ZETRON

Model 48-Jr Repeater Patch
Installation Manual

Part No. 025-9362C

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1. INTRODUCTION

OVERVIEW

The Model 48-Jr combines a telephone interconnect and a shared repeater panel in one small package. It provides dispatch and telephone interconnect operation that may be enabled or disabled for up to 154 user groups, based on CTCSS and DCS signaling. The Model 48-Jr provides the logic and control circuits to interface a transmitter, a receiver, and a telephone system. For on-site applications, the unit interfaces well with existing PBX installations or an outside telephone line. Inexpensive handheld radios may be used for dispatch operation since only CTCSS or DCS signaling is required and is most often a standard feature of the radio. DTMF encoding is required for access to and dialing of the phone line (interconnect). Calls may be placed from mobile-to-phone, phone-to-mobile, and mobile-to-mobile. Dispatch (repeater) operation is also supported.

TELEPHONE INTERCONNECT

The telephone interconnect portion of the product enables radio users to place and receive phone calls. Each of the up to 154 users may be allowed or denied access to the telephone line on a per user basis. To place a telephone call from a mobile radio, the user must key their radio and enter a DTMF "connect" code (typically "*"). If phone access is enabled, the user will hear the phone line dial tone and may begin dialing the desired number. Each user may have their dialing "toll restricted". This may be set to avoid toll or long distance charges being made to the system by its users. Ten speed dial numbers are available to the phone users. These may be programmed with frequently called or specially allowed toll numbers, as desired. Once a call is in progress, only the radio user who placed or received the call can speak with the telephone party. CTCSS/DCS validation is used to prevent other mobile users or interference from being heard by the phone or mobile involved in the call. A “half-privacy” masking tone may be enabled to prevent other mobiles from listening to the mobile side of the conversation. Increased security for the system can be provided by requiring the mobiles to use longer access codes when they sign on to the system.

The Model 48-Jr has both call limit and mobile activity timers to ensure that the call traffic does not become held up by long calls, and that all calls are properly terminated even if the mobile or phone party does not terminate the call manually.

MOBILE-TO-MOBILE CALLS

Mobile-to-mobile calls can be placed in a manner similar to phone calls. This gives the caller the ability to contact other mobile users in different groups. The caller will need to have this function enabled in user programming in order to place a mobile-to-mobile call. When enabled, the Model 48-Jr uses a trailing steering digit entered by the caller to determine whether call is being placed to the phone or another user. This feature works in much the same manner as the leading digits required by PBX systems for placing internal or outside calls.

When a mobile-to-mobile access is placed, the Model 48-Jr responds with an internally generated dial tone. At this prompt, the caller enters the user number of the mobile they wish to call. If the called mobile number is valid, then ring out tones are sent on the channel along with the appropriate CTCSS/DCS selective signal. When the called mobile answers, the two mobiles can communicate as though it were a phone call. Since the Model 48-Jr processes the CTCSS/DCS decode and encode throughout the entire call in order to provide cross-tone encoding, it can also ensure that other radios not involved in the call do not interfere with it.

DISPATCH

The Model 48-Jr is capable of decoding and encoding all 50 CTCSS tones and 104 DCS codes. This provides a potential total of 154 user groups that may be enabled or disabled for dispatch operation. When enabled, a user has only to key his or her radio and speak to contact others within their user group. The panel will regenerate the received tone/code to unsquelch other radios within the group. The Model 48-Jr also provides repeat audio processing, squelch tail elimination, repeater time-out, and repeater hold timer.

PRINTER PORT OPTION

A parallel printer interface port is available as an option for the Model 48-Jr. This option allows the interconnect to log detailed information at the end of each phone call concerning the time and date, duration of the call, the user that was involved, and the phone number dialed if the mobile originated the call. Dispatch airtime and the time spent trying to access reserved tones can also be recorded. This option provides a real-time output to a parallel printer.

FEATURES

- Phone-to-mobile calls
- Mobile-to-phone calls, with up to 10 speed dial numbers
- Mobile-to-mobile selective calling, across tone/code groups
- Dispatch (repeater) operation for up to 50 CTCSS and 104 DCS users
- Selective calling via CTCSS/DCS encode
- Database and validation for 154 users or groups
- Full duplex, half-duplex, or mobile half-privacy masking tone for interconnect operation
- Toll restrictions of phone number dialing, assignable on per-user basis
- Remotely programmable using DTMF commands via the phone or the radio
- Built-in dial click decoder to support calls dialed from rotary or pulse dial phones

- Programmable timers for Call limit, mobile activity time, and repeater hold time
- Repeat audio processing and squelch tail elimination

OPTIONS

- Parallel printer port interface, with real-time clock, to provide a call detail output
- Radio interface cable to generic radio applications
- Radio interface cables for interfacing to a Motorola GR300/GR500 repeater, or a pair of GM300 mobiles

2. SPECIFICATIONS

GENERAL SPECIFICATIONS

Power	11 to 16 volts DC, 300 mA nominal
Operating Temperature	0° to +60° Celsius, 95% relative humidity @ +50°C (non-condensing)
Size	5.9-in W x 7.4-in D x 1.7-in H
Weight	1.8 pounds

TELEPHONE INTERFACE

Line Type	End-to-End (B1), typical subscriber line
Connector	RJ11C modular jack
Incoming call	Ring detection on tip-ring pair; programmable number of rings before answering line
Call answer	Off-hook, tip-ring current draw
Call disconnect	Phone party disconnect via DTMF “#0”, mobile initiated disconnect, busy tone disconnect, call limit and mobile activity timers
Call progress tones	Dial tone, ringing, double ring, busy, and reorder
Hybrid	Dual transformer, high performance two-wire to four-wire converter for full duplex applications

RADIO INTERFACE

Connections	+12 volts DC, Ground, RX discriminator audio, TX mic audio, CTCSS/DCS encode, TX PTT, RX carrier detect
Connector	10-pin Molex
Adjustments	TX mic audio, TX CTCSS/DCS encode, RX audio, VOX sensitivity, Hybrid R/C, Carrier detect
Carrier detector	Internal noise squelch detector, or external COR input with polarity and threshold adjustments
PTT	FET pull to ground

TX audio	-40 to +6 dBm, HI/LO range selector, 1 kΩ output impedance
RX audio	-40 to +10 dBm, HI/LO range selector, 50 kΩ input impedance
Aux. output	FET pull to ground, DTMF code from phone or radio will activate

PROGRAMMABLE ITEMS

Mobile Initiated Interconnect

Connect code	DTMF ANI, 1 to 9 digits, default is "*"
Disconnect code	DTMF ANI, 1 to 9 digits, default is "#"
Mobile answer	ANI or Tone/Carrier incoming calls
Dialing mode	Regenerated DTMF or dial pulse
Toll restrict	First and second digit toll restrict, up to four digits in each position. Limits for the total number of digits dialed
Hookflash	Enable/Disable. Mobile may initiate hookflash with "*0"
Busy tone disconnect	Automatic disconnect on busy tones may be enabled for the first 20 seconds of a call, may be enabled for the entire call, or may be disabled
Autodials	10 speed dial numbers may be programmed for instant mobile access

Selective Calling

Telco rings before answer	1 to 10 rings, default is 1 ring, if set to zero then no phone-to-mobile calls allowed
Selective calling mode	System can call a specific single CTCSS/DCS user, or prompt the phone caller to overdial the number of the user they wish to call
Ring out mode	Ring out over the channel for 15, 30, or 60 seconds, or ring out only once over the channel and then wait up to 60 seconds for the mobile to answer
Phone line	May be made busy (taken off hook) during mobile-to-mobile calls so that callers get a busy signal from the C.O. or switch, or it can be left on-hook to ring until mobile becomes available

Dispatch Mode

Modes	Validated CTCSS/DCS users, or Carrier repeat
Repeater hold time	0 to 9 seconds, default is 3 seconds
Anti-kerchunker filter	Enable/Disable (Enabling this feature disables the repeater hold timer for short transmissions)

General

Station ID	Morse code call sign, programmable, may be set to ID after dispatch or interconnect activity if the interval has expired, or to ID periodically every time the interval expires, interval can be set from 0 to 99 minutes, default is 15 minutes
Call limit timer	1 to 10 minutes, default is 3 minutes, may be disabled, mobiles can be given the capability to extend a call in-progress
Mobile activity timer	30 to 99 seconds, will automatically terminate a call in progress if no mobile activity is seen before the timer reaches zero
Connect switch mode	Pressing the front panel switch can force the interconnect into the Conversation mode (a call already in-progress) or the Phone-Answer mode (come off-hook and prompt for user number overdial), the Connect button can also be used on site to initiate and select test and adjustment diagnostics
Aux. output	Programmable password to control access to the Aux. output function. Aux output can be turned On or Off remotely via DTMF commands

User Specific Selections

User numbers	User numbers are from a cross reference database table based CTCSS/DCS decode. Commands are available to program items on a per-user or globally (all users) basis, the 155 user database breaks down as follows: 0 = Carrier repeat, 1 to 50 = CTCSS tone users, 51 to 154 = DCS code users
User modes	Enabled, Disabled, or Reserved, reserved users will key the transmitter and generate the correct CTCSS/DCS encode, however, no repeat audio will pass, instead, a blocking or “Reserve” audio tone is transmitted, this is useful for dealing with delinquent customers and maintaining possession of seasonally used tones/codes
Dispatch	Enable/Disable

Mobile-to-phone	Enable/Disable
Mobile-to-mobile	Enable/Disable
Toll restrict	Toll calls allowed, or Toll calls restricted
Equipment type	Mobile user, or Talkback pager
Audio mode	Full duplex, half duplex, or half privacy
Tone-in-tail	Enable CTCSS/DCS encode during TX hold time, or drop the encode once mobile unkeys
Tone drop mode	Encode CTCSS/DCS during the entire interconnect call, or encode only during ring out and drop it after mobile answers (no encode at all during mobile originated calls)
Courtesy tone	Enable/Disable. Courtesy tone may be programmed system-wide to any Morse code character or digit.

ADDITIONAL SPECIFICATIONS

Indicators	Phone, Carrier, Transmit, Power
Switch	Manual Connect/Disconnect, can also used to select the installation test modes
Station ID	Morse code, 1000 Hz tone frequency and programmable call sign
Prompt tones	Progress tones, error tones, and warning tones sent to the phone or mobile
Programming	Programmable via DTMF commands from either the phone or from a mobile
Data retention	Nonvolatile EEPROM, no batteries to replace
Secondary protection	Telephone line input has high voltage clamps with protective fusing elements
Printer Port Option	Parallel printer port, DB25S connector, pin-out is PC compatible

3. OPERATION

OVERVIEW

In the broadest possible sense, the Model 48-Jr can be thought of as operating in one of two modes: the normal operating mode and the programming mode. This section deals with what goes on and the features available in the normal operating mode. Complete details on the programming mode and all programming commands are given in Section 4, Programming.

