commanded nearly all the way down, you may be driving the microphone input of the transmitter instead of a later stage. If you cannot drive a later stage, you may need to attenuate the audio output. See the *Transmitter Audio* section above regarding the TX Drive jumper.

Testing the Receiver Interface

Generate an RF signal on the receiver's input frequency. The blue COR indicator for the correct port should light on the 7330's front panel. If you have installed a CTCSS decoder, generate the correct CTCSS tone. The blue CTCSS indicator should light.

The controller should key the repeater transmitter. When the signal disappears, you should hear a courtesy beep after a short pause. The transmitter should stay keyed for a few more seconds, then unkey.

If this does not happen:

- With the COR connected between the receiver and controller, check the voltage on the COR line to see if it swings above and below the 2 V threshold.
- If a CTCSS decoder is used, with the decode line connected between the decoder and controller, check the voltage on the decode line to see if it swings above and below the 2 V threshold.

If the repeater is acting *upside down* (unkeying when a signal exists but keying afterwards), install or remove the COR inversion jumper as needed.

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 don't be concerned if this isn't 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 for 1 V p-p.
- Check the transmitter for proper deviation, and
- Adjust the Transmitter Audio Output pot as necessary.

Testing The DTMF Decoder

Your controller uses an 8870-type DTMF decoder IC on each receiver input. This crystal-controlled device 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 a number of things, including 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.)

Local Control
You can program the controller with a local DTMF keypad, if desired.

- Connect the audio from the keypad to a receiver audio input.
- Connect a switch between the correct COR Input and ground.
- Whenever the switch is ON (closed), the controller will accept commands from the keyboard. Return the switch to the OFF (open) position when finished programming.

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 receive audio level for 1 V p-p as described previously.
- Check the operation of the COR Input. If the COR input isn't active, the DTMF decoder will not be monitoring the receiver audio.
- Check to see if a command was entered to disable the DTMF decoder.

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 DTMF muting off.** Use the *Select DTMF Decoder Mute Delay* command on page 7-18. 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 1 V p-p, turn the audio level down. Overdriving the decoder will not help it decode any better.

- **Increase the DTMF decoder's detect time.** Each decoder's tone detect time is controlled by a 300K resistor on pin 16 of the decoder IC. This provides a rather fast 40 mS detect time (a telephone industry standard). Increasing the resistor 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 the resistor 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.

Appendix E

Specifications

Introduction

This section lists technical specifications of the 7330.

Receiver and Transmitter Ports

(All three receiver and transmitter interfaces have identical specifications.)

Receiver <u>Audio Input Impedance:</u> 25K ohms or greater; varies with input level pot setting

Receiver <u>De-emphasis Corner Frequency:</u> Approximately 200 Hz

Receiver <u>Audio Delay:</u> Adjustable via pot from 30 to greater than 250 milliseconds

Receiver <u>COR and CTCSS Input Thresholds:</u> Approximately 2.1 V

Receiver <u>COR and CTCSS Pullups:</u> 4.7K ohms to +5V, enabled or disabled via jumpers

Receiver <u>COR and CTCSS Input Logic:</u> Jumper-selectable for active low or active high

Transmitter <u>Audio Output Impedance:</u> 600 ohms

Transmitter <u>Audio Output Level:</u> 2 V p-p (10K ohms), 1 V p-p (600 ohms)

Transmitter <u>PTT Driver:</u> Open-drain power MOSFET (TPIC6B596N IC)

Transmitter <u>PTT Current:</u> Sinks 150 mA in the ON state (5 ohms to ground)

Transmitter <u>PTT Voltage:</u> Withstands 45 V in the OFF state

Overall measured <u>frequency response:</u> Shown with and without the audio delay feature in the tables below.

