RC-850 Repeater Controller
Programming Reference Manual

Firmware Version 3

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About This Manual . . .

This manual provides reference information for those responsible for programming repeaters controlled by the RC-850 Repeater Controller.

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Programming Summary

Voice Synthesizer Vocabulary - v3.4

Voice Synthesizer Vocabulary - v3.5

(Programming Sheets)

Chapter 1
Introduction

This chapter provides an overview of the Programming level commands.

Remote Programming
The RC-850 Repeater Controller is remotely programmable – many of its characteristics can be customized by the repeater owner, without the need to visit the site.

The controller has a set of simple, high level commands, which instruct it to modify information in its non-volatile memory. The information in its memory is referred to frequently during the course of normal operation. For example, ID messages, timer values, and much more are retrieved by the controller's operating system firmware from the non-volatile memory.

Since the memory can be reprogrammed thousands of times, and remembers its information even when power is removed from the controller, the repeater owner has a great deal of flexibility in customizing and changing the operation of the repeater system from anywhere.

Security
Since the repeater can be reprogrammed remotely, it's obviously necessary to provide a high degree of security against accidental or unauthorized reprogramming. The controller normally doesn't recognize programming commands – it must be "unlocked" with a secret custom code to accept these commands. The repeater owner can change the "unlock" code to any of more than 10 billion possible codes.

The controller may be instructed to ignore unlock and programming commands from certain command channels. For example, you may wish to allow programming commands only from the control receiver or from the control receiver and the phone.

Command Channels
Touch-Tone Programming commands may be entered from any of the repeater's command channels, including the main repeater receiver, the link / remote base receivers, the telephone line, the control receiver, and the local microphone. With the Computer Interface option, Touch-Tone commands may also be entered through the auxiliary Touch-Tone decoder, and serial ASCII commands may be entered through serial I/O ports 1 and 2.

Command entry through the repeater receiver, the link receivers, the phone line, the auxiliary decoder, and the serial ports may be inhibited by the repeater owner to enhance security. Command entry through the repeater receiver may also require sub-audible tone (PL) to guard command access.

Response Messages
The controller may respond to each Programming command with a unique response message, verifying that you've entered the command you intended. (The controller will respond with the unique messages, a "generic" message, or no response based on the Control Operator level selected "Command Acknowledgement Mode".) The response is provided to one of several channels depending on the command input channel.

Command Channel ---->	Response Channel
Repeater receiver	Repeater transmitter
Link / Remote receivers	Repeater / link / remote transmitters
Control receiver	Repeater transmitter
Telephone	Telephone
Local microphone	Repeater transmitter
Auxiliary decoder	Repeater transmitter
ASCII serial port 1 or 2	ASCII serial port 1 or 2

Command Entry From the Telephone
When entering commands over the air, the controller knows you're done entering tones when it sees your carrier drop. It then evaluates the Touch-Tone command you've sent. When controlling over the phone, there's no "carrier" to drop. It therefore is necessary to terminate a Touch-Tone command with the # key, which serves as an "Enter" key. When the controller sees the #, it evaluates and acts on the command you've entered.

For example, if the Programming command is *1101, it should be entered over the telephone as "*1101#".

Command Entry From the Serial Ports
Programming commands may be sent in serial ASCII format to Serial Port 1 or 2 on the Computer Interface option. ASCII command strings may be sent, similar to Touch-Tone commands, but terminated with <CR><LF> (carriage-return, line-feed).

Chapter 2
Unlocking and Locking the Controller

The controller normally operates in the "locked" mode, where Programming commands are not accepted. In order to access the Programming commands to make changes to the messages, timers, command codes, etc., the controller must be "unlocked".

Unlocking the Controller

The "unlock code" is programmed by the repeater owner, and can contain any keys except # or D. Two unlock codes may be stored in the controller's memory. The repeater owner may change between the two unlock codes remotely if it should become necessary for security reasons. If it becomes further necessary to actually change the unlock codes, they may be changed at the site as described below.

The controller is unlocked by entering the ten-digit unlock code, as a Touch-Tone sequence through any of the available Touch-Tone command channels - it responds with "UL" if the command was entered successfully. The controller may also be unlocked through serial port 1 or 2, by sending the unlock code as a serial ASCII sequence.

While the controller is unlocked, the "UL" prompt indicates that it is waiting for valid Programming commands. Each entry of a valid command extends the unlock timer for 60 seconds. If the timer times out, the controller locks itself back up.

While the controller is unlocked, it is expecting Programming commands. However, it will accept ordinary Control Op and User level commands while unlocked, by preceding them with "**".

Locking the Controller

The controller is normally locked back up after a series of Programming commands with the # key (## over the phone).

Programming the Unlock Code

The repeater owner may program two of his favorite ten-digit sequences as the controller's unlock codes. Simply flip DIP switch 8 "ON", and DIP switch 7 "OFF", and enter the desired primary ten-digit unlock code as Touch-Tone over any of the command channels. The controller writes the code into its non-volatile memory and responds by saying "UL PGM". DIP switch 7 may be turned "ON", and the procedure repeated for the secondary unlock code. DIP switch 8 should then be turned "OFF", and the controller may then be unlocked by entering the primary ten-digit unlock code (followed by # over the phone). If it should become necessary, the secondary unlock code may be selected remotely, with the "Secondary Unlock Code" programming command (see "Command Codes").

The ten-digit code should not contain # or D. Nor should it begin with the Pad Test or Autopatch user command prefixes, to avoid conficts with them.

Be sure to turn off DIP switch 8 after entering the desired unlock codes. The position of DIP switch 7 doesn't matter.

The controller should be unlocked only to enter Programming commands. Control Operator and User level commands do not require unlocking the controller. However, while unlocked, Control Operator and User level commands may be activated by proceeding them with **.

Chapter 3
The Message Editor

Messages are information and signalling provided by the controller to the users, Control Ops, and repeater owner. They may be generated in synthesized speech, Morse code, and a variety of other formats. Many of the messages are remotely programmable, including ID's, tail messages, Emergency Autodial responses, telephone answer and hangup messages, alarm messages, and many more. The ability to remotely program these messages, and the intelligence of the controller to construct "run time variable" message strings, are some of the keys to the power of the controller. They contribute to the evolution of the repeater into an information center.

The message editor is an interactive utility which allows the repeater owner to select a message, and then string together the speech vocabulary, Morse code, or other format signalling that will comprise the message.

The types of signalling which may be mixed within any programmable messages include:

- Synthesized speech (approximately 300 word internal vocabulary)
- Morse code (all letters, numbers, and punctuation)
- Digital Voice Recorder tracks (for remotely recordable audio, with ACC's DVR)
- DTMF (Touch-Tone) sequences
- Paging tones (two-tone sequential, 5/6 tone sequential, CTCSS, HSC display, GSC digital)
- External strobed devices (such as cartridge tape playback units)

The controller can automatically construct, as run-time variable synthesized speech strings, the following:

- Time of day, am/pm, and date
- "Morning/afternoon/evening"
- Analog telemetry and weather instrumentation readings, plus stored min/max readings
- Repeater system telemetry, such as number of messages in the mailbox, period repeater has been active, number of autopatches, period repeater has been timed out, etc.

Selecting the Message

The controller must be unlocked to use the message editor. The message to be edited is selected with one of the commands shown on the following pages. Once you've selected the message, you're "in the editor".

Messages may start out either as Morse code or synthesized speech. [The following chapter describes how to change type within a message.] Using the command *10... starts the message out as Morse code, while *11... starts it out as synthesized speech. The controller responds to the command with a unique response to confirm that you've chosen the message you intended (if the Control Op level "Unique Response Message" command acknowledgement mode is selected).

Once the message has been selected and you're in the editor, a new set of commands, along with vocabulary codes, are used to actually build the message. Commands provide the ability to review what you've entered, backspace, start over, store the message in the controller's non-volatile memory, or get out of the editor.

While you're editing the message, it's stored in the controller's temporary memory. The previously stored message isn't affected, until you write the newly edited message from the temporary to the non-volatile memory.

Vocabulary

Codes for Morse code and speech letters and numbers are based on their position on a telephone keypad. The first digit of the code indicates what button the letter appears on, and the second digit indicates whether it's the first, second, or third letter on the key. The letters Q and Z are represented by 70 and 90. Numbers are represented by 00 through 09. This logical layout makes it easy to enter letters and numbers without having to look up codes.

The additional synthesized speech vocabulary and Morse code punctuation characters are assigned two- and four-digit codes as shown in the tables below.

After each transmission, or after the # terminator is entered from the phone, the controller reads back the portion of the message entered during that transmission. Message construction can then continue. Generally it's best to enter a few characters at a time, so you can catch errors as you make them.

Commands

Several commands control the Message Editor's operation.

Read Back Message - At any time while editing a message, you can read back what's been entered so far with *2 (*2# over the phone). With long messages, it's always a good idea to enter a few characters at a time and occasionally read back the entire message to verify that you've entered what you intended.

Delete Last Character - If you make a mistake in entering a word or character, the last character entered can be deleted (i.e., backspace or rubout) with *1 (*1# over the phone). The deleted character is read back for confirmation. One character at a time can be deleted.

Delete Message - If you've made several errors, or have changed your mind about what you want the message to say, you can delete everything you have loaded into the editor for the selected message, with *3 (*3# over the phone). The delete message command lets you start over for the selected message.

Change Message Type - While editing a message, these commands specify the characters that follow are to be another one of the signalling types supported by the controller. The commands are described in the next chapter, "Advanced Message Editing".

Store Message in Memory - When you've completed editing the message and it's correct, it may then be transferred from the temporary memory (buffer) to the controller's non-volatile memory by entering a *0 (*0# over the phone). There will be a brief delay as the E2PROM is programmed, then the controller will announce "Write, UL", indicating a successful write operation, and that it is ready for either the next Programming level command or the Lock command.

Abort Message Editor - At any time while editing a message, you can abort the operation without storing the message with *4 (*4# over the phone), and return to a "UL" prompt, ready to enter either the next Programming level command or the Lock command.

These commands apply only to the message editor – not to any other Programming commands. For example, *0 is not used with other Programming commands – only to write edited messages into the controller's non-volatile memory.

If the controller responds to the Store Message in Memory command with "E R", a hardware error has occurred. Refer to the Hardware Reference Manual, "Troubleshooting", for suggestions.

An empty message can be written by selecting the message (*11..), then storing message in memory (*0), without entering any characters.

Message Size

Each programmable message may consist of a maximum number of characters shown below with its message select command. Exceeding the allowable message size causes the controller to respond with "Overflow". The overflowed characters are thrown away, and you may backspace (delete last character) or start over (delete message) to try again.

Synthesized speech words beginning with *9 take up 2 character slots each.

Message types other than speech are permitted a maximum size of one less than shown. For example, the Initial IDs allow 22 characters as speech messages. If they are selected as Morse code, only 21 characters are available.

Change Message Type commands also take up character spaces as well, as defined in the next chapter. For example, changing from speech to Morse code in the middle of a message uses up one character slot for the change.

Message Editor Commands

Read Back Message	*2	(to read back what you've entered so far)
Delete Last Character	*1	(to delete a mistaken character)
Delete Message	*3	(to delete the entire message to start over)
Store Message in Memory	*0	(after completed editing a message)
Abort Message Editor	*4	(to return to "UL" level without storing the message in memory)

Message Groups

Message selection commands are grouped in the following pages as:

- Alarm
- Courtesy Tone
- Control Op Command Response
- Demo / Bulletin Board / Pad Test
- Emergency Autodialer Responses
- ID
- Macros
- Mailbox
- Pager Prompt
- Patch
- Remote Base / Link
- Scheduler
- Special Patch Utilities
- Tail Messages
- Timeout Messages
- Touch-Tone Cover Tone
- User Call Signs
- User Function Responses

Alarm Messages

Alarm Messages	Morse	Speech	Response	# Chars
Alarm #1	*1078	*1178	"AL1"	10
Alarm #2	*1079	*1179	"AL2"	10
Alarm #3	*10106	*11106	"AL3"	5
Alarm #4	*10107	*11107	"AL4"	5

Purpose
The Alarm messages are generated periodically when the alarms are triggered.

Remarks
The alarms may activate the transmitter and announce the alarm messages defined above.

Examples
"Power amp's over temperature"
"Intruder, (laser), intruder"

See Also
Operation Manual – "Alarms"

Courtesy Tone Messages

Courtesy Tone #1	*1041	*1141	"CT1"	4
Courtesy Tone #2	*1042	*1142	"CT2"	4
Courtesy Tone #3	*1043	*1143	"CT3"	4
Courtesy Tone #4	*1044	*1144	"CT4"	4
Courtesy Tone #5	*1045	*1145	"CT5"	4
Courtesy Tone #6	*1046	*1146	"CT6"	4
Courtesy Tone #7	*1047	*1147	"CT7"	4
Courtesy Tone #8	*1048	*1148	"CT8"	4
Courtesy Tone #9	*10109	*11109	"CT9"	4
Courtesy Tone #10	*10110	*11110	"CT ten"	4
Courtesy Tone #11	*10111	*11111	"CT eleven"	4
Courtesy Tone #12	*10112	*11112	"CT twelve"	4
Courtesy Tone #13	*10113	*11113	"CT thirteen"	4

Purpose
The Courtesy Tone Messages may be Morse code characters, synthesized speech vocabulary such as sound effects, DVR tracks, etc.

Remarks
Courtesy Tones are generated at the end of each user transmission. The tone indicates that the timeout timer has been reset and that the next user may transmit. The one of twelve tone sets selected by the controller may also convey information, or telemetry, to users. Courtesy Tone 13, generated in addition to one of twelve, indicates a link or remote base in the transmit enabled mode. Courtesy Tones may be sine wave tone sets defined using the Courtesy Tone Parameter Programming commands, or may be messages defined above.

Courtesy Tones defined as messages override any sine wave tone sets defined for that particular courtesy tone. To restore sine wave tone sets, load an empty message into that set using the commands above (select the message, enter "*0" without entering any characters). Delay to the courtesy tone, and hang time, are always defined using the sine wave tone set commands (see Chapter 6 – "Courtesy Tone Parameters").

Examples
"N" (for use during net)
"DC" (for use during battery backup operation)
"tic-toc" (for general use)

See Also
Programming Reference Manual – "Courtesy Tone Parameters"
Operation Manual – "Courtesy Tones"

Control Operator Command Response Message

Generic Command Response	*1060	*1160	"COPR"	6

Purpose
When the Control Op Command Acknowledgement Mode is selected as Generic Response, the Control Operator Generic Response message is generated by the controller when it acknowledges Control Op level commands.

Examples
"dit-dit (Morse code "I")" "R" "C"

See Also
Control Operator's Reference Manual – "Control Operator Utilities"

Demo / Bulletin Board Messages

Demo Tag	*1067	*1167	"DEMO"	18
Bulletin Board #1	*10101	*11101	"B1"	24
Bulletin Board #2	*10102	*11102	"B2"	24
Bulletin Board #3	*10103	*11103	"B3"	24
Bulletin Board #4	*10104	*11104	"B4"	24
Bulletin Board #5	*10105	*11105	"B5"	24
Pad Test Responses	*10120	*11120	"PAD"	16

Purpose
The Demo Tag message follows the selected stored call sign using the Demo User command. The Bulletin Board messages are available to users as a means of posting information. The pad test responses determine the pad test readback for each of the 16 keys.

Remarks
The call sign Demo command allows users to make the repeater say their call. Their call sign is stored primarily for use with the mailbox and the reverse patch.

The Bulletin Board is an additional mailbox-like capability which allows the repeater owner to leave messages of general interest to the system's users. Information about the repeater, meeting notices, and general QST's may be left in the Bulletin Board.

The Pad Test Response message should consist of a 16 character message consisting of the desired responses for keys 1, 2, 3, 4, 5, 6, 7, 8, 9, *, 0, #, A, B, C, and D respectively. Each character must be a single slot character, i.e. no *9 words may be used.

Examples
Demo Tag message – "from WA6AXX, Repeater", therefore, Demo command results in "WB6KHP, from WA6AXX, Repeater"

Bulletin Board message – "Contact AXX for information on the repeater"

Pad Test Responses – "123456789 sierra 0 papa alpha bravo charlie delta"

See Also
Operation Manual – "Demo Messages, Bulltetin Board, and the Mailbox"

Emergency Autodialer Response Messages

	Morse	Speech	Response	# Chars
Emergency Autodial #0	*1050	*1150	"ADE0"	6
Emergency Autodial #1	*1051	*1151	"ADE1"	6
Emergency Autodial #2	*1052	*1152	"ADE2"	6
Emergency Autodial #3	*1053	*1153	"ADE3"	6
Emergency Autodial #4	*1054	*1154	"ADE4"	6
Emergency Autodial #5	*1055	*1155	"ADE5"	6
Emergency Autodial #6	*1056	*1156	"ADE6"	6
Emergency Autodial #7	*1057	*1157	"ADE7"	6
Emergency Autodial #8	*1058	*1158	"ADE8"	6
Emergency Autodial #9	*1059	*1159	"ADE9"	6

Purpose
The Emergency Autodialer Response messages are generated in response to user commands which activate the Emergency Autodialer.

Remarks
These messages would typically be loaded with the names or abbreviations of the emergency services accessible from the Emergency Autodialer.

Examples
"S J police" "Fire" "Operator" "9 1 1"

See Also
Operation Manual – "Telephone Interconnect"

ID Messages

	Morse	Speech	Response	# Chars
Initial ID #1	*1001	*1101	"IID1"	22
Initial ID #2	*1008	*1108	"IID2"	22
Initial ID #3	*1009	*1109	"IID3"	22
Forced CW ID	*1002	---	"FID"	14
Anxious ID	*1003	*1103	"AID"	14
Pending ID #1	*1004	*1104	"PID1"	26
Pending ID #2	*1005	*1105	"PID2"	26
Pending ID #3(0,1)	*1006	*1106	"PID3A"	26
Pending ID #3(2,3)	*1074	*1174	"PID3B"	26
Pending ID #3(4,5)	*1075	*1175	"PID3C"	26
Pending ID #3(6,7)	*1076	*1176	"PID3D"	26
Pending ID #3(8,9)	*1077	*1177	"PID3E"	26
Special ID	*1007	*1107	"SPID"	50
Periodic QST ID	*1000	*1100	"QST"	14
Touch-Tone Access Down ID	*1010	*1110	"TTID"	6
Aux. Transmitter Pager ID	*10100	*11100	"PGID"	4
Aux. Transmitter Phone ID	*10108	*11108	"PHID"	4

Purpose
These messages are the repeater's ID announcements, generated automatically by the controller to comply with ID requirements.