Throughout this section, the terms “user” and “mobile” will be used quite often, and may at first appear to be used interchangeably. While this is often the case, the two words do have slightly different connotations as far as a discussion of the Model 48-Jr’s operations is concerned. The term “mobile” is typically used to refer to a physical person somewhere out in the service area of the repeater, who is using a handheld radio, or the radio in a vehicle, to talk through the repeater. The term “user” is typically used to discuss an entity that exists in the Model 48-Jr’s database. The controller processes calls, imposes restrictions, or allows privileges all based on what it has recorded about the users in its database. Understanding this distinction will help you understand why a group of two or three (or more) “mobiles” in the real world can all be treated as a single “user” by the controller.

The Model 48-Jr generates a number of different tones and sounds in response to, or to announce various events. Users of the system should be made aware of the different types of sounds and their meaning.

Whenever the patch answers a ringing telephone line, it will generate a dial tone to prompt the caller to enter the user number of the party they wish to reach. The caller should only need to hear dial tone before entering the user number to be called. However, in some cases where the hybrid balance is not adequate or DTMF is sent at low levels, the caller may be required to wait until the dial tone drops before entering the user number.

The dial tone is generated for 6 seconds. After that amount time has passed, the dial tone will stop. The caller has another 4 seconds to begin entering a user number. If nothing is entered, the telephone line is hung up and the system returns to idle.

Ringing tones are generated by the patch and sent both back to the phone and out over the channel while the patch is waiting for a mobile to answer the call.

Errors made in using the system typically result in the generation of error tones preceding a disconnect. An error tone is two rapidly alternating tones (sometimes described as warble tones) sent out for about one second.

The Model 48-Jr will use its beep tone in various patterns to indicate several things. It may send a single beep to the phone when the mobile unkeys as a courtesy tone. If the phone party hears a single beep every few seconds while they are speaking, this is the mobile activity timer warning. If the caller hears a double beep every few seconds, then this indicates that the call limit timer is about to expire.

USER ENABLES

The Repeater Patch has Enable/Disable validation for each of the 155 users in its database. The users in this database are divided up as follows: users 01 to 50 are associated with the decoding of a CTCSS tone, users 51 to 154 are associated with the decoding of a DCS code, and user 00 is associated with carrier squelch operation.

When a mobile tries to access the phone line through the Model 48-Jr, he or she will send a DTMF "*", or whatever has been programmed as the Connect. While the patch is decoding this DTMF character, it is also decoding the CTCSS tone or DCS code that the mobile is transmitting. It uses that information to determine which set of user parameters to use in controlling the call. A chart showing the relationship between the user numbers and specific tones and codes is found in Appendix B.

PHONE-TO-MOBILE CALLS

The Repeater Patch defaults to answer a ringing phone line after one ring. It can be set to wait for up to ten rings if the patch is sharing the phone line, or disable if no phone originated calls are desired. Once the programmed number of rings has occurred, if set for over-dial operation, the patch will answer the line and issue dial tone for 6 seconds. After hearing the dial tone, the caller should enter the user number of the mobile that he or she wants to reach. This will tell the patch which decode and encode to use during the call and supply a set of user privileges and restrictions to use in controlling the call.

If the caller waits for more than 6 seconds before beginning to enter the user number of the desired party, the dial tone will drop. If the caller waits for more than 4 seconds after the dial tone ends to start entering the number, or if the number entered belongs to a user that is not enabled for Phone Access calls, the patch will return an error tone and terminate the call.

If the user number entered is valid, then the patch will key the transmitter, encode that user's tone or code, and ring out on the channel. The mobile that hears the ringing can connect the call by sending the DTMF connect code or by keying up with the correct tone as programmed. If the mobile does not respond within the ring out time programmed in the patch (15, 30, or 60 seconds), then the patch will issue an error tone to the phone and terminate the call.

A user may be programmed for "Talk-Back-Paging". If this was the case for the user being called, the system would send only one ring over the air. Shortly after the ring, the caller would hear two short beeps to announce that the voice channel between the phone and the mobile is now open and they may leave a voice message. The mobile may speak back to the caller by simply keying the radio and speaking. The call in this case does not have to be answered by the mobile using the usual "connect code".

The Repeater Patch may instead be set for Autocall operation. When this is programmed, the system is programmed with a specific users ID. Any calls received by the unit will ringout over the channel to the selected user tone or code while the phone remains ringing. The ringing will begin after the programmed number-of-rings have been received and will remain ringing until the caller hangs up or the mobile ring out time is exceeded or the called mobile

answers the call. This is very useful for automatic call forwarding to a mobile, from an office phone.

CONNECT BUTTON PHONE-ORIGINATED CALLS

There is another way in which a phone-to-mobile call can be placed. When the Model 48-Jr shares its phone line with another telephone, and that phone is physically located near the patch, an operator can force the patch on line by pressing the CONNECT button on the front panel. By default, this button will force the patch into the same state as if it had just answered a ringing phone line. The 48-Jr will issue dial tone and wait for the operator to enter the number of the user to be called. From that point on it is handled as a normal call.

The button can be programmed to respond to a press by simply dropping into the conversation mode, as though the ring out had already occurred and the mobile had answered. This mode for the CONNECT button would be used when the operator hailed the mobile over the radio prior to connecting the patch to the line.

If the patch is already involved in a phone call, or a mobile-to-mobile call, when the CONNECT button is pushed, then the patch will terminate the call in progress.

MOBILE ORIGINATED CALLS

To place a call, mobile keys up and sends the DTMF Connect code for that system. The default Connect code for the Model 48-Jr is simply a “*”, but the system operator can change it to be a string of digits up to nine digits long. In the case of longer Connect codes, once the sign-on sequence is started each additional digit must be transmitted within 1.5 seconds of the last, or the attempt to sign-on will be ignored.

While the patch is capturing the incoming DTMF digits, it is also decoding the tone or code being transmitted by the mobile and using that information to look up a user number. This will determine whether or not it responds to the mobile by providing access to the phone, or ignores the request. The patch must receive the correct DTMF Connect code and identify the user as one that is enabled for mobile originated calls before it will provide dial tone to the mobile. The mobile may then begin dialing the phone number.

The mobile can dial the phone number manually, or if the microphone used has preprogrammed number capability, have the mic send it (dialing speed should be kept under 10 digits per second). If the mobile wants to use one of the Autodial numbers programmed into the patch’s memory, then he or she will send a “*” plus a single digit (e.g. “*5”) to indicate which Autodial number should be used.

MOBILE-TO-MOBILE CALLS

This section discusses mobile-to-mobile calls. This term should not be confused with dispatch operation where one mobile may also communicate with another mobile. If dispatch operation is enabled for a specific tone in the system, and a mobile set to encode that tone

keys up on the channel, that same tone is encoded out of the Model 48-Jr and transmitted along with the audio from the keyed mobile to all of the other users on that same tone.

Mobile-to-mobile communications discussed here refer to the ability of a mobile to access the Model 48-Jr and request communications with a mobile in another tone group.

By default, none of the users in the database are allowed to place mobile-to-mobile calls. This capability can be enabled on a per user basis under user programming. When a user has this capability enabled, it changes the way he or she accesses the system. The user must now add a steering digit after the Connect code to tell the patch whether to route the call to the phone or another user. The two steering digits used are “9” for phone calls and “7” for mobile-to-mobile calls. So, for example, if a mobile that transmits a 100 Hz CTCSS tone keys up and sends “*7”, and the patch found user #13 valid, it would key the transmitter and generate a dial tone prompt to the mobile. If the mobile responded to that by sending the DTMF “36”, then the patch would interpret this as user #13 placing a call to user #36, and would start generating the tone 186.2 Hz and sending the ringing sound out the transmitter. The amount of time allowed for the called mobile to answer is set by the same Mobile ring out timer used in phone calls. (Refer to the Tone/Code table in Appendix B for User Number to tone/code translation.)

The patch only requires that the mobile originating the call be enabled for Mobile Selective calling. The mobile receiving the call only needs to be enabled.

DIALED NUMBER REGENERATION AND TOLL RESTRICTS

The Repeater Patch defaults to regenerating the DTMF digits received from the mobile user that are used to dial the telephone. Dialed number regeneration is a function where the mobile’s dialing is received and decoded by the Repeater Patch. The received number is then regenerated using the internal tone generating hardware of the 48-Jr and then sent down the phone line. This allows the panel to present a set level and quality of DTMF to the phone line regardless of which mobile is dialing or where they are in the repeater's service area. This can also be programmed to translate the mobiles DTMF into pulse dialing, should that be required by the connected telephone service.

Dialed number regeneration is a timed function. While dial regeneration is active, audio from the mobile unit connected to the system is not passed to the telephone line. The audio is muted to facilitate translation of the DTMF to pulse dialing (if programmed) and to accommodate toll restrict checking while dialing. As well it is muted to assure that only a single source of interference free DTMF is sent through the phone line to assure reliable dialing.

The way in which the dial regeneration is timed, is through a parameter called: "Dial Regeneration Inter-Digit Time-out". By factory default, this is set to 3 seconds. This sets the amount of time, after dial-tone is detected by the 48-Jr, that the user has to begin dialing the phone number. It is also used as the amount of time allowed between successive digits. To remain in dial regeneration, digits must be entered within this period of time. As intended, when the time is allowed to lapse, the mobile audio will be passed to the phone line to allow

conversation to take place. Should dialing continue after regeneration times out, the mobile's DTMF will be sent to the phone line. It would be possible then, that the quality of the received DTMF could affect dialing reliability.

Dial regeneration may be programmed for any time between 0 and 60 seconds. Using 0 or very short periods of time effectively disables this feature, while longer periods of time may allow a more comfortable dialing pace.

Besides waiting for regeneration to time out so a mobile can speak through to the phone, dial regeneration may be forced to end by the mobile after the mobile has finished dialing. This is especially useful and important when the regeneration time is set to a larger value. Canceling regeneration is accomplished by dialing a DTMF "*" after the last telephone number digit is dialed. Note that this "*" is not passed to the phone line.

While dialing, the panel checks the received DTMF digits to see if the dialing violates the toll restrictions programmed into the unit. If a match is found to the restricted digits, the phone connection will be immediately terminated.