Response With No Audio Delay								
TX Load	**-3 dB**	**-2 dB**	**-1 dB**	**0 dB**	**0 dB**	**-1 dB**	**-2 dB**	**-3 dB**
10K ohms	11 Hz	13 Hz	17 Hz	50 Hz	3 kHz	8 kHz	12 kHz	16 kHz
600 ohms	18 Hz	23 Hz	35 Hz	100 Hz	3 kHz	8 kHz	12 kHz	16 kHz

Response With Audio Delay								
TX Load	**-3 dB**	**-2 dB**	**-1 dB**	**0 dB**	**0 dB**	**-1 dB**	**-2 dB**	**-3 dB**
10K ohms	18 Hz	22 Hz	30 Hz	80 Hz	2 kHz	4.5 kHz	5.6 kHz	6.2 kHz
600 ohms	25 Hz	32 Hz	50 Hz	160 Hz	2 kHz	4.5 kHz	5.6 kHz	6.2 kHz

Tone Generators

(All three Tone Generators have identical specifications.)

<u>Distortion</u>: Shown at various tone frequencies in the table below

<u>Multitone Capability:</u> Encodes single and dual tones

<u>Filter:</u> Five-pole Butterworth lowpass filter with a cutoff frequency of 4000 Hz

<u>Tone accuracy:</u> Better than 0.12% for tones up to 1700 Hz

Distortion vs. Frequency					
Freq (Hz)	% THD	dB THD	dB 3rd Har.	dB 5th Har.	dB 7th Har.
100	1.70	-35	-35	-47	-50
300	1.65	-36	-35	-47	-50
1000	1.60	-36	-36	-56	-71
1500	0.90	-41	-41	-71	---
2000	0.26	-52	-52	---	---
3000	0.05	-66	-68	---	---

CTCSS Encoders

(All three CTCSS Encoders have identical specifications.)

<u>Measured distortion:</u> Shown at various CTCSS tone frequencies in the table below

<u>Phase Reversal:</u> Selectable 0, 120, or 180 degrees

<u>Filter:</u> Five-pole Butterworth lowpass filter with a cutoff frequency of 250 Hz

<u>Tone accuracy:</u> Better than 0.02%

<u>Output Level:</u> Adjustable 0 to 2 V p-p (700 mV rms) into 20K load

Distortion vs. Frequency					
Freq (Hz)	% THD	dB THD	dB 3rd Har.	dB 5th Har.	dB 7th Har.
67.0	1.7	-35	-35 (201 Hz)	-57 (335 Hz)	-75 (469 Hz)
85.4	1.3	-38	-38 (256 Hz)	-67 (427 Hz)	-85 (598 Hz)
100.0	0.76	-42	-42 (300 Hz)	-73 (500 Hz)	---
123.0	0.28	-50	-50 (369 Hz)	-83 (615 Hz)	---
151.4	0.10	-60	-60 (454 Hz)	---	---
173.8	0.05	-67	-67 (521 Hz)	---	---
203.5	0.03	-70	-70 (610 Hz)	---	---

Logic Inputs

Number of Logic Inputs: 4

Input Circuit: NPN-buffered

Input Threshold: Approximately 2.1 V

Pullups: 4.7K ohms to +5V, enabled or disabled via jumpers.

Logic Outputs

Number of Logic outputs: 8

Output Circuit: Open-drain power MOSFET (TPIC6B596N IC)

Current: Sinks 150 mA in the ON state (5 ohms to ground)

Voltage: Withstands 45 V in the OFF state

A/D Inputs

Number of A/D Inputs: 3

Input Range: 0 – 5 V or 0 – 25 V

Input Protection: Overvoltage

Clock/Calendar

Oscillator: 32.768 kHz temperature compensated crystal oscillator (TCXO)

Timekeeping Accuracy: ±1 min/year from 0°C to 40°C

Memory

Flash: 128 Mb (16 MB)

RAM: 512 KB CMOS SRAM with battery backup

Battery

Type: BR2032 lithium cell

DC Power

Input Voltage Range: +9 to +36 volts DC

Power Consumption: Approximately 1.5 watts

Input Protection: Reverse polarity

Cabinet

Height: single rack height (1U)