Remarks
All ID's should have valid call sign ID messages. See the Operation Manual, "Identification", for details on how the controller performs the ID function.

Initial ID's 1, 2, and 3 are generated randomly by the controller when an Initial ID is required.

The Forced CW ID should be programmed in Morse code – not speech, since it will be generated while a user is talking.

Pending ID's #3(A-E) are selected when a Pending ID 3 is required, based on the current Macro Set selected manually or by the Scheduler.

As always, each message, when generated in speech, may hold the number of characters shown. Morse code messages may hold one less than shown.

See Also
Operation Manual – "Identification"
Control Operator's Reference Manual – "ID Selection and Preview"

Examples
Initial ID – "Welcome to WA6AXX, Repeater."
Anxious ID – "WA6AXX Repeater"
Forced CW ID – "WA6AXX/R"
Pending ID – "From eight-teen hundred feet, this is WA6AXX Repeater."
Touch-Tone Access Down ID – "Seventy three, from WA6AXX Repeater."
QST ID – "This is WA6AXX Repeater, open system, PL 100 Hz."

The Periodic QST ID should be used only when a Control Operator is on duty at a local or remote control point. Automatic control of bulletin transmissions is not authorized on repeater output frequencies by Part 97. Use of the Periodic QST ID to "make your presence known" on a frequency, when you have reason to believe that it may cause interference to co-channel users, is an invitation for a citation from the FCC.

Macros

	Morse	Speech	Response	# Chars
Macro 1	*10141	*11141	"M1"	10
Macro 2	*10142	*11142	"M2"	10
Macro 3	*10143	*11143	"M3"	6
Macro 4	*10144	*11144	"M4"	6

Purpose
The macro messages may be included in other programmable messages to make the most efficient use of the storage space available.

Remarks
Macros are useful for storing the repeater's call sign, so that it only need be stored once in the controller's memory. Various ID's can include the "ID" macro, which is expanded out to the full call sign. Macros are also useful whenever there isn't sufficient space to store a particular message.

Example
Macro 1 can be loaded with the repeater call sign in synthesized speech, "WA6AXX, repeater". The various speech ID messages can be edited using the Macro 1 in place of the complete call sign.

See Also
Programming Reference Manual - "Advanced Message Editing (Message Macros)"

Mailbox Messages

	Morse	Speech	Response	# Chars
Mailbox Message #0	*1090	*1190	"MBM0"	6
Mailbox Message #1	*1091	*1191	"MBM1"	10
Mailbox Message #2	*1092	*1192	"MBM2"	10
Mailbox Message #3	*1093	*1193	"MBM3"	10
Mailbox Message #4	*1094	*1194	"MBM4"	18
Mailbox Message #5	*1095	*1195	"MBM5"	18
Mailbox Message #6	*1096	*1196	"MBM6"	18
Mailbox Message #7	*1097	*1197	"MBM7"	18
Mailbox Message #8	*1098	*1198	"MBM8"	18
Mailbox Message #9	*1099	*1199	"MBM9"	50
Mail Present Message	*1073	*1173	"MAIL"	5

Purpose
The Mailbox messages are the canned "notes" which may be left by one user for another. The Mail Present message may be included in any of the programmable messages as a run-time variable as an indication to users of mail present.

Remarks
The Mail Present message is an indication to users that mail is in the mailbox and that they might want to check to see if there is any for them.

The Mail Present run-time variable string might typically be included in Initial ID's, Pending ID's, and Tail Messages. [Run time variables are discussed in detail in the next chapter.] If there is mail present, the Mail Present Message is announced. If there is no mail, nothing is announced as a result of the Mail Present run-time variable included in the message.

Examples
Mailbox messages – "Phone home" "Call me on PIY repeater" "Call me at..." "The repeater will be down for service tomorrow from 2 p.m. to 5 p.m. Call AXX for information."

Mail present message – "(pause) (pause) Check for messages"
It could be included in a Tail Message as "Good (morning/afternoon/evening) (Mail Present run time variable)". If mail were present (in the morning), the Tail Message would say "Good morning, check for messages". If there were no mail, it would simply say "Good morning".

See Also
Operation Manual – "Demo Messages, Bulletin Board, and the Mailbox"

Pager Prompt

Morse	Speech	Response	# Chars
*10152	*11152	"PPRO"	10

Purpose
The Pager Prompt message is generated by the controller during a tone and voice page to allow time for the pager squelch to open and to cue the person when to begin speaking.

Remarks
The duration of the message should be long enough to allow the user's pager to stop beeping and open squelch.

Example
"Ready, set, ... go!"

Patch Messages

	Morse	Speech	Response	# Chars
Autopatch Activate	*1020	*1120	"AP up"	6
User Autodial Activate	*1029	*1129	"ADU up"	6
Antidial	*1072	*1172	"A N T I"	10
Patch Cover Tone	*1018	*1118	"PCT"	6
Patch Timeout Warning	*1017	*1117	"P time out alert"	6
Phone Answer	*1065	*1165	"P H A N"	18
Phone Hangup	*1066	*1166	"H A N G"	10
Reverse Patch Call-For	*10151	*11151	"RPC"	4

Purpose
These messages are generated at various times related to patch operation.

Remarks
The Autopatch and User Loadable Autodialer Activate messages are announced when a user brings up the patch in one of these modes.

The Antidial message is generated when a user brings up the Autopatch with a phone number trapped out by the antidialer.

The Patch Cover Tone is generated in place of the mobile's audio when the cover tone is active during a patch.

The Patch Timeout Warning message tells the user that the patch is about to time out. The user can complete the call or extend the timer.

The Phone Answer message is generated by the controller when answering an incoming phone call; that is, when someone calls the repeater on the phone.

The Phone Hangup message is generated when the the controller hangs up the phone.

The Reverse Patch "call-for" message is generated before the call-sign during directed reverse patches.

Examples
Autopatch Activate – "Auto patch"
User Loadable Autodialer Activate – "Auto dial"
Antidial – "Contact control operator"
Patch Cover Tone – "Beep-beep" [Morse code I]
Phone Answer – "Good (morning/afternoon/evening), this is WA6AXX Repeater, control."

Phone Hangup – "Call complete at (time) (am/pm) on (date)"
Reverse Patch "Call-For" – "Call for"

See Also
Operation Manual – "Telephone Interconnect"

Remote Base / Link Messages

	Morse	Speech	Response	# Chars
Remote Base #1 Name	*1063	*1163	"L1"	6
Remote Base #2 Name	*1064	*1164	"L2"	6
Remote Base #3 Name	*10115	*11115	"L3"	4
Remote Base #4 Name	*10114	*11114	"L4"	4
Remote Base #1 Freq. Prefix	*1061	*1161	"Remote 1 P"	6
Remote Base #2 Freq. Prefix	*1062	*1162	"Remote 2 P"	6
Remote Base #1 Mem. 1 Name	*10121	*11121	"L1N1"	6
Remote Base #1 Mem. 2 Name	*10122	*11122	"L1N2"	6
Remote Base #1 Mem. 3 Name	*10123	*11123	"L1N3"	6
Remote Base #1 Mem. 4 Name	*10124	*11124	"L1N4"	6
Remote Base #1 Mem. 5 Name	*10125	*11125	"L1N5"	6
Remote Base #1 Mem. 6 Name	*10126	*11126	"L1N6"	6
Remote Base #1 Mem. 7 Name	*10127	*11127	"L1N7"	6
Remote Base #2 Mem. 1 Name	*10131	*11131	"L2N1"	6
Remote Base #2 Mem. 2 Name	*10132	*11132	"L2N2"	6
Remote Base #2 Mem. 3 Name	*10133	*11133	"L2N3"	6
Remote Base #2 Mem. 4 Name	*10134	*11134	"L2N4"	6
Remote Base #2 Mem. 5 Name	*10135	*11135	"L2N5"	6
Remote Base #2 Mem. 6 Name	*10136	*11136	"L2N6"	6
Remote Base #2 Mem. 7 Name	*10137	*11137	"L2N7"	6

Purpose
These messages relate to operation of the Remote Bases and Links.

Remarks
The remote base names allow the user to verify he's entered the intended commands, and lets listeners understand what they're listening to.

The frequency prefixes allow frequency readback to announce the complete frequency, by preceding the MHz digit to the hundreds and tens MHz information.

The memory names replace frequency readback for a more meaningful response when selecting frequency memories. These require 8K E2PROM for storage.

When all BCD frequency digits are set to zero, the controller always responds with the name in place of frequency readback. If a remote is a single channel transceiver, set the frequency to its actual frequency for meaningful readback, or to all zeros so the controller reads back its name in place of frequency.

Examples
Remote Base Names – "Two meter" "UHF" "23 centi meter"
Frequency Prefix – "One four -ty" "Four four -ty" "Twelve nine -ty"

See Also
Operation Manual – "Remote Bases"

Scheduler

	Morse	Speech	Response	# Chars
Changeover Announcement	*10140	*11140	"Change over"	5
Event 1 Message	*10146	*11146	"E1"	12
Event 2 Message	*10147	*11147	"E2"	12
Event 3 Message	*10148	*11148	"E3"	12
Event 4 Message	*10149	*11149	"E4"	12
Event 5 Message	*10150	*11150	"E5"	12

Purpose
These messages are generated at scheduler changeovers and events.

Remarks
The Changeover Announcement is generated at a changeover when a new Macro Set is loaded by the scheduler. If the repeater transmitter is on the air, the announcement is made; if the transmitter is off the air, it isn't. Event messages are generated by the controller at scheduled event times.

Examples
Changeover Announcement – "Automatic control operator change over"
Event Message – "Net in two minutes"

See Also
Operation Manual – "The Scheduler"

Special Patch Utilities

	(Speech)	Response	# Chars
Phone Number Leading "1" Override	*1168	"LD over"	6
Phone Number Macro "A"	*11128	"MA"	6
Phone Number Macro "B"	*11129	"MB"	6
Phone Number Macro "C"	*11130	"MC"	6
Local Area Code	*1169	"Area code L"	3
Adjacent Area Code	*1170	"Area code J"	3
Permitted Area Code #1	*11117	"Area code P1"	3
Permitted Area Code #2	*11118	"Area code P2"	3
Permitted Area Code #3	*11119	"Area code P3"	3
Primary Patch Dialing Prefix	*1171	"PPRE"	8
Secondary Patch Dialing Prefix	*11138	"SPRE"	6
Tertiary Patch Dialing Prefix	*11139	"TPRE"	6

Purpose
The above information relates to patch operation. The information is stored using the message editor.

Remarks
The "override" and macro digit strings replace the first digit of any Autopatch or autodial phone number when its first digit is 1, A, B, or C. They allow macro-like expansion of area codes or other special sequences without requiring the full amount of storage in each autodial location.

The local and adjacent area codes cross reference to the stored exchange tables, which allow design of a custom calling area.

The permitted area codes are additional area codes in which all exchanges are considered to be local, or permitted.

The Patch Dialing Prefixes precede Autopatch and autodialer calls placed by the controller, based on the Autopatch access code, or prefix stored with the autodial number.

See Also
Operation Manual – "Telephone Interconnect"

Examples
An unusual phone company requires long distance calls to be placed with a leading "1121" instead of the normal leading 1. The Phone Number Leading 1 Override Message may be loaded with "1121". Long distance calls can then be placed through the controller with the standard leading 1 – the controller expands it out to the required 1121.

Many of our autodial numbers are 11 digit numbers, beginning with 1-415 and 1-602. We can load the Phone Number Macro A and B Messages with "1415" and "1602" respectively. We can now use eight digit autodial slots for these phone numbers by replacing the stored 1 and area code with A or B.

Our local area code is 408, and our adjacent area code is 415. We can load these into the Local and Adjacent Area Code messages, so that when Autopatch calls are placed, the controller checks the appropriate exchange tables to determine if the call is long distance.

From the repeater's location, all calls to area code 714 are toll-free, even though they require a leading 1. We can load "714" into Permitted Area Code #1, #2, or #3.

Our controller is connected to a PBX extension. All local calls should be preceded by "9 (pause)", while "7 (pause)" accesses a tie line to a nearby city. We can load the Primary Patch Dialing Prefix message with "9 (pause)", the Secondary with "7 (pause)", and the Tertiary Prefix as empty. The three Autopatch prefixes then automatically access the local line, the tie line, or the PBX directly.

Tail Messages

	Morse	Speech	Response	# Chars
Tail Message #1	*1011	*1111	"TM1"	6
Tail Message #2	*1012	*1112	"TM2"	6
Tail Message #3	*1013	*1113	"TM3"	6
Tail Message #4(0)	*1014	*1114	"TM40"	6
Tail Message #4(1)	*1081	*1181	"TM41"	8
Tail Message #4(2)	*1082	*1182	"TM42"	8
Tail Message #4(3)	*1083	*1183	"TM43"	8
Tail Message #4(4)	*1084	*1184	"TM44"	8
Tail Message #4(5)	*1085	*1185	"TM45"	8
Tail Message #4(6)	*1086	*1186	"TM46"	8
Tail Message #4(7)	*1087	*1187	"TM47"	8
Tail Message #4(8)	*1088	*1188	"TM48"	8
Tail Message #4(9)	*1089	*1189	"TM49"	8

Purpose
These are messages which may be selected to be announced periodically at the end of the repeater's hang time.

Remarks
When Tail Message #4 is selected, the controller generates TM4(0) through TM4(9) based on the Macro Set currently selected manually or by the scheduler.

See Also
Operation Manual – "Tail Messages"
Control Operator's Reference Manual – "Tail Messages"

Examples
"Net tonight at 8" "Weather alert!" "(time), (mail present)"

Timeout Messages

	Morse	Speech	Response	# Chars
Repeater Timeout	*1015	*1115	"Repeater timeout"	6
Repeater Timeout Clear	*1016	*1116	"Repeater timeout cancel"	10
Patch Timeout Warning	*1017	*1117	"Patch timeout alert"	6

Purpose
These messages announce timed out conditions of the repeater and the patch.

Remarks
The Repeater Timeout announcement warns listeners that the user has timed out the machine. The Timeout Clear message announces that it is again available.
The Patch Timeout Warning message indicates to the patch user that he has 30 seconds before the patch times out. He may extend the patch timer if desired.

Examples
Repeater Timeout – "Repeater time out - please wait"
Timeout Clear – "Time out cancel, (gun) (gun)"
Patch Timeout Warning – "Thir -ty seconds left"

Touch-Tone Cover Tone

Morse	Speech	Response	# Chars
*1019	*1119	TTCT	4

Purpose
This message is generated over the user's muted Touch-Tone commands.

Examples
"dit" [Morse code E], "tic-toc"

User Call Signs

	Speech	Response	# Chars
Call Sign	*12xx (xx = 00-99)	"Call"	6

Purpose
These messages are the call signs of the repeater's users.

Remarks
Call sign messages are used for the Directed Reverse Patch, the Mailbox, and for individual user access code cross-reference. The call sign messages should be synthesized speech.

Slots 78 and 79 are special. The unanswered reverse patch mailbox message is left for the user, from slot 79. Uncleared alarm messages are left for slot 78, from slot 79. Slot 79 should therefore be loaded with a message such as "The Repeater", or "The system", while 78 should be loaded with a message such as "Control Operators".

Call sign slots 80-99 are available only with the 8K byte E2PROM.

Examples
"WA6AXX", "N6HWL", "WB6 kilo hotel papa", "The repeater system"

User Function Response Messages

	Morse	Speech	Response	# Chars
User Function 1 High	*1021	*1121	"UF 1 high"	6
User Function 1 Low	*1031	*1131	"UF 1 low"	6
User Function 2 High	*1022	*1122	"UF 2 high"	6
User Function 2 Low	*1032	*1132	"UF 2 low"	6
User Function 3 High	*1023	*1123	"UF 3 high"	6
User Function 3 Low	*1033	*1133	"UF 3 low"	6
User Function 4 High	*1024	*1124	"UF 4 high"	6
User Function 4 Low	*1034	*1134	"UF 4 low"	6
User Function 5 High	*1025	*1125	"UF 5 high"	6
User Function 5 Low	*1035	*1135	"UF 5 low"	6
User Function 6 High	*1026	*1126	"UF 6 high"	6
User Function 6 Low	*1036	*1136	"UF 6 low"	6
User Function 7 High	*1027	*1127	"UF 7 high"	6
User Function 7 Low	*1037	*1137	"UF 7 low"	6
User Function 8 High	*1028	*1128	"UF 8 high"	6
User Function 8 Low	*1038	*1138	"UF 8 low"	6
User Function Byte 1 Name	*1030	*1130	"UFB1"	6
User Function Byte 2 Name	*1039	*1139	"UFB2"	6

Purpose
The User Function response messages indicate the state of the UF remote control logic outputs, with information about what the output states mean in your system.

Remarks
The UF outputs can be commanded high or low, and they may be interrogated. The response is a high or low beep, plus the message defined above.

The response to User Functions 9-32 is a high or low beep, followed by the output number. UF 9-32 don't have response messages as do UF 1-8. When controlled as groups, UF Byte 1 (outputs 17-24) and Byte 2 (outputs 25-32) respond with the programmable name and the value 0-255.

Examples
"Two meter high power", "North west down", "B E A M"

See Also
Operation Manual – "General Purpose Remote Control"

Chapter 4
Advanced Message Editing

This chapter describes advanced message editor capabilities. You may want to skip this chapter until you become familiar with the controller's operation in general.

Programmable messages may consist of a mixture of stored vocabulary synthesized speech, run-time variable speech strings, Morse code, Digital Voice Recorder tracks, paging tones, etc. This chapter describes editing messages which consist of other than simply synthesized speech vocabulary or Morse code characters.

The topics covered include:

- Run Time Variable Speech Strings
- Message Macros
- Changing Message Type
- Touch-Tone Signalling
- Pager Memory Signalling
- Digital Voice Recorder Tracks
- External Devices

Run-Time Variable Speech Strings

The RC-850 Repeater Controller is very smart – it can do and say much more than simply what you tell it to. For example, since the controller always knows what time it is, the time can be included in any programmable message. It also knows whether it's morning, afternoon, or evening, and can say the proper word based on the time of day; i.e., "Good Morning" in the morning, "Good Afternoon" in the afternoon, "Good Evening" in the evening.