An additional toll restrict method is available that limits the maximum number of digits that the toll restricted user may dial. At anytime during the telephone interconnect whether regeneration is active or not, if the "Maximum Number of Digits Dialed" is exceeded by the mobile, the call will also be immediately disconnected. This toll restrict method can be disabled by programming its value to a "0" or it can be set to any value from 1 to 99 digits.

Also note that if the mobile user has toll restricted dialing enabled (and restricted digits are programmed into the unit) audio will not un-mute until the toll restrict checking can be satisfied. That is to say, that the toll restricted user cannot wait until regeneration time expires nor force regeneration to end with a "*" until the first 1 or 2 digits have been dialed and toll restrict digit checking is complete.

The Model 48-Jr will detect dial tone before beginning to dial. While dial regeneration is active, the unit will buffer or hold internally up to 16 DTMF digits received from the mobile prior to dial tone being detected. Once having detected dial tone, the unit will proceed to dial the digits. The busy / dial tone VOX adjustments must be set for this to function correctly. The installation section covers these adjustments.

ONCE A CALL IS IN PROGRESS

Once a mobile has answered the ring out to his mobile, or the patch has exited the regenerate mode after dialing the phone number, the patch enters into the conversation mode, which it will remain in for the rest of the call. While in the conversation mode, the patch will control receive and transmit audio routing according to its system and user programming. The conversation mode, and the call, may be terminated in one of four ways:

1. DISCONNECT CODE: The mobile involved in the call may terminate it by sending the Disconnect code programmed for the patch. By default this is a DTMF ”#”, however this

can be changed in programming and be made up to nine digits long. While decoding the DTMF, the patch will also be checking the CTCSS/DCS decode and it will ignore the disconnect command unless the subaudible decode is correct for the mobile involved in the call.

2. BUSY TONE DISCONNECT: The Repeater Patch may be programmed to detect busy tones from the phone line in order to automatically disconnect a call if a busy line was dialed. Two types of busy tone disconnect are available. The first option will disconnect if busy was detected during only the first 20 seconds of the phone call. The second option will disconnect if busy is detected anytime during the call. By default this feature is disabled.

3. MOBILE ACTIVITY: The Repeater Patch keeps track of the mobile's activity in order to ensure that the mobile is still in range and capable of controlling the repeater. The mobile must transmit at least once before the Mobile Activity timer runs out, even if only momentarily, in order to keep the conversation going. Starting 12 seconds before the timer expires, the patch will send a single beep every three seconds to both the phone and the mobile to warn them that the mobile needs to key and reset the timer. If the timer reaches zero, then the patch disconnects the phone line and ends the call.

4. CALL LIMIT: The maximum length of calls is controlled by the Call Limit timer, which defaults to 3 minutes. Starting 15 seconds before the Call Limit time is reached, the patch will send a double beep every three seconds to both the phone and the mobile. Once the timer expires, the call is terminated and five fast beeps are sent to the mobile. The Repeater Patch can be programmed to allow the mobile the option of resetting the timer by transmitting a "*" while call limit warning beeps are heard.

REPEATER OPERATION

Since the Model 48-Jr has the capability to decode CTCSS/DCS, as well as encoding it, it is capable of providing community repeater dispatch service as well as telephone interconnect. Every one of the 154 CTCSS/DCS users in the Repeater Patch's database can be independently configured to support interconnect & dispatch, interconnect only, or dispatch only.

When ever the Repeater Patch detects carrier at the receive, it checks the receive audio for the presence of a CTCSS tone or a DCS code. If there is one and the database shows it to be enabled for dispatch service, then the Repeater Patch will key the transmitter, encode the tone or code, and turn on the repeat audio path. Unless in a Mobile Select call, the Model 48-Jr does not offer cross-tone capability. During repeater operation, the tone or code that it transmits is always the same as the one it decoded.

There are several timers that control the panel during dispatch operation. The Repeater Hold timer controls how long the panel will hold the repeater keyed after the last mobile to transmit unkeys. This timer defaults to three seconds, but it can be programmed to anywhere from zero to nine seconds. If the repeater is located in an area with a great deal of spurious or co-channel interference, or the mobile users like to test whether or not they are in range by

keying up for an instant (often called “kerchunking” the repeater), then the repeater can be subjected to a good deal useless ware and tear keying up for the hold time when there is no real traffic to serve. The Model 48-Jr offers a solution to this by providing a Anti-kerchunker Filter that can be enabled or disabled in programming. When enabled, this filter requires that the initial transmission that brings up the repeater has to be at least a half second long, or there will be no hold time and the transmitter will drop when the receive carrier detect does.

The Model 48-Jr protects the repeater against stuck-mic accidents by means of its Repeater Time-out timer. This is a fixed three minute timer that comes into effect whenever the panel sees the receive carrier detect signal continue unbroken for more than three minutes. The panel will unkey the transmitter and refuse to do any more dispatch or interconnect operations until the offending carrier signal stops.

The Model 48-Jr can be set to operate as a carrier only repeater if necessary. This disables the CTCSS/DCS encode and decode requirement and allows any received carrier to control system operation. Programming command 19# selects this mode and user "0" in the database selects the privileges available. External encode and decode connections could be used.

MORSE CODE STATION IDENTIFICATION

The Model 48-Jr can be programmed to transmit a Morse code station ID. The ID string can be up to eight characters in length and include both letters and numbers. The mode in which it transmits IDs and the period between IDs are also programmable.

The ID string is programmed into the panel using a DTMF command described in more detail in the Programming section. Briefly though, all the characters of the ID are converted into two-digit numbers and entered into the panel. The panel will play back the ID in Morse code at 10 wpm during programming in order to allow the installer to confirm the entry.

Whenever the ID is transmitted, it is always transmitted at 20 wpm, using a tone of 1000 Hz, and at 30% deviation. The default time period between IDs is 15 minutes, but it can be set to be anywhere between 1 and 99 minutes. The panel will key up while the channel is idle or wait until the interconnect or dispatch activity is finished if the ID period ends during a call.

The Morse ID Mode command determines how the Repeater Patch will behave when the ID period expires. The default mode of operation is that the unit will ID when the timer expires and there has been some channel activity since the last ID was transmitted. The unit can be set to ID periodically, that is, to ID when the timer expires whether or not there has been any activity. The unit can also be programmed to not ID at all, but to still retain the ID string and timer period in memory.

ACCESS TO PROGRAM MODE

The Model 48-Jr Repeater Patch is a highly programmable device. This allows the maximum flexibility for configuring the unit to suit many different installations. As received from the factory, the Repeater Patch has default values set for the various features that will be

sufficient for most common situations. In many cases, with the exception of enabling users, very little programming will need to be done.

To program any of these features or to enable users, "programming mode" must first be entered. This mode is entered using a 5 digit DTMF password from either a radio or a telephone. Once entered, DTMF commands are used to program the various features and set user privileges within the system. When complete, program mode will be exited and the system will begin operation as programmed, assuming all of the new values set during programming. Program mode can be reentered at any time to further change any feature or to add or change users in the system.

Accessing from a Phone

As mentioned, program mode may be entered from either a DTMF telephone or a DTMF equipped radio. If programming from a telephone, a call is placed to the telephone number of the line connected to the Model 48-Jr. As set from the factory, the unit will answer the line after the first ring and generate a dial tone. At this time, the programmer must enter the correct 5 digit Program Access Password. From the factory, this is set to: "12948". This too, may be re-programmed to any 5 digit value desired.

The above sequence of accessing program mode applies to Phone-to-Mobile overdial mode. If preset mobile Autocall or no phone to mobile operation is later programmed into the panel, the sequence of events to access program mode from the phone will change slightly. In most cases, access to program mode from the phone is available.

The Model 48-Jr may be set to Autocall to a preprogrammed user group (tone or code) when an incoming call is detected. The ring-out will continue until the mobile ring-out time is exceeded or the incoming call hangs up. In this case, the phone is not taken off hook but rather the channel rings out in cadence with the incoming ringing. If the mobile ring-out time is exceeded while the incoming line remains ringing, the line will finally be answered. At that point, two short beeps will be heard. The system will then wait for 10 seconds to allow the Program Access Password to be dialed.

The last variation is if the panel has been programmed for no Phone to Mobile operation (the number of "Rings to Answer" is programmed to 0). In this case, the Repeater Patch will ignore any incoming phone line ringing until the panel has received 10 continuous rings. At that time the line will be answered and two short beeps will be heard. The system will then wait for 10 seconds to allow the Program Access Password to be dialed.

Note

There is one circumstance that, if programmed, will make it impossible to access program mode from the phone side. If the Repeater Patch is programmed to autocall a specific mobile user, and if that mobile user is programmed as a talk back pager, the panel will answer the incoming call, send one ring over the air and place the phone caller on the air to send a voice message. The caller then has up to the mobile activity time to send the voice message or up to the call limit time if the mobile keys up and a two-way conversation takes place. In this

one case, the phone caller will never have the opportunity to access program mode. Unless specific applications dictate this type of use, this scenario is best avoided.

Accessing from a Mobile Radio

If a DTMF equipped radio is used to program the unit, the radio MUST be set to encode a CTCSS or DCS tone or code on the frequency pair used to communicate with the Repeater Patch. The radio may be set to encode any of the 50 CTCSS tones or any of the 104 DCS codes available, but it is required that the radio be set to encode one of them. Also, once program mode has been entered, that same code or tone must be used throughout that programming session. To enter program mode from a radio, simply key the mobile and enter the 5 digit Program Access Password. When using a radio to program the Repeater Patch, the programmer should remember to keep a small delay between the time the mobile is keyed, to the time DTMF digits are entered. The Model 48-Jr will always validate the subaudible encoding from the radio before it will recognize any DTMF digits. If an insufficient amount of time is left to decode subaudible, it is possible to improperly decode a command.

Regardless of accessing from a phone or a mobile, once the unit verifies the correct password has been entered, the unit will return a five-beep go-ahead prompt to indicate Program Mode access has been achieved.

Connect Button Multiple Function Operation

In addition to allowing an operator to connect or disconnect a call using the "Connect" button on the units front panel, the Model 48-Jr can be forcibly reset to factory defaults or made to perform adjustment tests through use of the Connect button.

The unit may need to be reset for instance, if the program access password was ever lost. Or if programming records were lost and complete reprogramming was deemed to be the best corrective step. A word of caution however, if the unit is reset to defaults, ALL previously programmed items are erased and there is absolutely NO way to recover previous programming.

To perform a button initiated reset, the Repeater Patch must be powered up with the button held down. The button must remain held in for several seconds until the Phone LED begins to blink rapidly. Prior to the start of blinking, the phone LED will illuminate and remain on after about 5 seconds. Continue holding the button. After about 3 more seconds, the LED will go out. Again, continue to hold the button. Finally, after about 3 more seconds, the LED will begin to rapidly blink. System reset is now underway and the button may be released. The time required to hold the button in to reset the unit is purposely long. It is designed this way to avoid an inadvertent reset from occurring. Note that a complete reset can also be performed from program mode.