Front Panel Indicators: 28 3-mm LEDs as shown in the table below

Legend	Indication	Color
ON	Power ON	Green
PORT 1 COR	Receiver 1 COR Input	Blue
PORT 1 CTCSS	Receiver 1 CTCSS Input	Blue
PORT 1 DTMF	Receiver 1 DTMF Decoder	Blue
PORT 1 PTT	Transmitter 1 Push-to-Talk	Blue
PORT 1 ENC	Transmitter 1 CTCSS Encoder	Blue
PORT 2 COR	Receiver 2 COR Input	Blue
PORT 2 CTCSS	Receiver 2 CTCSS Input	Blue
PORT 2 DTMF	Receiver 2 DTMF Decoder	Blue
PORT 2 PTT	Transmitter 2 Push-to-Talk	Blue
PORT 2 ENC	Transmitter 2 CTCSS Encoder	Blue
PORT 3 COR	Receiver 3 COR Input	Blue
PORT 3 CTCSS	Receiver 3 CTCSS Input	Blue
PORT 3 DTMF	Receiver 3 DTMF Decoder	Blue
PORT 3 PTT	Transmitter 3 Push-to-Talk	Blue
PORT 3 ENC	Transmitter 3 CTCSS Encoder	Blue
LOGIC IN 1	Logic Input 1	Blue
LOGIC IN 2	Logic Input 2	Blue
LOGIC IN 3	Logic Input 3	Blue
LOGIC IN 4	Logic Input 4	Blue
LOGIC OUT 1	Logic Output 1	Blue
LOGIC OUT 2	Logic Output 2	Blue
LOGIC OUT 3	Logic Output 3	Blue
LOGIC OUT 4	Logic Output 4	Blue
LOGIC OUT 5	Logic Output 5	Blue
LOGIC OUT 6	Logic Output 6	Blue
LOGIC OUT 7	Logic Output 7	Blue
LOGIC OUT 8	Logic Output 8	Blue

Rear Panel Items: Shown in table below

Legend	Use	Description
PORT 3	Port 3 Connector	9-Pin D-Sub Female
PORT 2	Port 2 Connector	9-Pin D-Sub Female
PORT 1	Port 1 Connector	9-Pin D-Sub Female
DC 9V-36V	DC Power Input Connector	Detachable Terminal Block
INIT	Initialize Pushbutton	
RESET	Reset Pushbutton	
I/O	Logic I/O and A/D Input Connector	25-Pin D-Sub Female
RS232-2	RS232 Serial Port 2 Connector	9-Pin D-Sub Female
RS232-1	RS232 Serial Port 1 Connector	9-Pin D-Sub Male

Hardware

Mounting Screws: Main Board and Display Board, 6-32x1/4 Philips pan head, stainless steel; Cabinet, 4-40x1/4 Philips pan head, stainless steel

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:

Telephone Line Suppressors Market Sources	
Citel America, Inc. 1111 Parkcentre Blvd., Suite 474 MiamiFL33169 (305) 621-0022 (FL) (800) 248-3548	L-COM Data Products 1755 Osgood Street, Rt. 125 North AndoverMA01845 (617) 682-6936 (617) 689-9484 (FAX)
ITW Linx Communications Products 201 Scott Street Elk GroveIL60007 (312) 952-8844 (312) 952-1633 (FAX)	MCG Electronics Inc. 12 Burt Drive Deer ParkNY11729 (516) 586-5125 Telex 645518
Telebyte Technology, Inc. 270 East Pulaski Road GreenlawnNY11740 (516) 385-8184 (FAX) (800) 835-3298 (516) 423-3232	PolyPhaser Corporation 1425 Industrial Way GardnervilleNV89410-1237 (800) 325-7170 (702) 782-4476 (FAX) Telex 272718
TII Industries, Inc. 1375 Akron Street CopiagueNY11726 (516) 789-5020 (Sales) (516) 789-5000 Telex 144631	L.E.A. Dynatech 12516 Lakeland Road Santa Fe SpringsCA90670 (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 …"