The controller has analog measurement capabilities – it can measure voltages and convert them to temperature, signal strength, and numerous other conditions. These measurements can also be included in any programmable messages; e.g., "At eighteen watts on 440 MHz, this is WA6AXX, Repeater".

In addition to the real time measurements, the controller stores the max and min values for each measurement channel, and these may be included in messages as well; e.g., "The low temperature this morning, fourteen degrees, at WA6AXX, Repeater".

Several system related pieces of information are available, such as the period of time the repeater was last timed out. The Timeout Clear message can say "Repeater time out for 32 seconds".

These are examples of controller generated synthesized speech strings determined by the controller at run-time – the actual time when they're said.

The run-time variable speech strings available in the message editor are defined below, and include:

Time and Date
Mailbox
Telemetry
Stored High Value Telemetry
Stored Low Value Telemetry

Remember that run-time variables are used just like other synthesized speech vocabulary after unlocking the controller and selecting a message to edit.

Time and Date Run-Time Variables

Morning/Afternoon/Evening *844
Time (in 12 or 24 hour format) *872
A.M. or P.M. (if 12 hour format) *832
Date (month and day) *833

These are announcements which are determined by the time of day and date. Time announcements are based on 12 or 24 hour clock mode selected by the repeater owner.

Examples
Morning/Afternoon/Evening in Tail Message: "Good (morning/afternoon/ evening)"

Time (12 hour), am/pm, Date in Phone Hangup Message: "Call complete at (time) (am/pm) on (date)"

Mailbox Run-Time Variables

Mail Present *994 (requires 2 character slots)
Number of Messages in Mailbox *5732 (requires 2 character slots)

The Mail Present variable expands out to the "Mail Present" message if there is mail in the mailbox. If there is no mail in the mailbox, nothing is generated.

The Number of Messages variable indicates the quantity of mail currently in the mailbox. This run-time variable requires two character slots.

Example
Assume the Mail Present Message = (number of messages run-time variable) + (pause) + ("check it out") and that a Tail Message = (mail present run-time variable). If there are three mailbox messages, the tail message would expand out to "Three messages, check it out". If there were no mail, the tail message would be silent.

See Also
Operation Manual – "Demo Messages, Bulltetin Board, and the Mailbox"

Telemetry Run-Time Variables

VRT channel 1-32 measurement*571 - *5732 (require 2 character slots)

Channels 1-16 are hardware analog inputs 1-16. Each input has assigned to it a "meter face" which determines scaling and measurement unit readback.

Channels 17-32 are additional types of weather related telemetry measured digitally by the controller, and also system datalogging information.

Examples
The Temperature meter face is assigned to channel 15. Including "*5715" in a programmable message results in "Fifty five degrees" (the actual measured temperature) to be spoken as part of the message.

Channel 25 is defined in the firmware as the "Number of repeater keyups" since last cleared. Including "*5725" in a message results in "Seventeen" (or whatever the actual number of keyups was).

See Also
Operation Manual – "Telemetry"

Stored High Value Telemetry Run-Time Variables

VRT Channel 1-32 max value *5733 - *5764 (channel+32)

Channels 33-64 store the highest measured value of channels 1-32. They are available for inclusion in messages and require two character slots.

High value channels are cleared manually with Control Op commands, or as Scheduler events. You could clear the outside temp max value channel each morning so that it contains valid daytime high temp data through the evening.

Example
Channel 47 stores the max measured value of channel 15 in the example above. Inclusion in a message results in the highest temperature, i.e., "seventy two degrees" to be spoken. An ID message could say, "To-days high temperature, seventy two degrees, at WA6AXX, Repeater".

Stored Low Value Telemetry Run-Time Variables

VRT Channel 1-16 min value *5765 - *5780 (channel+64)

Channels 65-80 store the lowest measured value of channels 1-16. They are available for inclusion in messages and require two character slots.

Min value channels are cleared manually with Control Op commands, or as Scheduler events. You might want to clear the outside temperature min value channel each evening so it contains valid overnight low temperature data throughout the next day.

Example
Channel 79 stores the lowest measured value of channel 15 in the example above. Inclusion in a message results in the lowest temperature; e.g., "forty five degrees", to be spoken. An ID message could say "Good morning - the low temperature, forty five degrees, at WA6AXX, Repeater".

Message Macros

	(from Morse)	(from speech)
Macro 1	15	*861
Macro 2	25	*862
Macro 3	35	*863
Macro 4	45	*852

Each programmable message is limited to a maximum size. Normally, there's plenty of room to fit everything you want a message to say in the space provided. Occasionally, there may not be room. The "message macros" are programmable messages which may be inserted inside other messages.

For example, your repeater call sign is used in all the repeater ID messages. By programming the speech call sign into one macro, and the Morse call sign into another, and inserting the macros inside the ID messages, you have more room in each ID for other information.

Examples
Macro #1 = "WA6AXX, Repeater" [speech]
Pending ID #2 = "Good afternoon, this is (macro #1), at eight teen hundred feet overlooking repeater valley"

Changing Message Type

Each programmable message may contain a mixture of Morse code and synthesized speech characters, Digital Voice Recorder tracks, paging tones, voice response telemetry measurements, etc.

After the controller is unlocked, the message to be edited is selected by a programming command, which specifies whether it starts out as a Morse code or speech message. At any point inside the message, a different "type" may be selected. For example, an ID message may say in synthesized speech "From fifteen hundred feet, this is WA6AXX, Repeater...", then switch to Morse code to say "SAN JOSE".

Messages which start as a type other than Morse or speech should be selected as a speech message with the appropriate programming command, and then the first "character" entered into the message should be a type change.

The commands to change message type within a message are summarized below and described individually. (^ means unkey over the air, or enter # from phone.)

	code	**response**
Change to Morse (until another "change")	*50^	"check"
Change to speech (until another "change")	*51^	"check"
DTMF digits	*52(digits)^	(dtmf)
Pager memory xy and optional data	*53xy(data)^	(paging tones)
Digital Voice Recorder Track #0-127	*55xyz^	(dvr track)
External device #1-4 activate	*56x^	(ext dev)

Change to Morse Code

While editing a message, "*50" may be imbedded anywhere within the character sequence. All characters following the *50 (until a new "change" command) are generated as Morse code.

Example Pending ID #1 = [speech] This is WA6AXX, Repeater [Morse] SAN JOSE

Unlock and select PID1 as speech message (*1104)
Enter 65 91 21 06 21 92 92 34 80 34 ^ *50 ^ 73 21 62 11 51 63 73 32

As usual, you may unkey (or enter # from phone) at various points along the way while entering the message. The controller will read back what you entered during that transmission, so that you can be sure that you're entering what you intend. Be sure to unkey before and after the change command.

Change to Synthesized Speech

While editing a message, "*51" may be imbedded anywhere within the character sequence. All characters following the *51 (until a new "change" command) are generated as synthesized speech.

Example Pending ID #1 = above example plus [speech] seven -ty three

Unlock and select PID1 as speech message (*1104)
Enter 65 91 21 06 21 92 92 34 80 34 ^ *50 ^ 73 21 62 11 51 63 73 32 ^ *51 ^ 34 07 60 03

Touch-Tone Signalling

While editing a message, "*52" may be imbedded anywhere within the character sequence. All characters following the *52 until the end of the transmission (or until the # over the phone) are generated directly as Touch-Tone, with one tone generated per digit entered. The *52 and tone digits must be entered as a single transmission. Touch-Tone # and D may not be generated with this method.

*52[Touch-Tone digits] entered as a single transmission

Example

Alarm #1 message = Touch-Tone sequence "ABC1472580369" followed by [speech] "intruder alert"
Unlock and select Alarm #1 message as speech message (*1178)
Enter *52ABC1472580369 ^ *51 ^ *764 40

Pager Memory Signalling

Paging tones stored in the controller's 50 user memories may be generated from any of the programmable messages. Paging formats which include optional data transmission may include data to be sent along with the activation tones. Tone and voice formats may be specified so that a synthesized speech message or DVR track may follow.

*53xx[*][data] ^
xx = 00-49
* is optional – indicates voice page for HSC and GSC only

data is optional – numeric encoded data

Example

Pager memory 25 addresses a five-tone sequential pager. We want to follow the paging tones with a synthesized speech message saying "Net in two minutes". Event #1 is scheduled to occur at 7:58 pm on Tuesdays.

Unlock and select Event #1 message as speech message (*11146)
Enter *5325 ^ *51 ^ 25 62 02 *645

When the message is activated, the controller generates the paging tones followed by a brief pause to allow the pager's speaker to open, and then says, "Net in two minutes".

Digital Voice Recorder Tracks

Any programmable message may include prerecorded audio from ACC's DVR. The tracks may be recorded remotely and are always available for use by the message editor. DVR tracks are referenced in messages as

*55xyz^ where xyz is the track number 0-127

Example

Build Pending ID1 from DVR tracks 3 and 19 and speech words.
Unlock and select PID1 as a speech message (*1104)
Enter *553 ^ *5519 ^ *51 ^ 65 91 21 06 21 92 92 34 80

When the message is activated, the controller replays DVR tracks 3 and 19, followed by synthesized speech, "This is WA6AXX, Repeater."

External Devices

External tape playback units and other devices may be activated from any programmable message. Up to four devices may be addressed independently. External devices are referenced in messages as

*56x^ where x is external device #1-4

Example

Specify Pending ID1 as external device #2.
Unlock and select PID1 as a speech message (*1104)
Enter *562 ^

When the message is activated, the controller strobes device #2 and waits for its busy signal to return inactive.

Chapter 5
Morse Code Parameters

The characteristics of messages generated by the controller in Morse code are fully programmable. The speed, pitch, and level of various classes of Morse code messages may be programmed independently. Control Operator responses could be high speed; informative ID messages can be sent more slowly; the Forced CW ID can be lower in level and high in pitch so it can be heard yet not compete with the user talking.

The following sections describe programming the speed, pitch, and level of the Morse code messages. There are seven classes of messages:

- Initial ID Messages
- Forced CW ID Message
- Anxious ID Message
- Pending ID, Periodic QST ID, Pager and Phone Line ID Messages
- Special ID Message
- User Command Response Messages, including
  - All User level command responses
  - Tail Messages
  - Courtesy Tone Messages
  - Repeater and Patch Timeout Messages
- Control Operator Response Messages, including
  - Control Operator level command responses
  - Programming level command responses

Morse Code Speed

The speed of response messages can be selected to be between 5 and 35 words per minute. The commands include the speed directly in WPM.

```
Initial ID *2000(speed)    speed = 5-35 WPM
Forced CW ID    *2001(speed)
Anxious ID *2002(speed)
Pending/QST ID  *2003(speed)
Special ID *2004(speed)
User Command    *2005(speed)
Control Op Command    *2006(speed)
```

Examples
Set the Forced CW ID speed to 20 WPM - *200120
Set the Control Op Command response speed to 35 WPM - *200635

Part 97 requires Morse code repeater ID's to be 20 WPM or less.

Morse Code Pitch

The pitch of Morse code messages can be programmed to be between 0 and several thousand Hertz. The practical high frequency limit for clean sine waves is approximately 3000 Hz. The commands include the pitch directly in Hertz.

```
Initial ID *2010(pitch)    pitch = 0-3000 Hz
Forced CW ID    *2011(pitch)
Anxious ID *2012(pitch)
Pending/QST ID  *2013(pitch)
Special ID *2014(pitch)
User Command    *2015(pitch)
Control Op Command    *2016(pitch)
```

Examples
Set the Forced CW ID pitch to 880 Hz – *2011880
Set the Control Op Command response pitch to 1200 Hz – *20161200

Morse Code Level

The level of Morse code messages may be programmed to 0 db, -3 db, -6 db, or -9 db. 0 db is the maximum level of the controller's tone generator. For example, if the tone generator is adjusted with its pot to 3.5 kHz deviation, -3 db results in 2.5 kHz, -6 db in 1.75 kHz, and -9 db in 1.25 kHz deviation.

```
Initial ID *2020(level)    level =    0 (0 db)
Forced CW ID    *2021(level)          1 (-3 db)
Anxious ID *2022(level)          2 (-6 db)
Pending/QST ID  *2023(level)          3 (-9 db)
Special ID *2024(level)
User Command    *2025(level)
Control Op Command    *2026(level)
```

Examples
Set the Forced CW ID level to -6 db - *20212
Set the Control Op Command response level to 0 db - *20260

Chapter 6
Courtesy Tone Parameters

The Courtesy Tone is generated by the controller at the end of each user transmission. The tone indicates that the repeater timeout timer has been reset, and that the next user may transmit. In addition to these functions, the actual tone selected (out of the twelve available) may convey telemetry, or information to users, such as status of the repeater.

The tones may be sine wave tone sets defined with Programming commands described below; or they may be messages, defined with the Courtesy Tone Message commands. Tone "messages" override tone "sets" described in this chapter. To restore a sine wave tone set if a message has been defined, an empty message must be written into the Courtesy Tone message.

Each tone set may consist of up to three segments of tones. The pitch, duration, and delay between tones may be programmed independently. The delay to the Courtesy Tone after the user unkeys, and the repeater hang time, are also programmed with these commands.

Courtesy Tones 1-8 are selected for signals through the main repeater receiver, based on a prioritized system of telemetry described in the Operation Manual (Courtesy Tones). Tones 9, 10, 11 and 12 indicate signals coming though the remote base or link receivers. Tone set 13 is generated in addition to the otherwise selected tone when a remote base or link is in the transmit enabled mode.

In the commands below, T is the tone set 1 through 13:

Tone Set	T
1-8	1-8
9 (RB/Link1)	9
10 (RB/Link2)	0
11 (RB/Link3)	*1
12 (RB/Link4)	*2
13 (RB/Link TX)	*3

Delay To/Between Segments

The delay to the first segment, and the delay between tone segments, may be programmed in milliseconds.

	Command	Response	
Delay To Segment 1	*3T10(delay)	BPD	delay = 85 - 3500 ms
Delay From Segment 1 to 2	*3T20(delay)	BPD	T = tone set 1-9,0(10)
Delay From Segment 2 to 3	*3T30(delay)	BPD	*1(11), *2(12), *3(13)

Segment Pitch

The pitch of each segment may be programmed in Hertz. Each segment is actually a dual tone, and each of the two frequencies may be programmed independently. Setting pitch A and B the same allows 0 db and -3 db levels as defined in the Segment Level commands. Setting one of the pitches to zero allows -6 db and -9 db levels. The pitches may be set differently for dual tones (similar to Touch-Tone).

Segment 1A Pitch	*3T11(pitch)	BPP	pitch = 0 - 3000 Hz
Segment 1B Pitch	*3T12(pitch)	BPP	
Segment 2A Pitch	*3T21(pitch)	BPP	
Segment 2B Pitch	*3T22(pitch)	BPP	
Segment 3A Pitch	*3T31(pitch)	BPP	
Segment 3B Pitch	*3T32(pitch)	BPP	

Segment Level

The level of each segment can be programmed. If the two pitches for the segment are both non-zero, the level can be set to 0 db or -3 db. If one pitch is set to zero Hz, the level can be set to -6 db or -9 db.

Segment 1 Level	*3T13(level)	BPL	level = 0 (0/-6 db)
Segment 2 Level	*3T23(level)	BPL	1 (-3/-9 db)
Segment 3 Level	*3T33(level)	BPL	

Segment Duration

The duration of each segment can be programmed. A segment can be blanked out by setting its duration to zero.

Segment 1 Duration	*3T14(dur)	BPD	dur = 0 - 3500 ms
Segment 2 Duration	*3T24(dur)	BPD	
Segment 3 Duration	*3T34(dur)	BPD	

Hang Time

The repeater's hang time, or the duration the repeater transmitter remains on after the Courtesy Tone sounds, is programmed as part of the Courtesy Tone sets. The hang time may be set between the Segment 1 Delay period and 10 seconds. If set to zero, a true zero hang time results, and the Courtesy Tone is suppressed - this may be useful in certain linking applications.

Hang Time	*3T40(hang time) hang time = 0 -10,000 ms	BPHT

Preview Courtesy Tone

While programming Courtesy Tone parameters over the air, the tone set being modified is generated at the end of your transmission, even if it isn't otherwise currently selected. While unlocked and commanding over the air, you can listen to any of the tone sets without having to modify them by using the Preview command.

Preview	*3T50	BPPRV

This command modifies the next courtesy tone generated by the repeater. The tones are not generated over the telephone if controlling from the phone.

Copy Courtesy Tone Set

The contents of one sine wave tone set may be copied to another with the copy command. You may have a set that you'd like to experiment with, without the risk of destroying the original. The copy command lets you copy a source set to a destination set. The source set is not changed – the destination set is written over with information from the source.

Copy Source to Destination	*3(dest)0(source)	BPCPY

For example, to copy tone set 3 parameters to set 6 so that we can work on them without modifying the original (set 3), enter *3603.

Programming Example
Design Courtesy Tone Set #4 to be a single 440 Hz, 150 ms tone, with a 250 ms delay to the tone, and a 4 second hang time.

*3410250	250 ms delay to segment 1
*3411440	pitch a = 440 Hz
*3412440	pitch b = 440 Hz (single freq. tone, 0 db)
*34130	level = 0 db
*3414150	duration = 150 ms
*34200	zero out delay and duration for unused

```
*34240          segments 2 and 3
*34300
*34340

*34404000     hang time = 4 second (4000 ms)
```

Only those parameters to be changed need be entered. For example, to increase the duration to 200 ms, enter *3414200.

Chapter 7
Timers

The various timers in the repeater system are programmable by the repeater owner. The timer values are entered directly in seconds as part of each command.

Certain of the timers may be disabled by setting their value to zero. For example, it may be desirable to disable the Emergency Autodialer Timer, relying on only the activity timer for emergency calls. However, disabling certain timers may have unexpected results. Disabling the Tail Message Timer, for example, will cause tail messages to be generated at every tail. Disabling the Phone Answer Delay timer will cause the phone never to be answered.

The maximum timer duration is 1799 seconds (30 minutes). Values above 1799 "wrap around" and will result in unpredictable durations.

The timers which may be programmed include:

- Alarm Timer
- Command Decoder Timers
- External Device Timer
- ID Timers
- Patch Timers
- Phone Answer Delay Timer
- Repeater Timeout Timers
- Spare Audio 1 Timer
- Tail Message Timer
- Touch-Tone Access Mode Timer
- Transmitter Turn-on Delay Timer

Hang time and delay to the courtesy tone are programmed with Courtesy Tone Programming commands.