If the button were released after the Phone LED is on steady but before the rapid blinking begins, the Repeater Patch will enter into alignment tests. The Connect button can be used to initiate and select the various alignment test at any time desired. This is accomplished by simply holding in the button for longer than 3 seconds when the unit is in an idle condition. When held for sufficiently long, the Phone LED will begin blinking rapidly to indicate the

button has been recognized and adjustment tests have been selected. The tests are executed sequentially with subsequent presses of the button. In addition, if it were desired to leave the adjustment tests prior to cycling through all of the tests, the button may again be held down for greater than 3 seconds to force the unit to return to idle. A complete description of the adjustment tests can be found in Section 5.

MODEL 48-JR FEATURES

The remainder of this section will briefly cover some of the other features and options in the Model 48-Jr.

Connect Code

The Connect code is a DTMF sequence transmitted by the mobile in order to gain access to the patch for interconnect or mobile-to-mobile calls. The default code is simply a "*", but it can be programmed to be up to nine digits long. This Connect code not only allows operators to have better control over who can access a system, it also makes it easy to select a specific system when several are in use on the same channel.

Note

Single digit Connect and Disconnect codes can be falsed by voice and noise. For this reason, multidigit codes are highly recommended.

Disconnect Code

The Disconnect code is transmitted by the mobile in order to terminate a call in progress. The default code is simply "#", but it can be programmed with up to a nine digit code. The patch will only respond to the code if it is accompanied by the same CTCSS/DCS decode that was used to initiate the call. A phone may disconnect a call by dialing "# 0".

Mobile Answer Type

Mobiles receiving calls through the Model 48-Jr may be required to either use the Connect Code or to simply key up with the correct CTCSS/DCS to answer. This is programmable and affects the answer requirements for all users.

Toll Restrict on First and Second Digits

When a toll restricted user is dialing a telephone number, the Model 48-Jr will not allow the call to go through if either the first or the second digit dialed is found on one of the two toll restriction lists in the patch's memory. If the patch finds a match, it will terminate the call before the mobile finishes dialing.

Restricting the Number of Digits Dialed

In conjunction with or in place of digits that are restricted for a mobile to dial, the total number of digits that a mobile dials can also be limited. The digit count is maintained throughout the entire call for a mobile and when in force, any attempt to exceed the maximum allowed number of dialed digits will result in the call being disconnected. Using this in combination with restricted digits allows enough toll restrict flexibility for almost any situation.

Call Limit Timer

The Model 48-Jr will limit the total length of all phone or mobile-to-mobile calls according to the value of the Call Limit timer. The default limit for this timer is three minutes. This value can be programmed from one to 10 minutes long, or the timer can be disabled by entering a value of zero. The patch will start sending double beeps every three seconds to both the phone and the radio 15 seconds before the timer expires, as a warning that the call is about to end. The patch can be programmed to allow the mobile to reset the Call Limit timer by entering a DTMF "*", after the Call Limit warning beeps begin. This feature will allow longer calls to take place while still effectively reminding users of the amount of time being used.

Mobile Activity Timer

The Model 48-Jr has a Mobile Activity timer to automatically terminate any call in progress if the mobile stops taking an active part in the call. The default value for this timer is 30 seconds. It can be programmed from 30 to 99 seconds in length. The patch will start sending single beeps every three seconds to both the phone and the mobile 12 seconds before the timer expires, to warn the calling parties that the mobile needs to key up to reset the timer.

Courtesy Tone

The Model 48-Jr can generate a beep tone to the phone every time the mobile unkeys to confirm this fact to the phone caller. This is particularly helpful to callers who are not used talking on half duplex systems. The feature defaults to being disabled for all users. It can be selectively enabled on a per user basis.

The Courtesy Tone defaults to a Morse code “E.” It may be programmed to be any available Morse code character or digit.

Half Privacy tone

Normally, the Model 48-Jr will default to handling phone calls in the half duplex mode and, while the mobile is keyed up and speaking, the patch will repeat the receive audio out the transmitter. Some system operators may want or need some privacy for the conversations going on over the system. Enabling the Half Privacy feature for those users who have sensitive conversations will cause two things to happen. The patch will no longer repeat the receive audio out the transmitter, and it will transmit a masking tone to discourage people with scanners from listening to the output of the repeater. The Half-Privacy feature cannot be used with full duplex interconnect operations.

Busy Tone Detect On/Off

The Model 48-Jr has the ability to automatically disconnect the call whenever a busy tone is detected from the phone. The default condition is that this feature is disabled. This may be enabled only during the first 20 seconds of a mobile-originated call, or it can be enabled for the entire length of the call.

Note

Some dial-up services will have a computer generated voice read back numbers to the caller. The speech cadence of these machine voices can confuse the patch into thinking it is hearing a busy tone and cause it to terminate the call. If the system users are going to be calling a service like this very often, then the system operator will probably need to disable this feature entirely.

Hook Flash

The Model 48-Jr can be programmed to allow the mobile to generate a “hook flash”, that is, to put the phone back on-hook momentarily and then come back off hook again. This feature is useful when the Repeater Patch has been placed on an extension from a PBX switch and the radio user needs to give the PBX commands to transfer calls, etc. When this feature has been enabled and the patch is in the conversation mode, a mobile initiates a hook flash by sending the DTMF combination “*0”. The patch will go on-hook for 600 milliseconds and then go back off-hook and return to the dial regeneration mode.

Note

In many PBX systems, once you do a hook flash, you preface the following command number with a "#". Since the default Disconnect code for the Repeater Patch is also "#", this would terminate the call. If you intend to use the hook flash feature, you should review the commands you intend to use after the hook flash, and alter the Connect and Disconnect codes in the patch as necessary to prevent it from becoming confused with PBX commands.

Dial Click

The Model 48-Jr has a built-in "dial click" decoder circuit to allow callers to enter user numbers from rotary or pulse telephones. Whenever it answers the telephone line and prompts the caller to enter a number, the Repeater Patch starts listening for either DTMF digits or a pattern of noises that could be the clicking sound of digits dialed from a rotary or pulse telephone. The patch will continue with whichever method of decoding it hears first, until it has a whole user number. If, however, the patch hears a DTMF digit after it has started decoding the dial clicks and before it has a valid user number, then it will flush the digit buffer and start over again looking for DTMF digits.

The program mode provides a simple test command to help the installer set the sensitivity of this circuit to ensure the best performance in decoding the digits dialed from a rotary or pulse telephone.

Mobile-to-Mobile Calls Off/On Hook

This feature allows the system operator to choose what state the phone line will be in while a mobile-to-mobile call is in progress. The default is the patch will leave the phone on hook. If a person calls the patch while a mobile-to-mobile call is in progress, they will continue to hear the phone ring with no indication of why the patch never answered. In some systems, it may be preferred that the patch take its phone line off hook during mobile-to-mobile calls, then, if someone calls that number, they will receive a busy signal from the telephone company. When enabled, this feature applies to mobile-to-mobile selective calls only, dispatch operation will always leave the phone on hook.

Autodial Numbers

The Model 48-Jr has memory slots available for ten autodial numbers. These slots are numbered 0 to 9, and each slot can hold a phone number up to 16 digits in length. Any user can access the autodials while the patch is in the regenerate mode. Once the mobile has drawn dial tone from the patch in the normal way, he or she indicates the autodial number they wish to use by sending a "*" as the first digit dialed, followed by the single digit which identifies the autodial number desired. For example, sending the DTMF pair "*0" will cause the patch to dial whatever number is in slot "0". The patch does not confuse this with the command to do a hook flash because you can only access autodials while the patch is in the regenerate mode, and you can only do a hook flash while the patch is in the conversation mode.

Autodial numbers are never toll restricted. This is a convenient way of allowing users access to only specific toll calls. In some cases it might be desired to allow calls to only a selected few numbers. By restricting a user's maximum number of digits dialed to two, and programming autodials with allowed numbers, total control over phone calls can be obtained.

Talk Back Pager calls

When a phone caller or another mobile places a call to a talk back pager, the caller and the called mobile will hear one ring. The caller will then hear two short "talk" beeps. Once these beeps are heard, the callers voice is transmitted over the radio channel. The called mobile need only to key the radio to respond to the call and begin a two way conversation. The call will then progress for the normal call-limit time. Note that the telephone audio will be on the channel for the duration of the mobile activity time regardless of whether the talkback pager answers.

Full or Half Duplex Operation

Any of the users in the database may be set to operate as a half or full duplex mobile. This only applies to the interconnect operations and never to mobile-mobile whether dispatch or selective call. When set to full duplex and full duplex mobile radios are used, mobiles may simultaneously transmit and receive voice to the telephone. By default, users are assumed half duplex and must be programmed to full duplex if appropriate.

Tone in Tail

By default the subaudible encoding sent by the Model 48-Jr during repeater operation is turned off during the repeater hold time when no mobile activity is detected. Any user can be set to not drop tone encoding during repeater hold time, if so desired.

No Subaudible Encoding during Interconnect operation

For privacy from other users during phone connections, a user can be programmed to have the panel NOT encode subaudible for phone interconnects. Using this scheme, the connected radio must switch off tone controlled squelch or switch to a channel programmed to operate without tone squelch in order the hear the phone audio. If the mobile receives a call, the ringing transmitted to the mobile will still be encoded to unsquelch the radio but when the line is answered encoding will stop. Dispatch operation or selective call to another mobile will still operate as normal.

Optional Printer Port for Call Detail Reporting

The Model 48-Jr Repeater Patch may be equipped with an optional printer port. This will report all call detail information which may later be used for billing purposes. The printer port also reports all programming activity and can serve as a convenient record for the programmed items in the system.

The Printer Port Option consists of a printed circuit card containing PC compatible parallel printer port and a battery backed up real-time clock. The option card plugs into the Model 48-Jr and allows a PC compatible printer cable to be connected between the panel and a printer. All information is reported in real time to the printer. The printer option will report

all phone-mobile, mobile-phone and mobile-mobile selective call activity. Any reserved tone keyups and toll restrict violations are also noted. The option can be also be programmed to report dispatch operation if desired.

Auxiliary Output

The Model 48-Jr has an auxiliary output capable of sinking up to 200 mA of DC current. The output is an open-drain FET circuit that pulls to ground when it is turned on. The output is clamped with a 20V Zener. This output can be used to drive an external relay that can be used to control such things as antenna switches, or power amplifiers. The currently set state of the Auxiliary output is stored in EEPROM memory, so the patch will restore the output to that state even after power to the unit is cycled.