Alarm Timer

	Command	**Response**
Alarm	*4019(period)	"AL timer"

Purpose
The alarm timer determines the length of time the alarm will sound over the air.

Remarks
If the alarm is not cleared before the timer expires, the system leaves a message in the mailbox alerting the Control Op of the alarm condition.

Command Decoder Timers

Sequence Interdigit Timer	*4004(period)"SEQ"
Beginning of Transmission to Sequence	*4018(period)"SQB"
Sequence to End of Transmission	*4005(period)"SQE"
Individual User Access Code Timer	*4020(period)"IUA"
Repeater Activity Timer	*4021(period)"rptr A timer"

Purpose
These commands relate to command decoding.

Remarks
The Sequence Interdigit timer disqualifies Touch-Tone commands entered over the air when the digits are separated by more than several seconds. Its purpose is to eliminate the effects of decoder falsing.

The Beginning of Transmission to Sequence timer requires the user to key down for several seconds before starting to enter a Touch-Tone command. This can encourage users to ID before entering their commands and reject jammers.

The Sequence to End of Transmission timer disqualifies Touch-Tone commands entered long before the end of the user's transmission. It eliminates the effects of decoder falsing.

The Individual User Access Code timer determines how quickly a user must enter a command function after entering his user access code. This timer applies only to the classes of user commands which have the Individual User Access attribute set.

The Repeater Activity timer causes the controller to reload the currently selected link / remote base and user function output macro set information after a period of repeater inactivity (on the repeater receiver channel). It automatically "cleans up" these functions unintentionally left on by a user. To function, both the scheduler must be turned on, and the Repeater Activity Timer must be enabled by the Control Op.

Examples
Sequence Interdigit Timer = 5 seconds (~3-15 seconds)
Beginning of Transmission to Sequence Timer = 0 seconds (~0-15 seconds)
Sequence to End of Transmission Timer = 8 seconds (~5-15 seconds)
Individual User Access Code Timer = 15 seconds (~0-1799 seconds)
Repeater Activity Timer = 600 seconds (~60-1799 seconds)

External Device Timer

	Command	Response
External Device Timer	*4028(period)	"EXT"

Purpose
The External Device timer functions as a failsafe timer in case an external message device source fails to provide a valid busy signal to the controller.

Example
An external cartridge tape machine is used for a tape ID message. The tape runs about 25 seconds. The External Device timer may be set for approximately 35 seconds.

ID Timers

	Command	Response
Initial ID Timer	*4000(period)	"Timer IID"
Forced CW ID Timer	*4001(period)	"Timer FID"
Anxious ID Timer	*4002(period)	"Timer AID"
Pending ID Timer	*4003(period)	"Timer ID"
Periodic QST ID Timer	*4017(period)	"Timer QST"

Purpose
These timers define the timing related to the ID sequencing.

Remarks
The ID timing is described in detail in the Operation Manual, "Identification".

Examples
Initial ID Timer = 10 seconds (~1-15 seconds)
Forced CW ID Timer = 60 seconds (~1-? seconds)
Anxious ID Timer = 180 seconds (~1-? seconds)
Pending ID Timer = 360 seconds (~30-? seconds)

The sum of the periods of the Pending ID Timer plus Anxious ID Timer plus Forced CW ID Timer must be less than 10 minutes in order to comply with Part 97.

Patch Timers

Autopatch Timeout	*4008(period)	"AP timeout"
User Loadable Autodialer Timeout	*4009(period)	"AU timeout"
Emergency Autodialer Timeout	*4010(period)	"AE timeout"
Patch Timer Extend Timer	*4016(period)	"Timer X"
Patch Activity Timer	*4013(period)	"APAT"
Reverse Patch Ring Timeout	*4027(period)	"RP timeout"

Purpose
These timers relate to patch operation.

Remarks
The Autopatch, User Loadable Autodialer, and Emergency Autodialer Timeout timers are the overall timers for these functions. They limit the overall patch to the duration programmed (plus approximately 30 seconds). When the timer times out during a patch, the Patch Timeout Warning message is generated, and if the timer is not extended by the user, the patch times out 30 seconds later.

The Patch Timer Extend timer is the value loaded when the user extends the patch after being warned of the impending timeout.

The Patch Activity timer hangs up the patch if there is either no activity or a constant carrier on the repeater receiver channel for the specified period. The activity timer is reset at the beginning and end of each user transmission.

The Reverse Patch Ring Timeout timer limits the duration of the ringing over the repeater. For a directed reverse patch, the timer starts after the call sign announcements.

Examples
Autopatch Timeout = 180 seconds (0, ~60-1799 seconds)
User Loadable Autodialer Timeout = 180 seconds (0, ~60-1799 seconds)
Emergency Autodialer Timeout = 600 seconds (0, ~60-1799 seconds)
Patch Timer Extend Timer = 60 seconds (0, ~30-1799 seconds)
Patch Activity Timer = 45 seconds (0, ~30-1799 seconds)
Reverse Patch Ring Timeout Timer = 45 seconds (~20-90 seconds)

Phone Answer Delay Timer

Phone Answer Delay Timer	*4012(period)	"PHAN"

Purpose
This timer determines how long the phone is allowed to ring for incoming calls before the controller answers it.

Remarks
The answer delay is approximate because the controller waits for a ringing voltage pulse to go away before going offhook to avoid hot switching the relay.

The value should be set longer than 8 seconds to avoid spurious phone answering due to transients on the phone line.

Phone answering can be disabled by setting the timer value to zero.

Example
Phone Answer Delay Timer = 15 seconds (0, ~8-60 seconds)

Repeater Timeout Timers

Long Timeout Timer	*4006(period)	"Repeater timer L"
Short Timeout Timer	*4007(period)	"Repeater timer S"

Purpose
These are the repeater timeout timers which limit the maximum transmission duration through the repeater main receiver.

Remarks
Two values may be programmed and a Control Op or the scheduler can select one to be active.

Examples
Long Timeout Timer = 180 seconds (~30-1799 seconds)
Short Timeout Timer = 45 seconds (~15-1799 seconds)

Spare Audio 1 Timer

Spare Audio 1 Timer	*4014(period)	"SP1 timer"

Purpose
This timer limits how long a user may activate the Spare Audio 1 function.

Example
Spare Audio 1 Timer = 90 seconds (0, ~30-1799)

Tail Message Timer

Tail Message Timer	*4015(period)	"TM timer"

Purpose
When the Control Op "Tail Message Timer" mode is selected for tail message frequency, this timer determines how frequently the tail message is generated.

Example
Tail Message Timer = 600 seconds (~60-1799 seconds)

Touch-Tone Access Mode Timer

Touch-Tone Access Mode Timer *4011(period) "TTAM"

Purpose
This timer determines how long the Touch-Tone Access Mode remains "up" after the end of repeater activity.

The Touch-Tone Access Mode timer may be disabled by setting the value to zero. When disabled, Touch-Tone Access may be brought up and down manually, and will not time out.

Example
Touch-Tone Access Mode Timer = 60 seconds (0, ˜15-1799 seconds)

Transmitter Turn-on Delay

Turn-on Delay *4026(period in ms) "TX on"

Purpose
This timer delays turn-on of the repeater transmitter when a new signal appears at the repeater receiver. It can help reject against interference.

Example
Turn-on delay = 700 ms (0, ˜100-3500)

This function would normally be disabled by setting the timer value to zero.

Chapter 8
Setting the Clock/Calendar

The RC-850 Controller includes a crystal controlled time-of-day clock and calendar. It allows users to request the time of day; the time and date may be included in any programmable message; and the clock/calendar drives the Scheduler. The clock/calendar may be set at any time after powerup with these Programming commands.

Time of Day Set

*4100 (am/pm) (hours 10s) (hours 1s) (minutes 10s) (minutes 1s)
am -> am/pm=0
pm -> am/pm=1

Note: The time command should be entered so that it's evaluated by the controller "straight up", or right on the new minute.

Examples
It's 7:56 am. Enter *410000756
It's 11:45 pm. Enter *410011145

Date Set

*4101 (month 10s) (month 1s) (day 10s) (day 1s) (year 10s) (year 1s)

Examples
It's March 15, 1985. Enter *4101031585
It's October 25, 1999. Enter *4101102599

Day of Week Set

*4102 (dow)
dow / 0 = Sunday
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday

Example
It's Monday. Enter *41021

Select 12/24 Hour Format

*41031 12 hour format (female voice readback)
*41032 24 hour format (male voice readback)

The clock should always be set using 12 hour format. This command determines the format for time of day announcements requested by users or included in programmable messages.

Chapter 9
Command Codes / Channels

Command code prefixes may be defined for each class of user command and for Control Operator commands. In addition, each class of user command may be assigned a set of attributes (characteristics).

Control Operator Command Prefix and Root Set

Control operator commands consist of a programmable prefix followed by a three-digit root code. The prefix may be between one and seven digits long. Two separate prefixes are available – one for use from over the telephone command channel, and another for use over the other command channels.

The root codes specify the actual control operator function to be performed, and are drawn from one of four different sets. The repeater owner can specify which set of root codes are to be used.

The repeater owner has the option at any time to change the command prefix, and/or the root code set, so he can partially or completely change the codes.

Control Op commands may be between four and ten digits long, for ease of use, or for optimum security. Since different prefixes may be used over the air vs. over the phone, phone commands could be short, while over the air commands could be long with A/B/C digits included to maximize security. Control operator level commands may also selectively require PL over the air, or may be disabled completely over the air and/or over the phone.

*5000(1-4)	Control Operator Command Root Set 1-4
*5001(prefix)	Control Operator Command Prefix (Over the air)
*5014(prefix)	Control Operator Command Prefix (Over the phone)

Example
Select control operator root set #3, and define the over the air prefix as A3C9, and the over the phone prefix as 789. With the controller unlocked, enter

```
*50003
*5001A3C9
*5014789
```

See Also
Control Operator's Reference Manual

User Command Prefixes

The various classes of user commands consist of minimal length roots defined by the controller's firmware, preceded by one- to seven-digit prefixes defined with programming commands. As with Control Op commands, the tradeoff may be made between short, easy commands, or long secure ones, and they may be modified at any time remotely. The user commands are classified by function to allow independent modifications to be made for the various features. The repeater owner may want to make available only some of the user commands to users.

Care should be taken in selection of command code prefixes to avoid conflicts among the various user and Control Operator commands. Each valid command must be unique to be interpreted correctly by the controller. For example, if a Control Operator command prefix is *2538 and the autopatch command prefix is *, then *2538085 could be interpreted as a control operator command with root code 085, or as an Autopatch to 253-8085.

The prefixes should also not begin with the same sequence as the Touch-Tone Pad Test to prevent a conflict.

Any user command may be disabled by loading an empty prefix; i.e., no digits following the *50xx. For example, if you don't intend to use the Secondary Autopatch, you may enter *5016 to disable access to that function. If you don't intend to use Spare Audio 1 function, enter *5012. Disabling unused command prefixes helps minimize potential code conficts.

Patch Commands

*5005(prefix)	Primary Autopatch Prefix
*5016(prefix)	Secondary Autopatch Prefix
*5017(prefix)	Tertiary Autopatch Prefix
*5003(prefix)	Primary Emergency Autodialer Prefix
*5018(prefix)	Secondary Emergency Autodialer Prefix
*5004(prefix)	User Loadable Autodialer Bank 0 Prefix
*5019(prefix)	User Loadable Autodialer Bank 1 Prefix
*5029(prefix)	User Loadable Autodialer Bank 2 Prefix
*5007(prefix)	User Loadable Autodialer Bank 0 Load/Erase Prefix
*5020(prefix)	User Loadable Autodialer Bank 1 Load/Erase Prefix
*5030(prefix)	User Loadable Autodialer Bank 2 Load/Erase Prefix
*5013(prefix)	Patch Utility Group P Prefix (reverse patch answer, custom hangup, duplex, cover, timer extend)
*5021(prefix)	Patch Utility Group Q Prefix (redial, hookflash)
*5011(command)	Reverse Patch Activate Command
*5022(command)	Patch / Spare Audio 1 Hangup Command (loading an empty command makes the hangup command #)

The Autopatch, Emergency Autodialer, and User Loadable Autodialers may all have the same prefix. For example, if they're all "*", with the User Loadable Auto- dialer Bank 1 prefix as "*1" and Bank 2 prefix as "*2", then *(phone number) activates the Autopatch, *0 activates an Emergency Autodialer slot, *99 activates a Bank 0 User Loadable Autodialer slot, *199 activates a Bank 1 Autodialer slot.

The Patch Hangup command may be set to # by loading an empty command; i.e., *5022.

Remote Control Commands

*5023(prefix)	BSR Remote Control Prefix
*5002(prefix)	User Function Remote Control Prefix

Link / Remote Base Commands

*5006(prefix)	Link / Remote Base Prefix

Others

*5015(prefix)	Paging Prefix
*5012(command)	Spare Audio 1 On Command
*5010(prefix)	Demo Message / Bulletin Board Prefix
*5025(prefix)	Mailbox Prefix
*5009(prefix)	Voice Response Telemetry Prefix
*5008(prefix)	Touch-Tone Access Up/Down Prefix
*5026(prefix)	Touch-Tone Pad Test Prefix
*5027(prefix)	User Mapped Control Operator Command Prefix
*5028(prefix)	Individual User Access Code Prefix

User Command Attributes

Each class of user command may have associated with it an optional set of attributes. The attributes include:

X	PL required for this command in Access/Command Mode B, F, and J
Y	PL not required for this command in Access/Command Mode C, G, and I
Z	User command belongs to User Command Group A or Group B
ZZ	Requires individual user access command

Programming a new command prefix for a user command clears all its attributes. The attributes may be selectively set after the prefix is defined.

(attributes) = (X Y Z ZZ) 0 = clear the attribute, 1 = set the attribute
  X 1 = PL required ...
  Y 1 = PL not required ...
  Z 1 = Group B (0 = Group A)
  ZZ 1 = Requires individual user access ...

Patch Attributes

*5055(attributes) Primary Autopatch Attributes
*5066(attributes) Secondary Autopatch Attributes
*5067(attributes) Tertiary Autopatch Attributes
*5053(attributes) Primary Emergency Autodialer Attributes
*5068(attributes) Secondary Emergency Autodialer Attributes
*5054(attributes) User Loadable Autodialer Bank 0 Attributes
*5069(attributes) User Loadable Autodialer Bank 1 Attributes
*5079(attributes) User Loadable Autodialer Bank 2 Attributes
*5057(attributes) User Loadable Autodialer Bank 0 Load/Erase Attributes
*5070(attributes) User Loadable Autodialer Bank 1 Load/Erase Attributes
*5080(attributes) User Loadable Autodialer Bank 2 Load/Erase Attributes
*5063(attributes) Patch Utility Group P Attributes
*5071(attributes) Patch Utility Group Q Attributes

The Patch Hangup attributes X and Y are the same as the attributes associated with the command to activate the patch. Attributes Z and ZZ don't apply.

Remote Control Attributes

*5073(attributes) BSR Remote Control Attributes
*5052(attributes) User Function Remote Control Attributes

Link/Remote Base Attributes

*5056(attributes) Link Attributes

Others

*5065(attributes) Paging Attributes
*5062(attributes) Spare Audio 1 On Attributes
*5060(attributes) Demo Message / Bulletin Board Attributes
*5075(attributes) Mailbox Attributes
*5059(attributes) Voice Response Telemetry Attributes
*5058(attributes) Touch-Tone Access Up/Down Attributes
*5076(attributes) Touch-Tone Pad Test Attributes
*5077(attributes) User Mapped Control Operator Command Attributes
*5078(attributes) Individual User Access / Identify Attributes

Example
Set the Tertiary Autopatch attributes to require PL in Access/Command Mode B, F, and J; require individual user access code before accessing.

```
*5067 1 0 0 1
         |       |
        X      ZZ
```

Remember that if the Tertiary Autopatch Prefix is reprogrammed, the attributes are cleared and must be reprogrammed.

Individual User Access Codes

Users may be assigned individual access codes for selective access to certain functions, defined as "requires individual user access" by its attributes. The access codes are three digit numbers, ranging from 000 to 799, and follow the Individual User Access command prefix to form the user level command. In response to the user command to "open up" these functions, the controller says "control up". At that time, a programmable timer begins to run, which automatically takes control back down at its timeout. The user may also manually take control down by entering the Individual User Access prefix plus (*). The user may interrogate the status with (IUAC).

Interrogate = (IUAC)
Control down = (IUAC)*

Each three digit code may be enabled or disabled individually, and for convenience, all codes may be enabled or disabled with a single command.

```
*4610     Disable all 800 individual user access codes
*4611     Enable all 800 individual user access codes
*4610xyz  Disable user access code xyz
*4611xyz  Enable user access code xyz
           (xyz = 000 - 799)
```

Users whose call signs are stored in the controller may be acknowledged when activating the individual user access command. A user's three digit access code should consist of one programmable digit, followed by their two digit call sign slot.

User access code = (programmable digit 0-7)(two digit callsign slot number)

The programmable first digit may be crossed to a call sign slot with the command

```
*45DCC    Specify first digit "D" for call sign slot "CC"
           (D = 0-7,  CC = 00-99)
```

In this way, the one hundred access codes crossed to call signs may be randomly "scattered" throughout the eight hundred possible access codes.

Example
WA6AXX is stored in call sign slot 57. We want his individual user ID code to be 657, so that when he activates his individual user access command, the controller will acknowledge by announcing his call sign. Enter *45657 to cross access code 657 to call sign slot 57. Access code 657 may be enabled by entering *4611657.

The user would like to activate the Tertiary Autopatch (see example above). The Individual User Access Prefix is 1*.

The user first enables individual user access by entering 1*657. The controller responds by saying "WA6AXX, control up". The user may then proceed with activating the autopatch. When he's done, he may disable individual user access by entering 1**, or allow it to time itself down.

User Mapped Control Operator Commands

Up to ten Control Op level commands may be mapped to user level commands, consisting of a user level prefix followed by one digit (0-9). This capability allows the repeater owner to provide a small subset of Control Op commands to certain users, without needing to disclose the Control Op prefix and root codes.

```
*5000 0 xxx  User Mapped Control Op Command 0
*5000 1 xxx  User Mapped Control Op Command 1
*5000 2 xxx  User Mapped Control Op Command 2
*5000 3 xxx  User Mapped Control Op Command 3
*5000 4 xxx  User Mapped Control Op Command 4
*5000 5 xxx  User Mapped Control Op Command 5
*5000 6 xxx  User Mapped Control Op Command 6
*5000 7 xxx  User Mapped Control Op Command 7
*5000 8 xxx  User Mapped Control Op Command 8
*5000 9 xxx  User Mapped Control Op Command 9
          (xxx = Control Op root 1 code)
```

Positions may be cleared by entering the Dummy root code – 231.

Example
The repeater owner would like to make the Repeater Enable and Repeater Disable commands available to several repeater users, without disclosing Control Op level command codes. The two commands can be mapped to User Mapped Control Op Commands 0 and 1, by entering *5000 0 031 and *5000 1 032. Assuming the User Mapped Control Op Prefix is 654, then the commands 6540 and 6541 function as Control Op level commands for Repeater Enable and Disable.

Primary / Secondary Unlock Code Select

Two unlock codes may be stored in the controller (see Chapter 2 – "Unlocking and Locking the Controller"). One of the two may be selected remotely.

*58080 Primary Unlock Code Select
*58081 Secondary Unlock Code Select

Command Channel Enable / Disable

Programming and Control Op level commands may be blocked from several command channels to enhance system security.

*58010 Disable command from repeater receiver
*58011 Enable command from repeater receiver

*58020 Disable command from telephone
*58021 Enable command from telephone

Chapter 10
Logic I/O Senses

Certain of the logic inputs and outputs of the controller may be selected to be high true (high when active) or low true (low when active). These include link and remote base COS and PTT signals, the telephone offhook signal, and PL logic inputs.

Repeater transmitter PTT signal, and repeater receiver and control receiver COS signal logic senses are set with DIP switches on the main controller board. See the Hardware Reference Manual.

s = 0 => low true / active low
s = 1 => high true / active high

*5100s Link / Remote Base 1 COS Logic Input
*5101s Link / Remote Base 2 COS Logic Input
*5102s Link / Remote Base 1 PTT Logic Output
*5103s Link / Remote Base 2 PTT Logic Output

*5108s Link / Remote Base 3 COS Logic Input
*5109s Link / Remote Base 4 COS Logic Input

*5104s User / Control Op PL Logic Input
*5112s User Only PL Logic Input

Special Function

*5105p Phone Offhook p = 0/FCC registered board, 1/non-registered board
*5106q User Function Logic Outputs q = 0/latched, 1/expanded

Example
Set remote base 1 PTT output to be active low.

*51020

Chapter 11
Emergency Autodialer Numbers

The Emergency Autodialer telephone numbers may be programmed with the following commands. Each phone number may be up to eleven digits long and may begin with Macro Digit A, B, or C to form longer telephone numbers if necessary. [Leading 1 may be replaced by the Phone Number Leading 1 Override, if necessary, for unusual telephone systems which require other than a leading one for long distance.]

*5200(telephone number)	Emergency Autodial #0
*5201(telephone number)	Emergency Autodial #1
*5202(telephone number)	Emergency Autodial #2
*5203(telephone number)	Emergency Autodial #3
*5204(telephone number)	Emergency Autodial #4
*5205(telephone number)	Emergency Autodial #5
*5206(telephone number)	Emergency Autodial #6
*5207(telephone number)	Emergency Autodial #7
*5208(telephone number)	Emergency Autodial #8
*5209(telephone number)	Emergency Autodial #9

Example: Load telephone number 1-408-555-1212 into location 9.

*5209 14085551212

Emergency Autodialer response messages are programmed using the Message Editor, described in Chapter 3.

Logical Phone Line

If multiple or remote phone lines are configured, leading Macro Digits A, B, or C, or no leading macro digit, direct the call to the various logical phone lines. The macro digits are expanded out as well. Normally in this application the macros would be loaded with empty messages, and the leading macro digits would be used only to direct the call to the proper logical phone line.

Leading Macro Digit	**Logical Phone Line Selection**
none or A	Logical Phone Line #1
B	Logical Phone Line #2
C	Logical Phone Line #3

See Also
Operation Manual "Telephone Interconnect"

Chapter 12
Macro Sets and the Scheduler

Macro Sets can be stored for manual selection by Control Ops and automatic selection by the Scheduler. They contain information describing the complete Control Operator defined setup of the repeater, plus link, remote base, and remote control user function information. Events are one-shot happenings which may include message generation and clearing telemetry memories. Scheduler setpoints define when changeovers occur to different Macro Sets, and when events are to occur.

Macro Sets

Macro Sets are stored as Control Operator setup, remote base and link setup, and UF output setup. Setpoints define what setup information is loaded at each changeover – Control Operator setup only, remote/link setup only, UF setup only, or all setup.

Store Control Op, Remote, Link, and UF Setup into Macro Set
*591x Store current setup into Macro Set x (x = 0-9)

Macro Set 0 is special in that it is automatically loaded by the controller on powerup. Macro Set 0 should contain the desired powerup condition of the controller. All ten sets are available for manual selection by the Control Operator, and for automatic selection by the scheduler.

Events

Events are scheduled generation of programmable messages and scheduled clearing of telemetry min/max memories.

Five event messages may be programmed using the message editor. Message events specify the message number and an attribute, which defines under what circumstances the message is to be generated. For example, an event message may be generated only if the repeater is not in use, or it may be generated on top of any user talking through the repeater at the event time. Messages may also be directed to the auxiliary (remote base) transceivers.

Setpoints

Setpoints define when changeovers to different Macro Sets occur or when events are to occur. Up to thirty setpoints may be scheduled. Setpoints are defined by a time of day and day of week. The day of week may be any one day, every day, weekdays, or weekends.

Setpoints may be removed by loading an invalid time, such as 00 o'clock, or 99 o'clock. Setpoints are always programmed using 12 hour am/pm format, even if the time of day clock is selected for 24 hour military time announcements.

Changeover Setpoint

*42(ss)(dow)(am/pm)(10's hours)(1's hours)(10's minutes)
(1's minutes)(Macro Set)(changeover attribute)

Event Message Setpoint

*43(ss)(dow)(am/pm)(10's hours)(1's hours)(10's minutes)
(1's minutes)(event message)(event attribute)

Event Telemetry Memory Clear Setpoint

*44(ss)(dow)(am/pm)(10's hours)(1's hours)(10's minutes)
(1's minutes)(telemetry memory channel)

Only one setpoint will be activated at a particular day / hour / minute. If more than one setpoint qualify at a particular time, the lowest numbered setpoint is the one which will be activated. If several actions should occur at approximately the same time, specify a different time for each setpoint.

In some cases, this characteristic can conserve setpoints. For example, if something should happen everyday at 10 pm, except Thursday, when something else should happen, then place the Thursday setpoint in a lower numbered position than the everyday setpoint. The Thursday setpoint will be guaranteed to occur on Thursday, while the "everyday" setpoint will occur on days other than Thursday.

Also be aware that some scheduler actions wait for the channel to be clear. Changeovers wait for any user to unkey. Event messages, depending on their attribute, may also wait for a clear channel. Only one scheduler action is held pending at a time. This means that if a changover is pending, waiting for the user to unkey, and a minute later a telemetry clear event occurs, the changeover will be lost. Leave several minutes after changeovers and waiting event messages until the next scheduler action.

ss = setpoint 00-29 (both changeovers and events share the same 30 setpoints)

dow = day of week
0 = Sunday 5 = Friday
1 = Monday 6 = Saturday
2 = Tuesday7 = everyday
3 = Wednesday 8 = weekdays
4 = Thursday 9 = weekends

am/pm
0 = am
1 = pm

(10's hours)(1's hours)(10's minutes)(1's minutes)
Time of day of the setpoint (i.e. 10:58)

[Hours digits may be set to a "wildcard" value with Touch-Tone "D". Setting 10's and 1's hours to D causes a match every hour at "minutes" after.]

Macro Set
0-9 = Macro Set 0-9

Changeover Attribute
0 = Control Operator setup only
1 = Link and Remote Base setup only
2 = User Function output setup only
3 = Control Op, Link/Remote, and UF setup

Event Message = 1-5

Event Message Attribute
0 = Repeater transmitter, if repeater not in use
1 = Repeater transmitter, wait for user to unkey
2 = Repeater transmitter even if in use
3 = Remote base #1 transmitter, memory 9
4 = Remote base #2 transmitter, memory 9
5 = Remote base #3 transmitter

Event Telemetry Channel = 33 - 80

Example - Let's Schedule Our Repeater
Now let's actually schedule the operation of our repeater. The three most important steps are PLAN, PLAN, and PLAN. We need to figure out in advance exactly what we want the repeater to do, then what the repeater's schedule should be. The Scheduler will do what you ask, but it can't read your mind (even now)!

Let's decide what we want our Scheduler to do for starters. Perhaps you'd like to turn off certain features at night, leaving them on until later on weekends for the party goers. Maybe you have a net Tuesdays, and you'd like to remind users for several hours before net time. Just before the net we can fire off the users' pagers with an event message. During the net it might be nice to have a distinctive courtesy tone. It might be a good idea to have frequent time reminders as people are going to work in the morning. And wish everyone TGIF on Friday afternoons. And OGIM (Oh goodness it's Monday) on Monday mornings. We can wake up the repeater owner weekday mornings with a "signon" event message. And ask "Why are you up?" as a tail message in the middle of the night. Finally, we can maintain daily valid min/max temperature information for the built-in temperature sensor by clearing the memories daily. This will be a good start - we can always add more capability later on.

From our example above, we can decide what Macro Sets and events we need. Since the controller always powers up to Macro Set 0, it's best to make that our normal daytime operation set. We can define our sets:

```
Macro Set 0: Normal daytime
Macro Set 1: Weekday mornings frequent "Time" tail message
Macro Set 2: Friday afternoon "TGIF" tail message
Macro Set 3: Monday morning "OGIM" tail message
Macro Set 4: Tuesday net reminder "Net tonight ..." tail msg and PID3
Macro Set 5: Net in progress "N" courtesy tone
Macro Set 6: Normal nighttime
Macro Set 7: Middle of night "Why are you up?"
Macro Set 8: not used - available for future use
Macro Set 9: not used - available for future use
```

And our events:

```
Event msg 1: Tuesday 7:58 pm pager message
Event msg 2: Weekdays 6:45 am "signon" message
Event:       Everyday 10 am clear VRT channel 15 max memory (47)
Event:       Everyday 7 pm clear VRT channel 15 min memory (79)
```

Let's start defining our macro sets with set 0. Make sure all the Control Operator selections are what we want (enter the proper Control Operator commands if you're not sure what they're set at), along with the remote base and UF setups, although in this example they're not important. Unlock the controller, and enter the *5910 programming command (responds with "INIT"). You've taken a snapshot of the current setup of the controller, and it's been stored as Macro Set 0. From now on, on powerup, or when Macro Set 0 is selected automatically by the Scheduler or manually by the Control Op, the controller will be in the same state that it's in now.

Let's load the various tail messages, ID's and so on for the various special macro sets and events. We can load

```
TM4(1) (*1181): (time) (am/pm) (msgs present)
TM4(2) (*1182): "TGIF"
TM4(3) (*1183): "OGIM"
TM4(4) (*1184): "Net tonight at 8:30"
TM4(7) (*1187): "Why are you up?"

PID3(C) (*1175):"BARC Net tonight at 8:30, on WA6AXX, repeater"

Courtesy Tone 8 (*1048):  Morse code "N"

Event 1 Message:"(pager memory 35 - group call) Net in two
  minutes"
Event 2 Message:"Time for all Control Operator 's to get up and
             get go -ing (explosion).  This is WA6AXX,
             repeater" (use message macros to fit it all in)
```

Now back to the Macro Sets. For set 1, let's select TM4 (114) and TMS1 (116) with the right Control Operator commands, then unlock the controller and enter "*5911" to store state 1. For set 2, let's select TM4 again, but less frequently with TM Timer (**/prefix/118), and store the state with *5912. Set 3 for Monday morning is pretty much the same except for the automatic selection of TM4(3), so we can store the existing state again into set 3 (*5913).

Set 4 for Tuesday net reminder again uses TM4(4), and PID3(C). Let's make sure that the pending ID at least rotates through PID3 by selecting RPID command (105), then storing the state using *5914.

Set 5 selects a special courtesy tone for during the net, CT8 as loaded above. We also want the tail message off, so we command TM OFF (**/prefix/115), and CT8 (**/prefix/148). Now we can store the current state into Macro Set 5, by entering *5915.

Normally during the night, we may want to disable the Autopatch and User Loadable Autodial, require PL for Control Operator commands, disable Spare Audio 1 and the Pad Test, lock the User Autodialer, disable the reverse patch, and so on. We can enter the appropriate Control Operator commands. We may want the tail message off (**/prefix/115). Now we can enter "*5916" to store the state.

Say in the middle of the night we'd like the controller to ask "Why are you up?" as a tail message. We can modify the set we last defined by selecting TM4(7) (**/prefix/114), generated every 4 tails TMS4 (**/prefix/117). Store the modified nighttime state in 7 by entering *5917.

Now we've defined and stored all the Macro Sets for our example. We can get back to the daytime set by manually selecting Macro Set 0 (**/prefix/130). Now we define the changeover and event times, or setpoints.

Friday afternoons at 1 o'clock let's select set 2 for the TGIF tail mesage, until 7:30. Monday mornings we want the "OGIM" message from 6:30 until 9. Tuesdays from 4:30 til net time we want the net reminder state, and at net time we switch over to the "N" courtesy tone. We can switch to the nighttime state at midnight on weeknights and at 1:30 am on weekends. From 3 to 6 am, let's ask "Why are you up?". From this we can define our setpoints with programming commands:

Setpoint	**Time**	**Day**	**Macro Set/Event**	**Prog Command**
0	1:00 pm	Fridays	MS2	*42 00 5 10100 2 0
1	7:30 pm	Fridays	MS0	*42 01 5 10730 0 0
2	6:30 am	Mondays	MS3	*42 02 1 00630 3 0
3	9:00 am	Mondays	MS0	*42 03 1 00900 0 0
4	4:30 pm	Tuesdays	MS4	*42 04 2 10430 4 0
5	8:00 pm	Tuesdays	MS5	*42 05 2 10800 5 0
6	8:30 pm	Tuesdays	MS0	*42 06 2 10830 0 0
7	12:00 am	weekdays	MS6	*42 07 8 01200 6 0
8	1:30 am	weekends	MS6	*42 08 9 00130 6 0
9	3:00 am	everyday	MS7	*42 09 7 00300 7 0
10	6:00 am	everyday	MS0	*42 10 7 00600 0 0
11	7:00 am	weekdays	MS1	*42 11 8 00700 1 0
12	9:00 am	weekdays	MS0	*42 12 8 00900 0 0
13	7:58 pm	Tuesdays	EV1	*43 13 2 10758 1 1
14	6:45 am	weekdays	EV2	*43 14 8 00645 2 1
15	10:00 am	everyday	clr 15 max	*44 15 7 01000 47
16	7:00 pm	everyday	clr 15 min	*44 16 7 10700 79
17-29	not used - available for later use			

If we ever want to erase a setpoint, we can do it by loading a time that will never happen, e.g. 00 o'clock, or *42 xx 0 00000 0 0.

Now we're done! You can think about jazzing it up some more by providing additional PID3's as different states are selected for ID message variety, adding more events, and so on.

Chapter 13
Telemetry Meter Faces

The Meter Face Assignment commands define a particular meter type to be assigned to each of the sixteen analog input channels. Note that many analog channels may be assigned the same meter type, making it possible to have several temperature sensors, several voltage and power readings, etc.

```
*55 CC FF  CC is hardware analog input channel 01-16
           FF is meter face number 00-33
```

Meter face FF is assigned to hardware analog input channel CC.

Analog input channel 15 should be assigned meter face 05, and channel 16 should be assigned meter face 00 for readback of internal temperature and voltage.

Meter Faces	**(FF)**
Voltage	
0-16 volts	00
0-32 volts	25
0-256 volts	24
Current	
0-64 ua	23
0-4 amps	22
0-8 amps	21
0-16 amps	01
0-32 amps	20
Power	
0-2 watts	17 (fractional)
0-4 watts	18
0-8 watts	19
0-8 watts	11 (whole units)
0-16 watts	12
0-32 watts	13
0-64 watts	14
0-128 watts	15
0-256 watts	16
Temperature/Weather	
LM335 sensor	05
Hi accuracy	06
Direction (cardinal)	08
Direction (deg)	26
Wind speed	09

Receiver Measurements
(sampled 1 sec. into repeater
user's transmission)

S-meter	02
Freq. error	03
Freq. error inverted	27
Quieting	04
Deviation	10

Receiver Measurements
(measured on request)

S-meter	30
Freq. error	31
Quieting	32
Deviation	33

Miscellaneous

General 0-100	07
Empty assignment	99

Example
Assign the S-meter "meter face" to analog input channel 1, so that it's automatically measured 1 second into the user's transmission and read back when interrogated. This will allow users to read their signal strength into the repeater by entering the user command (VRT prefix) 1. The programming command to make this assignment is "*55 01 02".

Example
Assign the S-meter "meter face" to analog input 4 so that we can read the S-meter on a remote base transceiver. The measurement will be made when our command is evaluated by the controller. The programming command to make this assignment is "*55 04 30".

Example
Assign the LM335 temperature sensor meter face to channel 15, with "*55 15 05".

Temperature Calibrate

The Temperature Calibrate command adjusts the on-board temperature sensor and others using the LM335 sensor meter face (05). It is used to set the readback to agree with a reference thermometer, and is normally done at the factory.

```
*5500 xxxx    xxxx = 0-9999 calibration constant
      (typically 3000-5000, approximately 100 units per degree error)
```

If the adjustment needs to be made in the field, select a constant such as 4000 and read temperature. If the readback is, for example, five degrees high, subtract 500 from the constant and try again. Continue until you're within a couple of degrees of the thermometer.

Chapter 14
Patch Restrictions and Mapping

Telephone calls placed through the Autopatch may be toll restricted. The Control Operator selects long distance enable or disable independently for each of the three Autopatch access commands. These selections may also be automatically implemented by the Scheduler.

An "antidialer" may trap specific telephone numbers, or blocks of numbers, from being placed through the Autopatch.

Toll Restrict

When long distance is disabled by the Control Operator or Scheduler, the controller examines the number to be dialed to determine if it's considered to be a toll call. Two toll restrict modes are available to choose from depending on the characteristics of the repeater system and the local telephone company.