The state of the Auxiliary output can be changed and interrogated while in the program mode. It can also be changed without entering the program mode. The mobile user will connect to the panel for a mobile-to-phone call, and then, instead of dialing a phone number, send either the DTMF command “**1” to turn the output on, or “**0” to turn the output off. When this method is used to change the state of the Auxiliary output, the Repeater Patch will confirm the state of the output by returning a high pitched beep for on (1800 Hz), or a low pitched beep for off (500 Hz).

In order to prevent unwanted changes in the Auxiliary output’s state, either by accident or deliberate tampering, the Repeater Patch will allow the system operator to program a security code for the Auxiliary output function. If a password has been programmed for the Auxiliary output, it is added to the end of whichever command code is being sent to the patch. That is, you would send “**1<password>“ to turn the FET on and “**0<password>“ to turn it off. The password can be from one to five digits in length.

Continued …

4. PROGRAMMING

PROGRAM MODE ACCESS

The Model 48-Jr may be programmed from any DTMF equipped radio that is capable of generating a CTCSS tone or DCS code, or it may be programmed by placing a call to the unit's telephone line and using DTMF from the calling phone.

The Model 48-Jr provides no way of reviewing the programmed state of any system-wide attributes although user enables may be reviewed with the use of a DTMF decoder or the printer port option. Good programming record keeping habits are a must! The optional printer port accessory, which is available for the Model 48-Jr, is a valuable aid when programming the unit. An attached printer will record all programming activity and provide a convenient hard copy record of all items programmed. The printer port option also provides call detail records for billing purposes.

To program the unit over the air, enter the program mode access code with a DTMF equipped radio. The radio used must have either CTCSS tone or DCS encoding enabled. Any available tone or code may be used; it does not need to be enabled in the database. Once in program mode, the tone/code used to access the mode is validated by the Model 48-Jr anytime the radio keys up to issue a command. Thus the same tone/code must be used throughout that particular programming session. If a DTMF equipped radio is used to program the unit, the radio MUST be set to encode a CTCSS or DCS tone, or code on the frequency pair used to communicate with the Repeater Patch. The radio may be set to encode any of the 50 CTCSS tones or any of the 104 DCS codes available, but it is required that the radio be set to encode one of them. Also, once program mode has been entered, that same code or tone must be used throughout that programming session. To enter program mode from a radio, simply key the mobile and enter the 5 digit Program Access Password. When using a radio to program the Repeater Patch, the programmer should remember to keep a small delay (>200 msec) between the time the mobile is keyed, to the time DTMF digits are entered. The Model 48-Jr will always validate the subaudible encoding from the radio before it will recognize any DTMF digits. If an insufficient amount of time is left to decode subaudible, it is possible to improperly decode a command.

To program the Model 48-Jr over the dial-up phone line, dial the phone number of the unit's attached phone line. The next step depends on the unit’s previously programmed state. When in the factory default configuration, the 48-Jr will answer the phone after the first ring and generate a dial-tone. At this time, the programmer has 10 seconds to begin entering the program access code. The default access code is 12948. Other phone modes may be programmed that will affect the way in which program mode access is gained.

If rings to answer is set to "0" (ignore phone) the unit will answer after 10 rings and generate 2 beeps to prompt the caller to enter the program access code. The unit may instead be programmed for phone-to-mobile autocall. With this type of operation, a programmed CTCSS tone or DCS code is preprogrammed as the designated called mobile. The phone is left on-hook while the Model 48-Jr rings out over the channel encoding the preprogrammed

tone along with the transmitted ring. The ring-out will continue for the programmed Mobile-Ring-out time (or until answered). If the time is allowed to expire, the system will take the phone off-hook and issue two go-ahead beeps. In these cases, the programmer has 5 seconds to begin entering the program access code.

Once access to program mode has been gained, the Model 48-Jr will respond with a 5-beep go-ahead chirp to indicate successful access.

ENTERING A PROGRAM COMMAND

To program an item in the Model 48-Jr, enter the program command number and follow that with a DTMF "#" (pound key). Unkey and listen to the response generated by the unit. There are four possible responses to a command.

1) The unit will send a 5-beep go-ahead chirp if the command sent was successfully received and is complete.

2) Any time an error is detected in a programming command, a high-low warble error tone is sent. If this is heard, the command sent will NOT take affect and has NOT changed any value or attributes in the unit. The command must be re-entered if this is encountered.

3) If additional information is needed to complete the command, a 2-beep go ahead tone is sent to prompt for the program value. Enter the programmed value for the specific command and follow that data with the DTMF "#" key. Some programming commands require two data entries following the command number. If more information is needed, two more beeps are sent to prompt for the next data.

4) The last possible response to a programming command is a ringing sound. This is sent when exiting program mode.

Commands should be sent one at a time (do not try to "string" commands together) until go-ahead or error tones are sent. While programming, a key must be pressed every 60 seconds or the Model 48-Jr will time out and automatically exit program mode returning to normal operation. Remember too, that when programming the unit from a radio, a CTCSS tone or DCS code is being decoded and must be validated by the system before any DTMF information is recognized. Leave sufficient time after keying up the radio before generating DTMF data. This will help avoid frustrating errors.

As mentioned, the Model 48-Jr offers *no* method of reviewing the programmed settings of the system-wide parameters. It is important to *be careful* during programming and to *keep track* of all programmed settings. A programming log and quick reference list of commands are included in the appendices. The programming log in Appendix A should be used to record all programming activity.

FRONT PANEL RESET

As shipped from the factory, the unit has certain attributes set as defaults. Throughout this document, these defaults will be noted. If the default values match the requirements of the installation, it is not necessary to reprogram those values. Only if it is desired that a function be set differently, is it necessary to reprogram that function.

If, at any time, it becomes necessary to erase all previously programmed data and restore the unit to it's default condition, a reset may be performed. The unit may be reset with a program command while in programming mode (see Command 91) or by depressing and holding the "Connect" button on the units' front panel while applying power to the unit. Either method will completely reset all programmable items to factory defaults and completely clear the database. Once reset, it is impossible to recover any previously programmed parameters.

Resetting the unit using the front panel button is accomplished by holding the button down while powering on the unit. To avoid the possibility of accidental reset, the button must remain held for several seconds while waiting for the "Phone" LED on the front panel to begin rapid blinking. Prior to beginning blinking, the "Phone" LED will illuminate and remain on for several seconds, extinguish again for about two seconds and finally begin rapid blinking. Once blinking begins, the reset procedure has begun and the button may be released. When the blinking has stopped, reset is complete and the unit may again be programmed. You must now use the default programming password (12948) to access programming mode.

If the button were released while the "Phone" LED is in the steady on state, setup diagnostic and adjustment tests may be performed (see programming commands 92-96 described in “SETUP ADJUSTMENT TESTS” starting on page 4-19.

PROMPT TONES

While programming the Model 48-Jr, audio tones are used to prompt and indicate progress in the programming process. The tone types are:

Prompt tone	Meaning
Double beep	Enter command data
Five beeps	Command complete, ready
Warble hi/lo	Error, invalid command/data
Ringing	Program mode exit.

PROGRAMMABLE ITEMS

The remainder of this section will consist of in-depth descriptions of the programming commands, and, where necessary, some examples of how to use them.

Connect and Disconnect Codes

In order to initiate and disconnect from a phone call placed by a mobile radio through the 48-Jr's telephone interconnect port, a valid user must key up and enter the Connect code to establish the connection and must enter the Disconnect code to terminate the call. By default these are set to a DTMF "*" for Connect and a DTMF "#" to Disconnect. Unless a called user is programmed for talk-back or tone and carrier to answer, the Connect and Disconnect codes are also used to answer and terminate a "Phone-to-Mobile" call. All users on the system with phone access privileges, use the same access and disconnect codes. These codes may be reprogrammed as described in the following paragraphs.

01# xx...xx# CONNECT CODE

This command is used to re-program the connect code used to access the phone line from a radio. From 1 to 9 digits may be used as the Connect Code. This code may consist of any DTMF digit from 0 - 9 and "*". To program the Connect Code, enter "01#, once the 2-go ahead beeps are heard, enter the desired Connect Code and end the command with another DTMF "#". For instance, if it was desired to change the phone access to 123*, the command would be programmed as follows:

01#[beep-beep] 1 2 3 * # [beep-beep-beep-beep-beep]

02# xx...xx# DISCONNECT CODE

This command programs the code necessary for a mobile to hang up or disconnect from a phone call or select mobile call. From 1 to 9 digits may be used as the Disconnect Code and they may consist of any DTMF digit from 0 - 9 and "#". When programming the disconnect sequence, substitute a "*" in place of the "#" since the "#" itself is used to end the command. For example, to have a disconnect code of "#123", you would program:

02#[beep-beep] * 1 2 3 # [beep-beep-beep-beep-beep]

As a side note, a phone may disconnect a call at any time regardless of whether the call was initiated by a mobile or the phone. The phone side disconnect is fixed as a DTMF "# 0" and can not be reprogrammed.

Mobile Answer Type

When a call is placed to a mobile, either from the phone line or a select call enabled mobile, the Repeater Patch transmits a ringing signal while generating the called user’s tone. Unless the called user is defined as a talk-back pager type, the user must first answer the call to begin conversation.

The way in which a mobile unit answers a call placed to it, may be selected to be one of two different methods. By default, when a user hears a ringing channel, it is answered by keying up on the correct tone and entering the DTMF Connect Code (default = '*').

If desired, the answer type may be changed to require the called user to merely key up on the channel with the correct tone. The tone is verified by the system and two-way conversation may take place.

Changing this parameter affects the way that all of the users of the system answer a call. The answer type may be changed by entering command "03#" from programming mode. The programmer will then hear two go-ahead beeps. At that time, enter either a "0" to select Connect Code to answer or a "1" to select PTT+Tone to answer.

03# x#	MOBILE ANSWER TYPE	0 = Connect Code to answer (default) 1 = PTT+Tone to answer

Mobile-to-Phone, Pulse or DTMF Dialing

This command selects the dialing method that will be used for mobile-to-phone calls. The default mode is regenerated DTMF dialing to the phone. The Model 48-Jr can alternately be programmed to regenerate the mobiles telephone number dialing as pulse dialing to accommodate older phone systems. The regenerated dial mode and pulse dialing break/make ratio is programmed with this command by entering the appropriate data. As always, the command is first entered followed by a "#". The unit will respond with two beeps. Following that, the data is entered. Entering a "1" or "2" selects pulse dialing while a 0 selects DTMF dial regeneration.