Toll Restrict Mode A simply restricts calls to telephone numbers beginning with a 0 or 1, or longer than seven digits. This mode is sufficient for many repeater systems, providing the necessary protection against unauthorized toll calls.

Mode B permits the repeater owner to define the calling area available to users. He may specify which exchanges are permitted and which are restricted in two different area codes. All eight hundred exchanges in each area code may be individually defined as permitted or restricted (exchanges 200-999). In addition, he can define permitted area codes in which all exchanges are allowed (such as toll-free 800 numbers).

See the Operation Manual – "Telephone Interconnect" – for additional discussion on toll restriction.

Toll Restrict Mode Selection

*5691	Toll Restrict Mode A
*5692	Toll Restrict Mode B

Toll Restrict Mode B Exchange Tables

*5610	Define entire Local Exchange Table to be "long distance"
*5611	Define entire Local Exchange Table to be "local"
*5610xxx	Define exchange xxx in Local Exchange Table to be "long distance"
*5611xxx	Define exchange xxx in Local Exchange Table to be "local"
*5620	Define entire Adjacent Exchange Table to be "long distance"
*5621	Define entire Adjacent Exchange Table to be "local"
*5620xxx	Define exchange xxx in Adjacent Exchange Table as "long distance"
*5621xxx	Define exchange xxx in Adjacent Exchange Table as "local"

(Note: xxx is the three-digit telephone exchange, from 200 through 999.)

Area codes are defined using the Message Editor. Those which are used should be loaded as three-digit speech or Morse code messages. Unused area codes should be loaded as empty messages. (To enter an empty message, unlock the controller, select the message, and enter *0 - store message.)

*1169	Local Area Code
*1170	Adjacent Area Code
*11117	Permitted Area Code #1
*11118	Permitted Area Code #2
*11119	Permitted Area Code #3

Example
The local area code is 408. Unlock the controller and select the Local Area Code message with *1169. After the controller responds, then enter 04 00 08. The message editor reads back "408". Write the message into non-volatile memory with *0.

Antidialer

Ten telephone numbers or blocks of numbers may be loaded into the antidialer which are trapped by the Autopatch.

The telephone numbers stored in the antidialer may be up to eleven digits long. In addition to individual phone numbers, blocks of numbers may be stored using "wildcards" and "globals".

A wildcard in a digit position automatically "matches" any digit dialed by a user. For example, if a number stored in the antidialer is "253808W", then ten telephone numbers, from 253-8080 through 253-8089, will be blocked.

A global in a digit position causes a match to any telephone number which matches the digits preceding the global. For example, a number stored in the antidialer as "1301G" matches any telephone number beginning with a 1-301.

Wildcard = Touch-Tone D
Global = Touch-Tone *

*5300(telephone number)	Antidialer slot 0
*5301(telephone number)	Antidialer slot 1
*5302(telephone number)	Antidialer slot 2
*5303(telephone number)	Antidialer slot 3
*5304(telephone number)	Antidialer slot 4
*5305(telephone number)	Antidialer slot 5
*5306(telephone number)	Antidialer slot 6
*5307(telephone number)	Antidialer slot 7
*5308(telephone number)	Antidialer slot 8
*5309(telephone number)	Antidialer slot 9

Dialing Format

Telephone numbers are regenerated by the controller into the phone line. The dialing format may be selected with these commands. Dialing to remote phone lines is always normal DTMF.

*5400 Normal DTMF
*5403 Slow DTMF
*5401 Dial pulse 10 pps
*5402 Dial pulse 20 pps

Phone Line Dedicated / Shared

The controller may share a phone line with several other controllers at the same site. In the shared mode, the Phone Line Busy input is examined by the controller before placing a call. If it's in use by another controller, the user is given a "Busy" message. Otherwise, the controller grabs the phone line and sets the Phone Line Busy output.

In the normal Dedicated mode, the Phone Line Busy input is not tested prior to placing outgoing calls.

*5404 Dedicated phone line (normal)
*5405 Shared phone line

Logical Phone Line Assignment

There are three "logical phone lines" accessible from the Autopatch and autodialers. Each logical phone line is assigned to be Local Phone Line #1 or #2, or Remote Phone Line #1, #2, or #3. See the Operation Manual – "Telephone Interconnect - Multiple and Remote Phone Lines" – for more details.

The logical phone lines are assigned using the following programming commands.

*54061(L) Logical Phone Line #1 Assignment
*54062(L) Logical Phone Line #2 Assignment
*54063(L) Logical Phone Line #3 Assignment

L = 1 / Local Phone Line #1
2 / Local Phone Line #2
3 / Remote Phone Line #1
4 / Remote Phone Line #2
5 / Remote Phone Line #3

Example
Assign Logical Phone Line #1 to be Local Phone Line #1 and Logical Phone Line #2 to be Remote Phone Line #1.

*540611, *540623

Remote Phone Line Up / Down Channels

Remote telephone lines may be accessed automatically through the repeater system. The up and down channels to the remote phone line location may be through the auxiliary transceivers, the control receiver, and/or the repeater transmitter. The up and down channels are assigned with these commands.

```
*5407(u)   Up Channel Assignment
*5408(d)   Down Channel Assignment

         u = 0 / control receiver
               1 / auxiliary transceiver 1
               2 / auxiliary transceiver 2
               3 / auxiliary transceiver 3
               4 / auxiliary transceiver 4

         d = 0 / repeater transmitter
               1 / auxiliary transceiver 1
               2 / auxiliary transceiver 2
               3 / auxiliary transceiver 3
               4 / auxiliary transciever 4
```

Example
Assign the up channel for remote phone line calls to be auxiliary transceiver 2 (memory frequency 8) and the down channel to be the repeater transmitter.

```
*54072, *54080
```

Chapter 15
Remote Bases / Links

Remote Base Frequency Memories

Frequently used remote base frequencies may be stored in memories and may be accessed by users with abbreviated commands. In addition to frequency, the PL, antenna direction, and band select bits which are supplied in the serial data stream are also stored in the memories.

When users activate a remote base memory, the response, instead of the normal frequency readback, may be a programmable "name" which may be the call of the repeater or other identifier, such as "five-two" (short for 146.52 MHz).

Two memories for each remote base serve special functions and are not available to users. They are automatically activated when patch calls are directed to remote phone lines accessed through the auxiliary (remote base) transceivers and when the system sends paging tones or event messages directed to them.

To store a frequency memory, bring up the remote base on the desired frequency, with PL, direction, and band select properly selected if these are used. Then, unlock the controller and enter the "Store" command to write the information for the remote into memory. (The remote base may be commanded when the controller is unlocked by preceeding the remote base user command with **.)

*5711 Store Remote Base #1 Frequency Memory 1
*5712 Store Remote Base #1 Frequency Memory 2
*5713 Store Remote Base #1 Frequency Memory 3
*5714 Store Remote Base #1 Frequency Memory 4
*5715 Store Remote Base #1 Frequency Memory 5
*5716 Store Remote Base #1 Frequency Memory 6
*5717 Store Remote Base #1 Frequency Memory 7
*5718 Store Remote Base #1 Frequency Memory 8 (remote phone line)
*5719 Store Remote Base #1 Frequency Memory 9 (paging, events, modem messages)
*5741 Store Remote Base #2 Frequency Memory 1
*5742 Store Remote Base #2 Frequency Memory 2
*5743 Store Remote Base #2 Frequency Memory 3
*5744 Store Remote Base #2 Frequency Memory 4
*5745 Store Remote Base #2 Frequency Memory 5
*5746 Store Remote Base #2 Frequency Memory 6
*5747 Store Remote Base #2 Frequency Memory 7
*5748 Store Remote Base #2 Frequency Memory 8 (remote phone line)
*5749 Store Remote Base #2 Frequency Memory 9 (paging, events, modem messages)

See Chapter 3, "The Message Editor", for information on defining memory names.

Remote Base / Link Channel Assignment

Four hardware channels are available for assignment as remote bases, full duplex links, a control receiver, and the user selectable "Spare Audio 1" function.

Remote bases and links are handled similarly by the controller.

Each channel assigned as a remote base or link may permit certain levels of command entry from the remote / link.

*5761(c)(t) Remote Base / Link 1 Channel
*5762(c)(t) Remote Base / Link 2 Channel
*5763(c)(t) Remote Base / Link 3 / Spare Audio 1 Channel
*5764(c)(t) Remote Base / Link 4 / Control Receiver Channel

c = 1 / Link; 2 / Remote Base; 3 / Spare Audio 1; 4 / Control Receiver

t (applies to remote base / link selection only) = 0 / no command; 2 / user commands only; 3 / all commands ok

Example
Assign channel 1 as Remote Base 1, no command capability from the remote; channel 2 as Link 2, all commands ok; channel 3 as Remote Base 3, user commands only from the remote; channel 4 as Control Receiver.

*576120, *576213, *576322, *576443

Chapter 16
Pager Memories

Information identifying each pager in the system may be stored in one of fifty-four memories. Fifty memories are intended to address user's pagers while four memories specify optional signalling format to remote phone line locations.

Each pager is identified by its format, address, and frequency. Memories are loaded using programming commands of the format

```
*29xx f aaaa ü

   xx = pager memory 00-53

   f = format
      0 = two-tone 1 - 3 second  7 = CTCSS
      1 = two-tone 2.7 - .8 second8 = HSC pager activate
      2 = two-tone .4 - .8 second9 = HSC board mute
      3 = two-tone group call 8 second * = HSC board activate
      4 = DTMF   D = HSC pager mute
      5 = five-tone
      6 = six-tone (extended address)

   aaaa = address
      two-tone = A/G# A/T# B/G# B/T# (A=B for group call)
      DTMF = T1 T2 T3 T4 (1-4 digits)
      5/6 tone = T2 T3 T4 T5 (T1 fixed as 0, preamble fixed as 1)
      CTCSS = xx (2 digits, 01-32, see CTCSS frequency table)
      HSC = T2 T3 T4 T5 (T1 fixed as group call,
                      T2-5 may be group call - key "*")

   ü = frequency
      0 = repeater transmitter
      1 = Remote Base #1 memory 9
      2 = Remote Base #2 memory 9
      3 = Remote Base #3 (fixed frequency)
```

Examples

Memory 14 – Two-tone .4-.8 second, A = group #2 tone #3,
B = group #1 tone #5, repeater transmitter *2914 2 2315 0

Memory 3 – Six-tone, address 01234, Remote Base #1 transmitter
*2903 6 1234 1

Memory 38 – CTCSS 110.9 Hz, repeater transmitter *2938 7 15 0

Morse	Speech	Message	Response	#Char
*1078	*1178	Alarm #1	AL1	10
*1079	*1179	Alarm #2	AL2	10
*10106	*11106	Alarm #3	AL3	5
*10107	*11107	Alarm #4	AL4	5
*1041	*1141	Courtesy Tone #1	CT1	4
*1042	*1142	Courtesy Tone #2	CT2	4
*1043	*1143	Courtesy Tone #3	CT3	4
*1044	*1144	Courtesy Tone #4	CT4	4
*1045	*1145	Courtesy Tone #5	CT5	4
*1046	*1146	Courtesy Tone #6	CT6	4
*1047	*1147	Courtesy Tone #7	CT7	4
*1048	*1148	Courtesy Tone #8	CT8	4
*10109	*11109	Courtesy Tone #9	CT9	4
*10110	*11110	Courtesy Tone #10	CT ten	4
*10111	*11111	Courtesy Tone #11	CT eleven	4
*10112	*11112	Courtesy Tone #12	CT twelve	4
*10113	*11113	Courtesy Tone #13	CT thirteen	4
*1060	*1160	Generic Command Response	COPR	6
*1067	*1167	Demo Tag	DEMO	18
*10101	*11101	Bulletin Board #1	B1	12
*10102	*11102	Bulletin Board #2	B2	12
*10103	*11103	Bulletin Board #3	B3	12
*10104	*11104	Bulletin Board #4	B4	12
*10105	*11105	Bulletin Board #5	B5	12
*10120	*11120	Pad Test Responses	PAD	16
*1050	*1150	Emergency Autodial #0	ADE0	6
*1051	*1151	Emergency Autodial #1	ADE1	6
*1052	*1152	Emergency Autodial #2	ADE2	6
*1053	*1153	Emergency Autodial #3	ADE3	6
*1054	*1154	Emergency Autodial #4	ADE4	6
*1055	*1155	Emergency Autodial #5	ADE5	6
*1056	*1156	Emergency Autodial #6	ADE6	6
*1057	*1157	Emergency Autodial #7	ADE7	6
*1058	*1158	Emergency Autodial #8	ADE8	6
*1059	*1159	Emergency Autodial #9	ADE9	6
*1001	*1101	Initial ID #1	IID1	22
*1008	*1108	Initial ID #2	IID2	22
*1009	*1109	Initial ID #3	IID3	22
*1002	--------	Forced CW ID	FID	14
*1003	*1103	Anxious ID	AID	14
*1004	*1104	Pending ID #1	PID1	26
*1005	*1105	Pending ID #2	PID2	26
*1006	*1106	Pending ID #3 (0,1)	PID3A	26
*1074	*1174	Pending ID #3 (2,3)	PID3B	26
*1075	*1175	Pending ID #3 (4,5)	PID3C	26
*1076	*1176	Pending ID #3 (6,7)	PID3D	26
*1077	*1177	Pending ID #3 (8,9)	PID3E	26
*1007	*1107	Special ID	SPID	50
*1000	*1100	Periodic QST ID	QST	14
*1010	*1110	Touch-Tone Access Down ID	TTID	6
*10100	*11100	Aux. Transmitter Pager ID	PGID	4
*10108	*11108	Aux. Transmitter Phone ID	PHID	4
*10141	*11141	Macro 1	M1	10

*10142	*11142	Macro 2	M2	10
*10143	*11143	Macro 3	M3	6
*10144	*11144	Macro 4	M4	6
*1090	*1190	Mailbox Message #0	MBM0	6
*1091	*1191	Mailbox Message #1	MBM1	10
*1092	*1192	Mailbox Message #2	MBM2	10
*1093	*1193	Mailbox Message #3	MBM3	10
*1094	*1194	Mailbox Message #4	MBM4	18
*1095	*1195	Mailbox Message #5	MBM5	18
*1096	*1196	Mailbox Message #6	MBM6	18
*1097	*1197	Mailbox Message #7	MBM7	18
*1098	*1198	Mailbox Message #8	MBM8	18
*1099	*1199	Mailbox Message #9	MBM9	50
*1073	*1173	Mail Present Message	MAIL	5
*10152	*11152	Pager Prompt	PPRO	10
*1020	*1120	Autopatch Activate	AP up	6
*1029	*1129	User Autodial Activate	ADU up	6
*1072	*1172	Antidial	A N T I	10
*1018	*1118	Patch Cover Tone	PCT	6
*1017	*1117	Patch Timeout Warning	P time out alert	6
*1065	*1165	Phone Answer	P H A N	18
*1066	*1166	Phone Hangup	H A N G	10
*10151	*11151	Reverse Patch Call-For	RPC	4
*1063	*1163	Remote Base #1 Name	L1	6
*1064	*1164	Remote Base #2 Name	L2	6
*10115	*11115	Remote Base #3 Name	L3	6
*10114	*11114	Remote Base #4 Name	L4	6
*1061	*1161	Remote Base #1 Freq. Prefix	Remote 1 P	6
*1062	*1162	Remote Base #2 Freq. Prefix	Remote 2 P	6
*10121	*11121	Remote Base #1 Mem. 1 Name	L1N1	6
*10122	*11122	Remote Base #1 Mem. 2 Name	L1N2	6
*10123	*11123	Remote Base #1 Mem. 3 Name	L1N3	6
*10124	*11124	Remote Base #1 Mem. 4 Name	L1N4	6
*10125	*11125	Remote Base #1 Mem. 5 Name	L1N5	6
*10126	*11126	Remote Base #1 Mem. 6 Name	L1N6	6
*10127	*11127	Remote Base #1 Mem. 7 Name	L1N7	6
*10131	*11131	Remote Base #2 Mem. 1 Name	L2N1	6
*10132	*11132	Remote Base #2 Mem. 2 Name	L2N2	6
*10133	*11133	Remote Base #2 Mem. 3 Name	L2N3	6
*10134	*11134	Remote Base #2 Mem. 4 Name	L2N4	6
*10135	*11135	Remote Base #2 Mem. 5 Name	L2N5	6
*10136	*11136	Remote Base #2 Mem. 6 Name	L2N6	6
*10137	*11137	Remote Base #2 Mem. 7 Name	L2N7	6
*10140	*11140	Changeover Announcement	Change over	5
*10146	*11146	Event 1 Message	E1	12
*10147	*11147	Event 2 Message	E2	12
*10148	*11148	Event 3 Message	E3	12
*10149	*11149	Event 4 Message	E4	12
*10150	*11150	Event 5 Message	E5	12
------	*1168	Phone Number Leading "1" Override	LD over	6
------	*11128	Phone Number Macro "A"	MA	6
------	*11129	Phone Number Macro "B"	MB	6
------	*11130	Phone Number Macro "C"	MC	6