Entering a "1" for pulse dialing type selects a break/make ratio of 61/39. This is used in the US and the majority of other countries. When "2" is programmed, a pulse dialing ratio of 67/33 is selected. This may be required in the UK, certain areas of China and certain other countries.

05# x#	DTMF / PULSE DIAL MOBILE ORIGINATED CALLS

Dial Regeneration, Inter-Digit Time-out

The Model 48-Jr regenerates dialing to the phone line using either DTMF or pulse dialing as selected by Command 05. Regeneration of DTMF is used to ensure reliable noise free signals of sufficient amplitude into the phone line for dialing.

This command sets both the amount of time the mobile user has to begin dialing a phone number once the phone has been taken off hook and after dial tone is detected, and the amount of time between each digit dialed. Every time a digit is dialed, the inter digit time-out is reset. Entering a 0 for this value will disable regeneration. Voice audio is not passed from the mobile to the phone while regeneration is active. This is required to assure reliable dialing. The user can force the regeneration to end, and as a result, cause the mobile audio to

un-mute to the phone. This is done by entering a "*" after the last digit is dialed. The default inter-digit time is 3 seconds. The range is 0 to 60 seconds.

06# xx# DIAL REGENERATION INTER-DIGIT TIMING

Number of Rings Before Answer

This command sets the number of rings that will be ignored, before the 48-Jr will either answer the phone or begin ring-out over the channel (See Command 08 below). The range is from 0 to 10. If, for instance, a phone line is shared with an in-house phone, it might be desired to have the in house phone ring several times before beginning to ring-out over the air or answer the phone for overdial. Then, if the in-house phone is not answered after this number of rings, it will automatically ring-out or answer.

A value of “0” will cause the phone line to be ignored disallowing phone-to-mobile calls. Note that if “0” is programmed, the phone line will still be answered after 10 rings to allow the opportunity to access program mode. The default is one ring.

07# xx# NUMBER OF RINGS BEFORE ANSWERING

Phone-to-Mobile Ring-out User

This command selects phone-to-mobile calling mode and preset tone.

Two different types of phone-to-mobile calls are available. By default or by programming this value to “0”, a ringing phone line will be answered (after Rings-to-Answer is met) and the caller prompted with a dial tone. Upon hearing the dial tone, the desired user tone/code sequence number must be entered. If a valid and enabled user number is entered, the channel will begin ring-out on the tone specified by the user number. The caller may instead gain access to program mode by entering the program mode password rather than a user number.

This variable may instead, be programmed with the desired ring-out tone/code number. A value programmed from 1 to 154 will direct the 48-Jr to NOT answer a ringing phone but rather keyup on the channel and ring-out to that programmed user. If the caller hangs up the phone, ring-out will stop. If mobile answer timer expires without the called party answering, the phone will be answered and two beeps sent while waiting up to 10 seconds for the program access code. “0” is the default data value (overdial mode) for this command.

08# xxx# PHONE-TO-MOBILE RING-OUT TONE/CODE

Mobile Answer Time

These commands set the amount of time that a mobile user has to answer a call made to their radio from a phone or another mobile. There is an exception to the ring out time set by this command: A called user may be programmed for talk-back paging (See command 52). In

that case, a single ring-out will be sent over the air before the voice channel opens. The caller then has the opportunity to send a voice message. The default is 11# (30 seconds).

10#	MOBILE RING-OUT FOR 15 SECONDS (3 Rings)	
11#	MOBILE RING-OUT FOR 30 SECONDS (5 Rings)	(default)
12#	MOBILE RING-OUT FOR 60 SECONDS (10 Rings)	
13#	RING-OUT ONCE, WAIT 60 SECONDS FOR ANSWER	

Toll Restrict Digits

These commands are used to prevent users from dialing toll calls or to designate only certain types of calls through the interconnect. The following three commands, set the toll restrictions that will apply to any user that has toll restricts enabled in their user programming.

The first command will set the maximum allowed number of digits that may be dialed to the phone line. This number may be set from 0 to 99. Entering a 0 for this value will disable counting the dialed digits. If a toll restricted user attempts to dial more digits than allowed by this command, the system will disconnect the call.

14# xx#	MAXIMUM ALLOWED DIALED DIGITS

If, for example, users are allowed to dial any 7 digit local call and any 1+ toll call, but calls requiring a 1+ area code were not allowed, enter:

14#[beep-beep] 8 # [beep-beep-beep-beep-beep]

The next commands refer to the first and second digits the mobile dials to a phone line. Up to four digits can be restricted for each command. There are no default toll restricted digits. To clear the toll restricts for a digit, use the command without entering any digits between the first and second "#" signs. All users for whom restricted dialing has been activated will share these same restrictions. (see command 51#).

15# xxxx#	FIRST DIALED DIGIT TOLL RESTRICTED NUMBERS
16# xxxx#	SECOND DIALED DIGIT TOLL RESTRICTED NUMBERS

As an example: if 1 is to be restricted as the first digit dialed, and 3, 4 and 9 are to be restricted as the second dialed digits, you would program as follows:

15#[beep-beep] 1 # [beep-beep-beep-beep-beep]

16#[beep-beep] 3 4 9 # [beep-beep-beep-beep-beep]

Hook Flash

These commands enable or disable the ability of users to hook-flash a telephone line. If enabled, entering a "* 0" from the mobile will cause the telephone line to be placed on-hook for 600 milliseconds and return off-hook. The default is disabled.

17# HOOKFLASH ENABLE ON

18# HOOKFLASH DISABLED

Carrier or Tone Controlled Repeat Mode

These commands set the way that repeater operation is controlled. When carrier repeat mode is enabled, the internal CTCSS/DCS encoder/decoder is disabled. Received carrier only is necessary to cause the Model 48-Jr to repeat the received signal. The unit may then be used with external tone decoding. Specific attributes or privileges may also be programmed for carrier repeat mode. This information is set as user zero (See commands 51-53, user 0 for more information). When Carrier Repeat is disabled, the unit operates in Tone Controlled repeat mode. Here, internal tone/code validation controls access to dispatch (repeat) or interconnect. Tone controlled repeat (command 20) is the default.

19# ENABLE CARRIER REPEAT AUDIO AND CONTROL

20# DISABLE CARRIER REPEAT/ENABLE TONE/CODE REPEAT

Repeater Transmit Hold Time

This command is used to set the length of time, during repeat (dispatch) operation, that the transmitter will stay keyed up after a mobile unkeys. The valid range is from 0 to 9 seconds. The default is 3 seconds.

21# x# SET REPEATER HOLD TIME

On/Off Hook During Mobile-to-Mobile Calls

These commands set the state of the phone line during mobile to mobile select calls. By setting the 48-Jr to off-hook during these calls, the telephone switch can return a busy signal to a caller if the unit is busy, or rotary to the next line, right away. Leaving the line on-hook during these calls, will let caller continue to hear ringing while the unit ignores the phone line until the unit is free. The default is for the unit to remain on-hook during mobile-to-mobile calls.

23# OFF-HOOK DURING MOBILE-TO-MOBILE CALLS

24# ON-HOOK DURING MOBILE-TO-MOBILE CALLS

Morse Code Station Identification

If enabled, the Model 48-Jr will transmit the programmed call sign of the interconnected transmitter as determined by commands 26# and 27#. The ID is sent at 30% deviation and at 20 words per minute. The ID tone frequency is 1000 Hz. The default is no station ID. To prepare to enter the station ID, look up the letters and numbers of the ID in Table 4-1. When ready, enter the command followed with a "#". Following the 2 go-ahead beeps, enter the two

digit numbers representing the station ID characters. Terminate entry with a "#". The ID may be up to 8 characters in length. When the ID is programmed, it will be repeated to the programmer at approximately 10 wpm for verifying correct entry. The Morse ID is transmitted with no sub-audible tone or DCS encoding. Mobiles using tone controlled or DCS squelch will not hear the ID being transmitted during normal operation.

25# xx...xx# MORSE CODE STATION ID/CALL SIGN

Table 4-1. Station ID Cross-Reference

Digits	#	Code	Digits	Letter	Code	Digits	Letter	Code
00	0	– – – – –	12	A	• –	26	N	– •
01	1	• – – – –	22	B	– • • •	36	O	– – –
02	2	• • – – –	32	C	– • – •	17	P	• – – •
03	3	• • • – –	13	D	– • •	10	Q	– – • –
04	4	• • • • –	23	E	•	27	R	• – •
05	5	• • • • •	33	F	• • – •	37	S	• • •
06	6	– • • • •	14	G	– – •	18	T	–
07	7	– – • • •	24	H	• • • •	28	U	• • –
08	8	– – – • •	34	I	• •	38	V	• • • –
09	9	– – – – •	15	J	• – – –	19	W	• – –
			25	K	– • –	29	X	– • • –
30	/	– • • – •	35	L	• – • •	39	Y	– • – –
#	END		16	M	– –	20	Z	– – • •

Example: To set the call sign to "WNCR414, enter DTMF:

25 # 19 26 32 27 04 01 04 #

To remove (erase) an ID enter: "25 # #".

Morse Code ID Mode

The way in which the Model 48-Jr sends its station ID is set using command 26#. When this command is entered, the user will hear 2 go-ahead beeps. At that time, enter the ID type followed by another #. The user has 3 options for the type of ID: 0 = will turn off ID but leave any call sign intact in non-volatile memory, 1 = will set the unit to ID after every ID time interval but only if their has been system activity since the last time ID was transmitted. This is the system default, 2 = will instruct the unit to transmit its ID after every interval whether or not their has been any system activity.

26# x# MORSE ID TYPE

0 = off, 1 = Every interval if activity, 2 = Every interval

Morse Code ID Interval

The value of the Morse ID interval may be programmed. Command 27# is used to set the interval from 1 to 99 minutes. Following the go-ahead beeps after entering 27# command, one or two digits are entered to represent the interval in minutes. The default is 15 minutes.

27# xx# MORSE ID INTERVAL

Anti-Kerchunker Filter

When enabled, the Anti-Kerchunker filter cancels the "transmit hold time" and drops the repeater transmitter immediately if a mobile transmission is less than 1/2 second long. This prevents prolonged repeater transmission due to co-channel voice-falsing or momentary mobile key-ups.

28# KERCHUNK FILTER ENABLE

29# KERCHUNK FILTER DISABLE (default)

Call Limit Timer

During a phone call, a call timer is running. This can be programmed to time-out after a certain period of time, to assure that the phone line resource is not hogged by someone and to assure that if left unattended, the connection will self terminate if required. Such would be the case if a mobile using the interconnect had driven out of range of the system and was unable to disconnect the call. When the call limit is within 15 seconds of timing out, the unit will send double beep warning tones every 5 seconds to warn of the approaching time-out. The value for call limit may be from 0 to 10 and is the time in minutes for limiting calls. A value of 0 will turn off the call limit timing. The default value is 3 minutes.