------	*1169	Local Area Code	Area code L	3
------	*1170	Adjacent Area Code	Area code J	3
------	*11117	Permitted Area Code #1	Area code P1	3
------	*11118	Permitted Area Code #2	Area code P2	3
------	*11119	Permitted Area Code #3	Area code P3	3
------	*1171	Primary Patch Dialing Prefix	PPRE	8
------	*11138	Secondary Patch Dialing Prefix	SPRE	6
------	*11139	Tertiary Patch Dialing Prefix	TPRE	6
*1011	*1111	Tail Message #1	TM1	6
*1012	*1112	Tail Message #2	TM2	6
*1013	*1113	Tail Message #3	TM3	6
*1014	*1114	Tail Message #4 (0)	TM40	6
*1081	*1181	Tail Message #4 (1)	TM41	8
*1082	*1182	Tail Message #4 (2)	TM42	8
*1083	*1183	Tail Message #4 (3)	TM43	8
*1084	*1184	Tail Message #4 (4)	TM44	8
*1085	*1185	Tail Message #4 (5)	TM45	8
*1086	*1186	Tail Message #4 (6)	TM46	8
*1087	*1187	Tail Message #4 (7)	TM47	8
*1088	*1188	Tail Message #4 (8)	TM48	8
*1089	*1189	Tail Message #4 (9)	TM49	8
*1015	*1115	Repeater Timeout	Repeater timeout	6
*1016	*1116	Repeater Timeout Clear	Repeater timeout cancel	10
*1017	*1117	Patch Timeout Warning	Patch timeout alert	6
*1019	*1119	Touch-Tone Cover Tone	TTCT	4
-----	*12xx	Call Sign	Call	6
*1021	*1121	User Function 1 High	UF 1 high	6
*1031	*1131	User Function 1 Low	UF 1 low	6
*1022	*1122	User Function 2 High	UF 2 high	6
*1032	*1132	User Function 2 Low	UF 2 low	6
*1023	*1123	User Function 3 High	UF 3 high	6
*1033	*1133	User Function 3 Low	UF 3 low	6
*1024	*1124	User Function 4 High	UF 4 high	6
*1034	*1134	User Function 4 Low	UF 4 low	6
*1025	*1125	User Function 5 High	UF 5 high	6
*1035	*1135	User Function 5 Low	UF 5 low	6
*1026	*1126	User Function 6 High	UF 6 high	6
*1036	*1136	User Function 6 Low	UF 6 low	6
*1027	*1127	User Function 7 High	UF 7 high	6
*1037	*1137	User Function 7 Low	UF 7 low	6
*1028	*1128	User Function 8 High	UF 8 high	6
*1038	*1138	User Function 8 Low	UF 8 low	6
*1030	*1130	User Function Byte 1 Name	UFB1	6
*1039	*1139	User Function Byte 2 Name	UFB2	6

Morse Code Parameters

Speed	Pitch	Level		
*2000	*2010	*2020	Initial ID	speed = 5-35 WPM
*2001	*2011	*2021	Forced CW ID	pitch = 0 -3000 Hz
*2002	*2012	*2022	Anxious ID	level = 0 (0 dB)
*2003	*2013	*2023	Pending/QST ID	1 (-3 dB)
*2004	*2014	*2024	Special ID	2 (-6 dB)
*2005	*2015	*2025	User Command	3 (-9 dB)
*2006	*2016	*2026	Control Op Command	

Courtesy Tone Selection

Command			
*3T10 (delay)	Delay to Segment 1	BPD	delay = 0 - 3500 ms
*3T20 (delay)	Delay from Segment 1 to 2	BPD	T = tone set 1-9, 0 (10)
*3T30 (delay)	Delay from Segment 2 to 3	BPD	*1 (11), *2 (12), *3 (13)
*3T11 (pitch)	Segment 1A Pitch	BPP	pitch = 0-3000 Hz
*3T12 (pitch)	Segment 1B Pitch	BPP	
*3T21 (pitch)	Segment 2A Pitch	BPP	
*3T22 (pitch)	Segment 2B Pitch	BPP	
*3T31 (pitch)	Segment 3A Pitch	BPP	
*3T32 (pitch)	Segment 3B Pitch	BPP	
*3T13 (level)	Segment 1 Level	BPL	level = 0 (0/-6 dB)
*3T23 (level)	Segment 2 Level	BPL	1 (-3/-9 dB)
*3T33 (level)	Segment 3 Level	BPL	
*3T14 (dur)	Segment 1 Duration	BPD	dur = 0-3500 ms
*3T24 (dur)	Segment 2 Duration	BPD	
*3T34 (dur)	Segment 3 Duration	BPD	
*3T40 (hang time)	Hang Time	BPHT	hang time = 0-10,000 ms
*3T50	Preview Courtesy Tone	BPPRV	
*3(dest)0(source)	Copy Source to Destination	BPCPY	

Timers

*4019 (period)	Alarm	AL timer
*4004 (period)	Sequence Interdigit Timer	SEQ
*4018 (period)	Beginning of Transmission to Sequence	SQB
*4005 (period)	Sequence to End of Transmission	SQE
*4020 (period)	Individual User Access Code Timer	IUA
*4021 (period)	Repeater Activity Timer	repeater A timer
*4028 (period)	External Device Timer	EXT
*4000 (period)	Initial ID Timer	Timer IID
*4001 (period)	Forced CW ID Timer	Timer FID
*4002 (period)	Anxious ID Timer	Timer AID
*4003 (period)	Pending ID Timer	Timer ID
*4017 (period)	Periodic QST ID Timer	Timer QST
*4008 (period)	Autopatch Timeout	AP timeout
*4009 (period)	User Loadable Autodialer Timeout	AU timeout
*4010 (period)	Emergency Autodialer Timeout	AE timeout
*4016 (period)	Patch Timer Extend Timer	Timer X
*4013 (period)	Patch Activity Timer	APAT
*4027 (period)	Reverse Patch Ring Timeout	RP timeout
*4012 (period)	Phone Answer Delay Timer	PHAN
*4006 (period)	Long Timeout Timer	Repeater timer L
*4007 (period)	Short Timeout Timer	Repeater timer S

```
*4014 (period)  Spare Audio 1 Timer                  SP1 timer
*4015 (period)  Tail Message Timer                   TM timer
*4011 (period)  Touch-Tone Access Mode Timer         TTAM
*4026 (period in ms)  Turn-on Delay                  TX on
```

Setting the Clock and Calendar

```
*4100 (am/pm) (hours 10s) (hours 1s) (minutes 10s) (minutes 1s)
           am ' am/pm = 0
           pm ' am/pm = 1
*4101 (month  10s) (month 1s) (day 10s) (day 1s) (year 10s) (year 1s)
*4102 (dow)      dow / 0 = Sunday . . . 6 = Saturday
*41031           12 Hour Format
*41032           24 Hour Format
```

Command Codes / Channels

```
*5000 (1-4)        Control Operator Command Root Set 1 - 4
*5001 (prefix)     Control Operator Command Prefix (Over the air)
*5014 (prefix)     Control Operator Command Prefix (Over the phone)
*5005 (prefix)     Primary Autopatch Prefix
*5016 (prefix)     Secondary Autopatch Prefix
*5017 (prefix)     Tertiary Autopatch Prefix
*5003 (prefix)     Primary Emergency Autodialer Prefix
*5018 (prefix)     Secondary Emergency Autodialer Prefix
*5004 (prefix)     User Loadable Autodialer Bank 0 Prefix
*5019 (prefix)     User Loadable Autodialer Bank 1 Prefix
*5029 (prefix)     User Loadable Autodialer Bank 2 Prefix
*5007 (prefix)     User Loadable Autodialer Bank 0 Load/Erase Prefix
*5020 (prefix)     User Loadable Autodialer Bank 1 Load/Erase Prefix
*5030 (prefix)     User Loadable Autodialer Bank 2 Load/Erase Prefix
*5013 (prefix)     Patch Utility Group P Prefix (reverse patch answer,
                     custom hangup, duplex, cover, timer extend)
*5021 (prefix)     Patch Utility Group Q Prefix (redial, hookflash)
*5011 (command)    Reverse Patch Activate Command
*5022 (command)    Patch / Spare Audio 1 Hangup Command (loading an
                     empty command makes the hangup command #)
*5002 (prefix)     User Function Remote Control Prefix
*5006 (prefix)     Link / Remote Base Prefix
*5015 (prefix)     Paging Prefix
*5012 (command)    Spare Audio 1 On Command
*5010 (prefix)     Demo Message / Bulletin Board Prefix
*5025 (prefix)     Mailbox Prefix
*5009 (prefix)     Voice Response Telemetry Prefix
*5008 (prefix)     Touch-Tone Access Up/Down Prefix
*5026 (prefix)     Touch-Tone Pad Test Prefix
*5027 (prefix)     User Mapped Control Operator Command Prefix
*5028 (prefix)     Individual User Access Code Prefix
*5055 (attributes) Primary Autopatch Attributes
*5066 (attributes) Secondary Autopatch Attributes
*5067 (attributes) Tertiary Autopatch Attributes
*5053 (attributes) Primary Emergency Autodialer Attributes
*5068 (attributes) Secondary Emergency Autodialer Attributes
*5054 (attributes) User Loadable Autodialer Bank 0 Attributes
*5069 (attributes) User Loadable Autodialer Bank 1 Attributes
*5079 (attributes) User Loadable Autodialer Bank 2 Attributes
```

*5057 (attributes) User Loadable Autodialer Bank 0 Load/Erase Attributes
*5070 (attributes) User Loadable Autodialer Bank 1 Load/Erase Attributes
*5080 (attributes) User Loadable Autodialer Bank 2 Load/Erase Attributes
*5063 (attributes) Patch Utility Group P Attributes
*5071 (attributes) Patch Utility Group Q Attributes
*5052 (attributes) User Function Remote Control Attributes
*5056 (attributes) Link Attributes
*5065 (attributes) Paging Attributes
*5062 (attributes) Spare Audio 1 On Attributes
*5060 (attributes) Demo Message / Bulletin Board Attributes
*5075 (attributes) Mailbox Attributes
*5059 (attributes) Voice Response Telemetry Attributes
*5058 (attributes) Touch-Tone Access Up/Down Attributes
*5076 (attributes) Touch-Tone Pad Test Attributes
*5077 (attributes) User Mapped Control Operator Command Attributes
*5078 (attributes) Individual User Access / Identify Attributes

*4610 Disable all individual user access codes
*4611 Enable all individual user access codes
*4610xyz Disable user access code xyz (xyz = 000 - 799)
*4611xyz Enable user access code xyz (xyz = 000 - 799)
*45DCC Specify first digit ("D" for call sign slot "CC")
*5000 0 xxx User Mapped Control Op Command 0
*5000 1 xxx User Mapped Control Op Command 1
*5000 2 xxx User Mapped Control Op Command 2
*5000 3 xxx User Mapped Control Op Command 3
*5000 4 xxx User Mapped Control Op Command 4
*5000 5 xxx User Mapped Control Op Command 5
*5000 6 xxx User Mapped Control Op Command 6
*5000 7 xxx User Mapped Control Op Command 7
*5000 8 xxx User Mapped Control Op Command 8
*5000 9 xxx User Mapped Control Op Command 9 (xxx = Control Op root 1 code)
*58080 Primary Unlock Code Select
*58081 Secondary Unlock Code Select
*58010 Disable command from repeater receiver
*58011 Enable command from repeater receiver
*58020 Disable command from telephone
*58021 Enable command from telephone

Logic I / O Senses

*5100s Link / Remote Base 1 COS Logic Inputs = 0 / low true, 1 / high true
*5101s Link / Remote Base 2 COS Logic Input
*5102s Link / Remote Base 1 PTT Logic Output
*5103s Link / Remote Base 2 PTT Logic Output
*5108s Link / Remote Base 3 COS Logic Input
*5109s Link / Remote Base 4 COS Logic Input
*5104s User / Control Op PL Logic Input
*5112s User Only PL Logic Input
*5105p Phone Offhook p = 0 / TP-1, 1 / TP-3
*5106q User Function Logic Outputs q = 0/latched, 1/expanded

Emergency Autodialer Numbers

```
*5200 (telephone number)   Emergency Autodial #0
*5201 (telephone number)   Emergency Autodial #1
*5202 (telephone number)   Emergency Autodial #2
*5203 (telephone number)   Emergency Autodial #3
*5204 (telephone number)   Emergency Autodial #4
*5205 (telephone number)   Emergency Autodial #5
*5206 (telephone number)   Emergency Autodial #6
*5207 (telephone number)   Emergency Autodial #7
*5208 (telephone number)   Emergency Autodial #8
*5209 (telephone number)   Emergency Autodial #9
```

Macro Sets and the Scheduler

```
*591x Store current setup into Macro Set x  (x = 0-9)
*42 (ss) (dow) (am/pm) (10s hours) (1s hours) (10s minutes) (1s minutes)
   (Macro Set) (changeover attributes)
*43 (ss) (dow) (am/pm) (10s hours) (1s hours) (10s minutes) (1s minutes)
   (Event Message) (event attributes)
*44 (ss) (dow) (am/pm) (10s hours) (1s hours) (10s minutes) (1s minutes)
   (Telemetry memory channel)
```

Meter Faces

```
*55 CC FF     CC = hardware analog input channel 01 - 16
              FF = meter face number 00 - 33
*5500 xxxx    xxxx = 0 - 9999 calibration constant
```

Patch Restrictions and Mapping

```
*5691     Toll Restrict Mode A
*5692     Toll Restrict Mode B
*5610     Define entire Local Exchange Table to be long distance
*5611     Define entire Local Exchange Table to be local
*5610xxx  Define exchange xxx in Local Exchange Table to be long distance
*5611xxx  Define exchange xxx in Local Exchange Table to be local
*5620     Define entire Adjacent Exchange Table to be long distance
*5621     Define entire Adjacent Exchange Table to be local
*5620xxx  Define exchange xxx in Adjacent Exchange Table as long distance
*5621xxx  Define exchange xxx in Adjacent Exchange Table as local (xxx is
            the three-digit telephone exchange, from 200 through 999)
*1169     Local Area Code
*1170     Adjacent Area Code
*11117    Permitted Area Code #1
*11118    Permitted Area Code #2
*11119    Permitted Area Code #3
*5300 (telephone number)   Antidialer slot 0
*5301 (telephone number)   Antidialer slot 1
*5302 (telephone number)   Antidialer slot 2
*5303 (telephone number)   Antidialer slot 3
*5304 (telephone number)   Antidialer slot 4
*5305 (telephone number)   Antidialer slot 5
*5306 (telephone number)   Antidialer slot 6
*5307 (telephone number)   Antidialer slot 7
```

```
*5308 (telephone number)   Antidialer slot 8
*5309 (telephone number)   Antidialer slot 9
*5400    Normal DTMF
*5403    Slow DTMF
*5401    Dial pulse 10 pps
*5402    Dial pulse 20 pps
*5404    Dedicated phone line (normal)
*5405    Shared phone line
*54061 (L) Logical Phone Line #1 Assignment
*54062 (L) Logical Phone Line #2 Assignment
*54063 (L) Logical Phone Line #3 Assignment
           L = 1 / Local Phone Line #1
               2 / Local Phone Line #2
               3 / Remote Phone Line #1
               4 / Remote Phone Line #2
               5 / Remote Phone Line #3
*5407 (u)  Up Channel Assignment
*5408 (d)  Down Channel Assignment
           u = 0 / control receiver
               1 / auxiliary transceiver 1
               2 / auxiliary transceiver 2
               3 / auxiliary transceiver 3
               4 / auxiliary transceiver 4
           d = 0 / repeater transmitter
               1 / auxiliary transceiver 1
               2 / auxiliary transceiver 2
               3 / auxiliary transceiver 3
               4 / auxiliary transceiver 4
```

Remote Bases / Links

```
*5711  Store Remote Base #1 Frequency Memory 1
*5712  Store Remote Base #1 Frequency Memory 2
*5713  Store Remote Base #1 Frequency Memory 3
*5714  Store Remote Base #1 Frequency Memory 4
*5715  Store Remote Base #1 Frequency Memory 5
*5716  Store Remote Base #1 Frequency Memory 6
*5717  Store Remote Base #1 Frequency Memory 7
*5718  Store Remote Base #1 Frequency Memory 8 (remote phone line)
*5719  Store Remote Base #1 Frequency Memory 9 (paging, events)
*5741  Store Remote Base #2 Frequency Memory 1
*5742  Store Remote Base #2 Frequency Memory 2
*5743  Store Remote Base #2 Frequency Memory 3
*5744  Store Remote Base #2 Frequency Memory 4
*5745  Store Remote Base #2 Frequency Memory 5
*5746  Store Remote Base #2 Frequency Memory 6
*5747  Store Remote Base #2 Frequency Memory 7
*5748  Store Remote Base #2 Frequency Memory 8 (remote phone line)
*5749  Store Remote Base #2 Frequency Memory 9 (paging, events)
```

```
*5761 (c)(t)  Remote Base/Link 1 Channel
*5762 (c)(t)  Remote Base/Link 2 Channel
*5763 (c)(t)  Remote Base/Link 3/Spare Audio 1 Channel
*5764 (c)(t)  Remote Base/Link 4/Control Receiver Channel
       c =    1 / Link
              2 / Remote Base
              3 / Spare Audio 1
              4 / Control Receiver
       t (applies to remote base/link selection only) =
              0 / no command
              2 / user commands only
              3 / all commands ok
```

(pause)	34
A	21
abort	*992
about	*855
adjust	*944
advanced	*916
afternoon†	*842
alert	40
all	*685
alpha	*621
am	61
amateur	*917
amps	*831
an	62
and	74
are	72
area	*713
at	*742
ate	08
auto	*918
automatic	*741
B	22
be	22
base	*911
between	*660
bravo	*622
break	*743
button	*993
C	23
calibrate	*735
call	*751
cancel	*664
caution	*711
change	*875
charlie	*623
check	*865
circuit	*720
clock	*945
club	*926
code	75
complete	*721
computer	*927
connect	*940
control	*624
crane	*950
cycle	*951
D	31
danger	*712
days	*952
dayton	*928
dee	31
degrees	*722
delta	*631
device	*953
dial	*936
direction	*752
display	*954
door	*955
down	*654
E	32
east	*754
echo	*632
eight	08
eight†	*808
eighteen†	*884
electrician	*943
eleven	11
eleven†	*811
emergency	*937
enter	*995
equal	*893
evening†	*843
exit	*761
F	33
fail	*755
farad	*930
feet	15
fif-	50
fifteen†	*854
fifty†	*850
fire	*634
five	05
five†	*805
flow	*960
for	04
forty†	*840
four	04
four†	*804
fourteen†	*814
foxtrot	*633
frequency	*610
from	64
G	41
gage	*961
gallons	*991
gate	*845
gee	41
get	*962
go	*895
golf	*641
good†	*834
green	*762
H	42
ham	*938
hamfest	*946
hamvention	*947
henry	*642
hertz	*684
hi	*763
high	*763
hold	*963
home	*615
hours	*655
hundred	*640
I	43
inch	*964
india	*643
information	*996
-ing	*948
inspector	*785
intruder	*764
is	*733
is†	*823
J	51
jay	51
juliet	*651
K	52
kaye	52
kilo	*652
knot	*695
L	53
light	*934
lima	*653
line	*942
link	*998
left	*770
look	*957
low	*771
M	61
machine	84
manual	*965
me	*920
measure	*970
meeting	35
mega	*680
messages	*625
meter	*620

micro	*931
mike	*661
mill	*971
milli	*825
minus	*612
minutes	*645
mobile	*958
morning†	*841
motor	*972
move	*973
N	62
net	25
nine	09
nine†	*809
nineteen†	*894
north	*772
not	*695
november	*662
number	*734
O	63
o'clock†	*824
of	*694
off	*614
oh	63
oh†	*800
ohms	*933
on	*613
one	01
one†	*801
open	94
operator	*630
oscar	*663
out	*740
over	*773
P	71
patch	*966
papa	*671
pass	*774
passed	*974
percent	*675
phone	*914
pico	*932
please	*967
plus	*611
point	*674
position	*780
police	*968
power	*714
practice	85
press	*781
pressure	*935

probe	*975
pull	*980
push	*977
(pause)	34
Q	70
quebec	*670
R	72
radio	*976
range	*981
ready	*783
red	*744
remote	*910
repair	*745
repeat	*982
repeater	80
right	*665
romeo	*672
S	73
safe	*784
sea	23
seconds	*635
see	23
service	*723
set	*885
seven	07
seven†	*807
seventeen†	*874
shut	*765
sierra	*673
six	06
six†	*806
sixteen†	*864
slow	*983
smoke	*795
south	*790
speed	*984
s (suffix)	*915
start	*730
stop	*731
switch	*725
system	*997
T	81
(see -ty for suffix)	
tango	*681
tea	81
-teen	14
temperature	*724
ten	10
ten†	*810

test	*792
thank you	*978
the	24
the†	*821
thir-	13,30
thirteen†	*813
thirty†	*830
this is	65
thousand	*644
three	03
three†	*803
time	44
time†	*822
timer	*732
to	02
tomorrow	55
tonight	45
too	02
tool	*985
turn	*990
twelve	12
twelve†	*812
twenty	20
twenty†	*820
two	02
two†	*802
-ty	60
U	82
under	*775
uniform	*682
unit	*715
up	*650
V	83
valley	*986
valve	*941
victor	*683
volts	*750
W	91
wait	54
watts	*815
weather	95
whether	95
welcome	*913
west	*793
what's	*815
whiskey	*691
will	*912
won	01
write	*665
why	93