30# xx# CALL LIMIT TIME

Call Limit Extension

It is possible to allow interconnect users to extend their maximum call limit time. Using this feature, Call-Limit beeps will serve as a reminder to a user of the amount of time the connection has been established but still allow the call to continue if necessary. The following commands enable or disable call extend. If enabled, a user must enter a "*", once call-limit warning tones have begun to be sent, to extend the call. When extended, the call limit time resets to the full programmed value (see Command 30).

31# ALLOW CALL-LIMIT RESET

32# DISALLOW CALL-LIMIT RESET (default)

Courtesy Tone Morse Character

The Courtesy Tone defaults to a Morse code "E." It may be programmed to be any available Morse code character or digit. Table 4-1 cross references the Morse code characters to the values used to program this tone.

34# ss# COURTESY TONE MORSE CHARACTER

Morse Code Speed

The speed at which the Morse ID and Courtesy Tone Character are sent, can be set to either 20 or 25 wpm. By default Morse code is sent at 20 wpm. Using command 35# the rate can be changed to or from 25 wpm.

35# x#	SET MORSE SPEED	0 = 20 WPM (default) 1 = 25 WPM

Mobile Activity Timer

During a phone call, the mobile is expected to control the radio channel. This requires the mobile to transmit to the phone party (or at least key up) periodically during the call. If the mobile drives out of range or does not transmit within this time, the call will be terminated. Beginning at 12 seconds before the mobile activity timer times out, single beep warning tones are sent (at 5 second intervals) to warn the user of the approaching time out. The mobile activity may be programmed to be any value from 30 to 99 seconds. The default is 30 seconds.

36# xx# SET MOBILE ACTIVITY TIME

Printer Option

The following commands only apply if the optional parallel printer port is installed. The printer port is primarily used for logging call detail information for billing subscribers. Another feature of the printer port is real time record keeping of programming activity. When recording programming activity, program commands are sent to the printer one line per command. Headers denote entry to and exit from program mode and the activity is date and time stamped. This forms a valuable record of programmed information.

Commands 44# and 45# enable and disable the printer port. The default is disabled.

Commands 46# and 47# tell the printer port to either print both dispatch airtime AND interconnect usage or to only print interconnect usage.

Command 48# and 49# set the printer port's calendar and real-time clock. The real time clock is battery backed and should retain date and time with power removed. When first installed or due to daylight savings time etc., these commands are used to update the clock. The data for each of these commands must be six digits long.

44# PRINTER ENABLE (Option required)

45# PRINTER DISABLE

46# PRINT DISPATCH AIRTIME and PHONE LINE USAGE

47# DISABLE DISPATCH AIRTIME PRINTING, print PHONE LINE USAGE

48# xxxxxx# SET PRINTER PORT CALENDAR (dd mm yy)

49# xxxxxx# SET PRINTER PORT REAL TIME CLOCK (hh mm ss, 24 hr. format)

User Programming

There are four commands that are used to set all of the parameters for a user (or tone). These commands each consist of three parts. First the command is entered followed by "#". Following the double go-ahead beep, the user code is entered followed by another "#". Finally the specific parameter applying to that tone, is entered and terminated with a "#". This is confirmed by five beeps to indicate command complete, ready.

The user number represents the tone/code to be used by a mobile to access the phone line or by a group of mobiles for dispatch operation. From one to three digits may be entered for programming this number. Table B-1 in Appendix B lists the meaning for each value. The tones and codes are numbered sequentially from lowest to highest to derive the user number. As can be seen in Table B-1, values from 1 to 50 set CTCSS operation for encode and decode and codes 51 through 154 set the receiver and transmitter for DCS. Leading zeros may be entered if desired. 0 is an illegal value for a user number but the attributes and privileges are saved for carrier repeat mode as user #0.

User Enable

Following the go-ahead beeps from entering the user number, the actual parameters are set. For command 50#, the choice is 0, 1 or 2 as a parameter. 0 is entered to disable a user. If a user is changed from enabled to disabled, all programmed privileges remain intact and if later enabled, will resume operation as previously set. Disabled is the default condition for all users. A 1 is entered to enable a user. The system privileges available to the enabled user are determined by commands 51, 52 and 53 (discussed in the next subsections). A 2 is entered to reserve a tone.

A reserved tone is often used to hold a tone from being used by a co-channel system to save for future expansion. Often it is also used for "dead-beat" disabling a user. If a mobile keys up on a reserved tone, the repeater will transmit a 1200 Hz "reserved" indication while not allowing voice audio or interconnect access. There is a fixed 1 second TX hold time for reserved tone transmission. Any previously programmed attributes remain unaffected by programming a tone to reserved.

50# user# x# SET USER MODE

0 = Disable, 1 = Enable, 2 = Reserve

For example, to enable user 14, enter:

50#[beep-beep] 14#[beep-beep] 1#[beep-beep-beep-beep-beep]

User Attributes

The next three commands set the attributes or enables for a particular code. This may seem a little confusing at first but once understood, programming users becomes fast and easy. As in the User Enable programming above, the first two parts of these 3 commands are the same. That is: the first part of the command is the command number itself (i.e. 51#, 52# or 53#). Next is the user code that is to be affected by the programming. These are from the tone/code chart in Appendix B. The user number is followed with a "#".

Note

There is one special user code that may be used for these three commands. User number 999 may be used to set the attributes for every user (0-154) in the database. For example, if every user of the system is to be toll restricted if they are given phone access, you could enter: 51# 999# ***1#.

Finally comes the data. This is set using from 1 to 4 digits. The data that is entered can only be a "1",a "0" or a "*". A 1 tells the panel to turn ON an attribute, a 0 will turn it OFF and finally a "*" will leave the particular attribute AS IS in the database. This can be visualized as setting switches to turn on, turn off or leave along a particular attribute. As such, each of the switches has a position in the particular command. The first switch in the data field of a command always sets the first attribute. The second switch sets only the second attribute and the third and fourth do the same for their attributes.

These commands always take the form:

COMMAND # USER # DATA #

It is only necessary to enter as much data as needed. That is to say, if only the first two attributes need to be programmed for a particular command, then only two data digits need to be entered. Now let's say that only the second attribute for a command needed to be changed. In this case, the data for the first switch has to be included so the second switch data can be accessed. The data for the first switch may have already been programmed to a "1" or "0".

Rather than needing to know what the existing state is for the first switch, a DTMF "*" can be used instead. Using a "*" for a switch value will leave the data for that switch programmed AS IS. In this way, the programmer does not need to know what all of the attributes are currently programmed to in order to make a small change in the attributes. Therefore, if the second attribute for a user needs to be set to a 1, the programmer would enter: "Command # User # * 1 #". If the third attribute was to be switched, then the data field would be "* * 0" or "* * 1" as desired.

User Attributes #1

For command 51#, the first 1,0 or * that is entered selects the dispatch enable. By default, dispatch (repeat) operation is enabled for any enabled user (this value is preset to a "1"). To disable this feature a "0" would be used here. To leave the programmed state as is, a "*" can be used.

The second 1,0 or * affects the phone access. By default, an enabled user does not have phone privileges (the default state is "0"). To enable phone access for a user, this bit would need to be set to "1". To ignore the state of this bit in order to access the next bit, this may be programmed as "*".

The third 1,0 or * affects cross-tone mobile to mobile selective calls. By default, this is disabled (set to "0"). Enabling mobile-mobile select calling changes the connect requirements for a user. A steering digit must now be used to specify whether the user is signing on to access the phone line or another mobile on a different tone/code. See “Mobile-to-Mobile Calls” in Section 3 for more information.

Finally the fourth 1,0 or * affects the toll restrict enable. By default this is a "0" (disabled). If set to a "1", the user can only dial within the restrictions set by commands 14, 15 and 16 (see “Toll Restrict Digits” on page 4-7).

51# user# xxxx#		SET USER PROFILE #1	
	Profile #1 =	Dispatch Enable Y/N	1/0/* ("*" = don't change)
	(Enable)	Phone Access Y/N	1/0/*
		Mobile Select Call	1/0/*
		Toll Restrict Y/N	1/0/*

To enable dispatch and phone access for user number 13, you would program:

51# 13# 11# (51# 13# 11**# or 51# 13# 1100# would do the same).

To enable dispatch and phone access for all 154 users, enter:

51# 999# 11#

Please keep in mind that, even though attributes may be enabled for a specific user, that user must also be ‘enabled’ (see command 50#) in order to access the system.

User Attributes #2

The first attribute of command 52# will set a user to talkback paging mode. When set, a phone (or selective mobile) call to this mobile will cause the unit to send a single ring to this tone and then open the audio path so the mobile can receive voice messages. The called unit can key up and respond to the call (talkback) if desired.

The second is Full/Half duplex operation when connect to the telephone line. If selected, full duplex mobile is enabled for phone connections. Half duplex ("0") is the default.

The third is the Half privacy enable. For mobile to phone conversations, a 2500 Hz tone is send over the repeat audio path whenever the mobile keys their radio. This discourages eavesdropping by other users. By default this is off.

The fourth attribute is not use by this command and is only included for consistency. This may be programmed to 1, 0, * or omitted without having any affect on the system.

52# user# xxxx#		SET USER PROFILE #2	
	Profile #2 =	Talk Back Y/N	1/0/*
	(Enable)	Full/Half Duplex	1/0/*
		Half Privacy Y/N	1/0/*
		Not Used (Don't care)	1/0/*

User Attributes #3

The first enable in command 53# is used to enable/disable the CTCSS or DCS code transmitted by the 48-Jr to the mobile while in repeater hold time. By default, CTCSS or DCS is not transmitted during repeater hold time. This provides very quiet operation free of annoying white noise bursts.

The second enable, when set, will turn off CTCSS/DCS encoding while a mobile is connected to a phone line. This is sometimes used to prevent the phone conversation from being heard by other parties in the dispatch group. Dropping the tone squelch during interconnect generally requires that the user’s radio is setup so they may switch to a channel that does not have tone controlled squelch enabled.

The third enable will turn on or off the courtesy or turn-around tone used to signal that a radio user has unkeyed. This is useful when speaking to phone parties unfamiliar with talking in half duplex conversations.

The fourth attribute is not use by this command and is only included for consistency. This may be programmed to 1, 0, * or omitted without having any affect on the system.