X	92
x-ray	*692
Y	93
yankee	*693
yellow	*794
you	82
your	*987
Z	90
zed	*988
zero	00
zulu	*690

† = female speaker

*9xx take 2 character slots

Numbers - male

zero	00
oh	63
one	01
two	02
three	03
four	04
five	05
six	06
seven	07
eight	08
nine	09
ten	10
eleven	11
twelve	12
thir-	13
-teen	14
twenty	20
fif-	50
hundred	*640
thousand	*644
-ty	60

Numbers - female

oh†	*800
one†	*801
two†	*802
three†	*803
four†	*804
five†	*805
six†	*806
seven†	*807
eight†	*808
nine†	*809
ten†	*810
eleven†	*811
twelve†	*812
thirteen†	*813
fourteen†	*814
fifteen†	*854
sixteen†	*864
seventeen†	*874
eighteen†	*884
nineteen†	*894
twenty†	*820
thirty†	*830
forty†	*840
fifty†	*850

Sound effects

crowd	*892
explosion	*891
laser	*873
phaser	*882
tic	*860
toc	*870
train	*883
whistle	*881

Colors

green	*762
red	*744
yellow	*794

Directions

east	*754
north	*772
south	*790
west	*793

Names

charlie	*623
dee	31
henry	*642
jay	51
juliet	*651
kaye	52
mike	*661
oscar	*663
papa	*671
romeo	*672
victor	*683

Macros

macro 1	*861
macro 2	*862
macro 3	*863
macro 4	*852

Run-Time Variables

m/a/e	*844
time	*872
am/pm	*832
date	*833
mail present	*994
t.o.period	*5731
# mail	*5732
VRT	*57xx

Change Type

Morse	*50
speech	*51
dtmf	*52(digits)
pager	*53xx
ASCII	*54x
DVR	*55xyz
ext dev	*56x
tts	*58x

Message Editor Commands

Read Back Message	*2	(to read back what you've entered so far)
Delete Last Character	*1	(to delete a mistaken character)
Delete Message	*3	(to delete the entire message to start over)
Store Message in Memory	*0	(after completed editing a message)
Abort Message Editor	*4	(to return to "UL" level without storing the message in memory)

Morse Code Character Codes

A	21
B	22
C	23
D	31
E	32
F	33
G	41
H	42
I	43
J	51
K	52
L	53
M	61
N	62
O	63
P	71
Q	70
R	72
S	73
T	81
U	82
V	83
W	91
X	92
Y	93
Z	90
0	00
1	01
2	02
3	03
4	04
5	05
6	06
7	07
8	08
9	09

word space	11
-	10
/	12
:	14
?	20
;	24
,	30
(	50
AR	13
AS	80
SK	60
macro 1	15
macro 2	25
macro 3	35
macro 4	45

See v3.4 Vocabulary pages for Message Editor summary and Morse character programming codes.

(PAUSE)	34
A	21
A.M.	*110
ABORT	*992
ABOUT	*855
ABOVE	*112
ACKNOWLEDGE	*114
ACTION	*115
ADJUST	*944
ADVANCED	*916
ADVISE	*116
AERIAL	*117
AFFIRMATIVE	*118
AFTERNOON†	*842
AIR	*120
AIRPORT	*122
ALERT	40
ALL	*685
ALOFT	*124
ALPHA	*621
ALTERNATE	*125
ALTITUDE	*127
AMATEUR	*917
AMPS	*831
AND	74
ANSWER	*128
APRIL	*131
AREA	*713
ARRIVAL	*132
AS	*133
AT	*742
AUGUST	*135
AUTO	*918
AUTOMATIC	*741
AUTOPILOT	*136
AUXILIARY	*137
B	22
BAND	*138
BANK	*140
BASE	*141
BATTERY	*142
BELOW	*143
BETWEEN	*660
BLOWING	*144
BOARD	*145
BOOST	*146
BOZO	*147
BRAKE	*148
BRAVO	*622
BREAK	*743
BROKEN	*151
BUTTON	*993
BY	*152
C	23
CABIN	*153
CALIBRATE	*735
CALL	*751
CALLING	*155
CALM	*156
CANCEL	*664
CAUTION	*711
CEILING	*158
CENTER	*161
CHANGE	*875
CHARLIE	*623
CHECK	*865
CIRCUIT	*720
CLEAR	*163
CLIMB	*165
CLOCK	*945
CLOSED	*166
CLUB	*926
CODE	75
COME	*167
COMPLETE	*721
COMPUTER	*927
CONDITION	*168
CONGRATULATIONS	*170
CONNECT	*940
CONTACT	*171
CONTROL	*624
CONVERGING	*172
COUNT	*173
COURSE	*174
CRANE	*950
CROSSWIND	*175
CURRENT	*177
CYCLE	*951
D	31
DANGER	*712
DAYS	*952
DAYTON	*928
DECEMBER	*181
DECREASE	*182
DECREASING	*183
DEGREES	*722
DELTA	*631
DEPARTURE	*185
DEVICE	*953
DIAL	*936
DINNER	*186
DIRECTION	*752
DISPLAY	*954
DOOR	*955
DOWN	*654
DOWNWIND	*188
DRIVE	*190
DRIZZLE	*191
DUST	*192
E	32
EAST	*754
ECHO	*632
-ED(suffix)	*193
EIGHT	08
EIGHT†	*808
EIGHTEEN†	*884
ELECTRICIAN	*943
ELEVATION	*196
ELEVEN	11
ELEVEN†	*811
EMERGENCY	*937
ENGINE	*198
ENTER	*995
EQUAL	*893
-ER(suffix)	*210
ERROR	*211
ESTIMATED	*212
EVACUATE	*213
EVACUATION	*214
EVENING†	*843
EXIT	*761
EXPECT	*215
F	33
FAIL	*755
FAILURE	*216
FARAD	*930
FARENHEIT	*217
FAST	*925
FEBRUARY	*218
FEET	15
FIF-(prefix)	50
FIFTEEN†	*854
FIFTY†	*850
FILED	*223

FINAL	*224
FIRE	*634
FIRST	*225
FIVE	05
FIVE†	*805
FLAPS	*227
FLIGHT	*228
FLOW	*960
FOG	*230
FOR	*231
FORTY†	*840
FOUR	04
FOUR†	*804
FOURTEEN†	*814
FOURTH	*234
FOXTROT	*633
FREEDOM	*235
FREEZING	*236
FREQUENCY	*610
FRIDAY	*237
FROM	64
FRONT	*238
FULL	*241
G	41
GALLONS	*991
GATE	*845
GAUGE	*961
GEAR	*244
GET	*962
GLIDE	*245
GO	*895
GOLF	*641
GOOD†	*834
GREEN	*762
GROUND	*248
GUSTING TO	*250
H	42
HAIL	*251
HALF	*252
HAM	*938
HAMFEST	*946
HAMVENTION	*947
HAVE	*253
HAZARDOUS	*254
HAZE	*255
HEAVY	*257
HELP	*258
HENRY	*260
HERTZ	*684
HIGH	*763
HOLD	*963
HOME	*615

HOTEL	*642
HOUR	*261
HOURS	*655
HUNDRED	*640
I	43
ICE	*262
ICING	*263
IDENTIFY	*264
IGNITE	*266
IGNITION	*267
IMMEDIATELY	*268
IN	*270
INBOUND	*271
INCH	*964
INCREASE	*272
INCREASING TO	*274
INDIA	*643
INDICATED	*275
INFLIGHT	*276
INFORMATION	*996
-ING(suffix)	*948
INNER	*277
INSPECTOR	*785
INTRUDER	*764
IS	*733
IS†	*823
IT	*281
J	51
JANUARY	*282
JULIET	*651
JULY	*283
JUNE	*284
K	52
KEY	*285
KILO	*652
KNOTS	*286
L	53
LAND	*287
LANDING	*288
LATE	*956
LAUNCH	*291
LEAN	*292
LEFT	*770
LEG	*293
LESS THAN	*294
LEVEL	*295
LIGHT	*934
LIMA	*653
LINE	*942
LINK	*998

LIST	*296
LOCK	*297
LONG	*298
LOOK	*957
LOW	*771
LOWER	*310
LUNCH	*311
M	61
MACHINE	84
MAINTAIN	*312
MANUAL	*965
MARCH	*313
MARKER	*314
MAY	*315
MAYDAY	*316
ME	*920
MEAN	*317
MEASURE	*970
MEETING	35
MEGA	*680
MESSAGES	*625
METER	*620
MICRO	*931
MIKE	*661
MILES	*322
MILL	*971
MILLI	*825
MILLION	*323
MINUS	*612
MINUTES	*645
MIST	*324
MOBILE	*958
MODERATE	*326
MONDAY	*327
MONTH	*328
MORE THAN	*330
MORNING†	*841
MOTOR	*972
MOVE	*973
MUCH	*332
N	62
NEAR	*333
NEGATIVE	*334
NET	25
NEW	*335
NEXT	*336
NIGHT	*337
NINE	09
NINE†	*809
NINETEEN†	*894
NO	*342
NORTH	*772

NOT	*695
NOVEMBER	*662
NUMBER	*734
O	63
OBSCURED	*344
OCLOCK	*345
OCLOCK†	*824
OCTOBER	*346
OF	*694
OFF	*614
OH†	*800
OHIO	*348
OHMS	*933
OIL	*350
ON	*613
ONE	01
ONE†	*801
OPEN	94
OPERATION	*352
OPERATOR	*630
OSCAR	*663
OTHER	*353
OUT	*740
OUTER	*355
OVER	*773
OVERCAST	*356
P	71
P.M.	*358
PAPA	*671
PARTIALLY	*361
PASS	*774
PASSED	*974
PATCH	*966
PATH	*362
PER	*364
PERCENT	*675
PHONE	*914
PICO	*932
PLEASE	*967
PLUS	*611
POINT	*674
POLICE	*968
POSITION	*780
POWER	*714
PRACTICE	85
PRESS	*781
PRESSURE	*935
PRIVATE	*366
PROBE	*975
PROGRAMMING	*367
PULL	*980
PUSH	*977
Q	70
QUEBEC	*670
R	72
RADIO	*976
RAIN	*374
RAISE	*375
RANGE	*981
RATE	*376
READY	*783
REAR	*377
RECEIVE	*378
RED	*744
RELEASE	*381
REMARK	*382
REMOTE	*910
REPAIR	*745
REPEAT	*982
REPEATER	80
RICH	*383
RIG	*384
RIGHT	*665
ROAD	*385
ROGER	*386
ROMEO	*672
ROUTE	*388
RUNWAY	*390
S	73
-S(suffix)	*915
SAFE	*784
SAND	*391
SANTA CLARA	*392
SATURDAY	*393
SCATTERED	*394
SECOND	*395
SECONDS	*635
SECURITY	*396
SELECT	*397
SEPTEMBER	*398
SEQUENCE	*410
SERVICE	*723
SET	*885
SEVEN	07
SEVEN†	*807
SEVENTEEN†	*874
SEVERE	*413
SEXY	*414
SHORT	*415
SHOWERS	*416
SHUT	*765
SIDE	*417
SIERRA	*673
SIGHT	*418
SIX	06
SIX†	*806
SIXTEEN†	*864
SLEET	*423
SLOPE	*424
SLOW	*983
SMOKE	*795
SNOW	*425
SOUTH	*790
SPEED	*984
SPRAY	*427
SQUAWK	*428
STALL	*431
START	*730
STOP	*731
STORM	*433
SUNDAY	*434
SWITCH	*725
SYSTEM	*997
T	81
TANGO	*681
TANK	*435
TARGET	*436
TAXI	*437
-TEEN(suffix)	14
TELEPHONE	*438
TEMPERATURE	*724
TEN	10
TEN†	*810
TERMINAL	*440
TEST	*792
-TH(suffix)	*441
THANK YOU	*978
THAT	*442
THE	24
THE(long e)	*443
THE(short e)	*444
THE†	*821
THIR-(prefix)	13 or 30
THIRD	*447
THIRTEEN	*448
THIRTEEN†	*813
THIRTY†	*830
THIS	*451
THIS IS	65
THOUSAND	*644
THREE	03
THREE†	*803
THUNDERSTORMS	*452
THURSDAY	*453
TIME	44

TIME†	*822
TIMER	*732
TO	*455
TODAY	*456
TOMORROW	55
TONIGHT	45
TOOL	*985
TORNADO	*457
TOUCHDOWN	*458
TOWER	*460
TRAFFIC	*461
TRANSMIT	*462
TRIM	*463
TUESDAY	*464
TURBULANCE	*465
TURN	*990
TWELVE	12
TWELVE†	*812
TWENTY	20
TWENTY†	*820
TWO	02
TWO†	*802
-TY(suffix)	60
U	82
UNDER	*775
UNIFORM	*682
UNIT	*715
UNLIMITED	*467
UNTIL	*468
UP	*650
USE(noun)	*470
USE(verb)	*471
V	83
VALLEY	*986
VALVE	*941
VARIABLE	*473
VERIFY	*475
VICTOR	*683
VISIBILITY	*476
VOLTS	*750
W	91
WAIT	54
WAKE	*477
WAKE UP	*478
WARNING	*480
WATCH	*481
WATTS	*815
WAY	*482
WEATHER	95
WEDNESDAY	*484
WELCOME	*913
WEST	*793
WHISKEY	*691
WILL	*912
WIND	*487
WITH	*490
WRONG	*491
X	92
X-RAY	*692
Y	93
YANKEE	*693
YELLOW	*794
YESTERDAY	*492
YOU	*493
YOUR	*987
Z	90
ZED	*988
ZERO	00
ZONE	*494
ZULU	*690

SOUND EFFECTS

CROWD	*892
EXPLOSION	*891
LASER	*873
PHASER	*882
TIC	*860
TOC	*870
TRAIN	*883
WHISTLE	*881

NUMBERS (MALE)

NUMBER	*734
ZERO	00
OH	63
ONE	01
TWO	02
THREE	03
FOUR	04
FIVE	05
SIX	06
SEVEN	07
EIGHT	08
NINE	09
TEN	10
ELEVEN	11
TWELVE	12
THIRTEEN	*448
THIR-(prefix)	13
-TEEN(suffix)	14
TWENTY	20
FIF-(prefix)	50
HUNDRED	*640
THOUSAND	*644
MILLION	*323
-TY(suffix)	60
FIRST	*225
SECOND	*395
THIRD	*447
FOURTH	*234

NUMBERS (FEMALE)

OH†	*800
ONE†	*801
TWO†	*802
THREE†	*803
FOUR†	*804
FIVE†	*805
SIX†	*806
SEVEN†	*807
EIGHT†	*808
NINE†	*809
TEN†	*810
ELEVEN†	*811
TWELVE†	*812
THIRTEEN†	*813
FOURTEEN†	*814
FIFTEEN†	*854
SIXTEEN†	*864
SEVENTEEN†	*874
EIGHTEEN†	*884
NINETEEN†	*894
TWENTY†	*820
THIRTY†	*830
FORTY†	*840
FIFTY†	*850

DAYS OF THE WEEK

DAYS	*952
SUNDAY	*434
MONDAY	*327
TUESDAY	*464
WEDNESDAY	*484
THURSDAY	*453
FRIDAY	*237
SATURDAY	*393

MONTHS OF YEAR

MONTH	*328
JANUARY	*282
FEBRUARY	*218
MARCH	*313
APRIL	*131
MAY	*315
JUNE	*284
JULY	*283

AUGUST	*135
SEPTEMBER	*398
OCTOBER	*346
NOVEMBER	*662
DECEMBER	*181

COLORS

GREEN	*762
RED	*744
YELLOW	*794

DIRECTIONS

EAST	*754
NORTH	*772
SOUTH	*790
WEST	*793

NAMES

CHARLIE	*623
DEE	31
HENRY	*642
JAY	51
JULIET	*651
KAYE	52
MIKE	*661
OSCAR	*663
PAPA	*671
ROMEO	*672
VICTOR	*683

MACROS

MACRO 1	*861
MACRO 2	*862
MACRO 3	*863
MACRO 4	*852

RUN-TIME VARIABLES

M/A/E	*844
TIME	*872
AM/PM	*832
DATE	*833
MAIL PRESENT	*994
T. O. PERIOD	*5731
# MESSAGES	*5732
VRT	*57xx

CHANGE TYPE

MORSE	*50
SPEECH	*51
DTMF	*52(digits)
PAGER	*53xx
DVR	*55xyz
EXT. DEVICE	*56x