53# user# xxxx#		SET USER PROFILE #3	
	Profile #3 =	Tone in Tail Y/N	1/0/*
	(Enable)	No Tone Phone Y/N	1/0/*
		Courtesy Tone Y/N	1/0/*
		Not Used (Don't care)	1/0/*

Connect Button Mode

This command is used to determine what happens when the connect button on the front panel is briefly pressed. Note that the button, if held down for 3 seconds, accesses the alignment diagnostics. This command refers to the buttons affect when pressed for less than 3 seconds. The default is that the button forces the patch to pick up the phone line and connect the caller to the radio (command 58#). The caller can immediately start talking to the radio user. In the alternative mode (command 59#) the patch will pick up the phone and prompt the caller to over dial a user number so that a selective call can be made. Also note that a button pressed during phone interconnect or select mobile-mobile calls will force a disconnect.

58# CONNECT BUTTON ACTIVATES CONVERSATION MODE

59# CONNECT BUTTON ACTIVATES PHONE ANSWER

Auxiliary Control Password

The Model 48-Jr has an auxiliary output consisting of a FET capable of sinking up to 200 mA of DC current. The output is clamped with a 20V Zener and is open drain. This can be used for driving a 12V DC relay connected to such things as antenna switches etc.

The AUX output can be accessed from program mode (see Command 84 below) or from an interconnect access. To access the auxiliary control without entering program mode, the user first gains access to the phone line by a.) Having phone line access enabled in the user's database and then b.) Entering the Connect Code. The user must then enter: "**1" to turn the AUX output FET ON or "**0" to turn the AUX output FET OFF. The system will confirm the state of the AUX output by returning a high frequency (1800 Hz) beep to indicate the FET is ON or a low frequency (500 Hz) beep to indicate the FET is OFF. The system will then disconnect the phone line and return to an idle state.

To afford additional protection against accidental activation of the AUX output from an interconnect access, a password may be programmed and then be required to change the state of the AUX output. If a password has been programmed, a user must enter "**1<password>" to turn ON the FET or "**0<password>" to turn the FET off. The password may be from 1 to 5 digits in length. To remove (erase) a password, enter: "83 # #". The default is no password.

83# xxxxx# OPTIONAL AUX-CONTROL ACCESS PASSWORD

Please note: In the explanation of the AUX-Control output, the discussion tells how to turn the output FET ON and OFF. When the FET is ON the actual output line will be pulled to ground potential. When this line is connected to a 12 volts-DC relay, for example, the other end of the relay's coil would be connected to 12 volts-DC. Thus, when the AUX output goes to ground, the relay will be activated. Likewise, when the AUX output is switch OFF, the line will float. In the case of being connected to a relay, the path to ground will be open and switch off the relay.

Auxiliary Output Control

Command 84# is used to set the AUX output state when in program mode. The command is entered and followed with a #. At this point the 2 go-ahead beeps are heard. For this command only, the 48-Jr will interrogate the current state of the output FET and send go-ahead beeps at a high or low frequency to reflect the outputs existing state. High frequency (1800 Hz) beeps indicate that the FET is ON. Low frequency (500 Hz) beeps indicate the FET is OFF. At this point the programmer may change the state by entering the appropriate 1# or 0# or may leave the output as is by simply entering a #. It is not necessary to re-enter the current state to leave the output unchanged. If the state if the AUX output is set with a 1# or 0#, a single long high or low tone will be sent before the 5-"command complete" beeps to confirm the new setting.

84# x#	SET AUX OUTPUT STATE	1 = Turn on FET
		0 = Turn off FET

Busy Tone Disconnect

The Model 48-Jr has the ability to automatically disconnect a mobile originated call when the dialed phone number is busy. This is accomplished by measuring the duration and rate of the telephone busy tone using a VOX detector circuit on the logic board. Some calls may be made to automated dial up services that read back numbers (such as directory assistance) or other audio that "sounds like" a busy tone to the 48-Jr. For this reason, a command to disable the busy tone detect is provided. If busy tone detect is desired, it can be set to be active throughout the whole call or enabled for only the first 20 seconds of the call. The default is off.

85# AUTOMATIC DISCONNECT ON BUSY TONE (FIRST 20 SECONDS ONLY)

86# BUSY TONE DISCONNECT DISABLED

87# AUTOMATIC DISCONNECT ON BUSY TONE (ENTIRE CALL)

Enable High-Speed Programming Upload

This command will not normally be used and should NEVER be used if manually programming. When executed, this command will turn off all prompt tones and command complete tones. Error tones are also turned off and no error indication is given. This command would only be used if a means were available of uploading the DTMF programming commands from a computer or some type of DTMF cloning device. Once set, this state is only canceled by exiting program mode.

88# HIGH SPEED PROGRAM UPLOAD MODE ENABLE

Autodials

There are ten autodial numbers available. To access an autodial, a user must first sign onto the system in the normal manner. During the dial regeneration time and as the first two digits dialed, the user may access an autodial by first entering a DTMF "*" followed by the desired autodial number (0 to 9). The system will first look for and detect dial-tone through use of a VOX circuit, once detected it will then begin automatically dialing the programmed number. The DTMF number dialed is only sent out the telephone line and is not repeated over the air. A confirming beep is send to the connected radio with each dialed digit to show dialing progress. An autodial may be up to 16 digits in length. Toll restricts do not apply to autodials and so may be used for specific long distance access for toll restricted users.

The format for the command is 89# n# xx...xx#. After entering the 89#, two go-ahead beeps are heard. At this time a single digit from 0 to 9 (followed by a #) is entered representing the autodial memory slot. Two more go-ahead beeps are then heard and the phone number is entered followed by a # to complete the command.

89# 0# xx...xx# PROGRAM AUTODIAL 0 (up to 16 digits)

89# 1# xx...xx# PROGRAM AUTODIAL 1 (up to 16 digits)

89# 2# xx...xx# PROGRAM AUTODIAL 2 (up to 16 digits)

89# 3# xx...xx# PROGRAM AUTODIAL 3 (up to 16 digits)

89# 4# xx...xx# PROGRAM AUTODIAL 4 (up to 16 digits)

89# 5# xx...xx# PROGRAM AUTODIAL 5 (up to 16 digits)

89# 6# xx...xx# PROGRAM AUTODIAL 6 (up to 16 digits)

89# 7# xx...xx# PROGRAM AUTODIAL 7 (up to 16 digits)

89# 8# xx...xx# PROGRAM AUTODIAL 8 (up to 16 digits)

89# 9# xx...xx# PROGRAM AUTODIAL 9 (up to 16 digits)

Note: If the line from the Model 48-Jr is connected to a PBX or similar equipment, where a "9" or some other digit(s) is required to access an outside line, this must be included in the autodial number. Remember that autodials can only be accessed if done with the first two digits dialed by the radio.

Program Mode Access Code

The DTMF access code required to put the 48-Jr into program mode is user programmable for added security. The number must be five digits long and defaults to "12948".

It must be noted that if the password is ever forgotten or misplaced, the ONLY way to gain access to program mode is to reset the unit to factory defaults by means of holding the front panel button while applying power to the unit. All programmed information will be lost and the program access code will return to 12948.

90# xxxxx# SET PROGRAM MODE ACCESS PASSWORD (Must be 5 digits)

Reset all Programmable Settings to Default

This command will erase ALL previous settings in the unit and return them to the Zetron factory-set defaults.

Caution!

There is absolutely no way of restoring previously programmed settings once this command is used.

To minimize the risk of unintentionally executing this command, the command is entered followed by the # and the user is given 2 go-ahead beeps prompting for the program access code. By default the command would be: 91# 12948# As previously mentioned, the unit can also be reset by applying power to the unit with the front panel button held in.

91# password# RESET ALL PROGRAMMED VALUES/DATABASE
(use program mode access password)

SETUP ADJUSTMENT TESTS

Five tests are available to assist the technician in installing the 48-Jr. These tests may be accessed from program mode by entering the DTMF command listed below or they may be accessed by using the Connect button on the front panel.

This section covers program mode access of the diagnostics. Details on using the Connect button during setup can be found in the Installation section of the manual. In either case, each of these tests will timeout after running for three minutes. If left to timeout, the unit will return to the operating mode rather than the Diagnostic or Program modes.

Transmit Audio Level Setup

This command will key the transmitter and send a 1-kHz test tone. Adjust the TRANSMIT LEVEL pot (R3) for 70% of allowable channel deviation (typically 3.5 kHz). The test is terminated with a DTMF "#", by pressing the Connect Button or by timing out.

92# TRANSMIT 1k HZ. AUDIO TEST

Repeat Audio (Audio Input) Level Setup

When this command is executed, the 48-Jr will enter a temporary carrier repeater mode. When a receive carrier is detected, the 48-Jr will repeat the received audio. Send a signal to the Model 48-Jr of a known deviation and adjust the "RX LEVEL" pot (R2) until the deviation on the transmit channel matches the deviation on the receive channel. The test is terminated with a DTMF "#", by pressing the Connect Button or by timing out. The test requires a service monitor and a radio to transmit on the 48-Jr's receive channel.

93# REPEAT AUDIO TEST/RECEIVE LEVEL TEST

CTCSS/DCS Transmit Level Adjustment

This test will key the transmitter and send selected CTCSS tones and a DCS code. When first executed, the unit will send a 67 Hz tone. The output level pot (R7) on the tone Encoder/Decoder board should be adjusted for 600-750 Hz deviation. Pressing any DTMF key on the radio advances the test to the next tone. Adjust for minimum and maximum levels on lowest and highest tones. The test is terminated with a DTMF "#", by pressing the Connect Button or by timing out. See “CTCSS/DCS Board Jumpers and Potentiometers” in Section 5 for information on jumpers that affect this adjustment.

94# CTCSS/DCS TX ADJUST TEST (67, 131.8, 254.1 Hz - DCS-023)

Hybrid Adjust

This test is used to adjust the hybrid in the 48-Jr to match the impedance of the telephone line that it is operating on. Be sure a call has been placed to the 48-Jr before entering this test. The 48-Jr will take the phone line off hook, key the transmitter and send a dual-tone signal out to the phone line. The balance of the hybrid is adjusted using R95 and R96. These two controls should be adjusted for minimum tone output to the transmitter. The frequency of the tones sent are 400 Hz and 2500 Hz. The adjustments of R95 and R96 should be repeated back and forth until minimum transmitted audio is achieved. After adjusting one of the pots for minimum, go back and adjust the other for minimum. Repeat this process until the best results are achieved. The hybrid test is exited by entering a # from the radio, pressing the Connect button or timing out.

95# HYBRID ADJUST

It should be noted, that if it should be necessary to talk to the party at the other end of the phone line during this diagnostic, the technician may key a radio on the system's receive frequency to talk through to the phone line. The hybrid tones are temporarily stopped when the keyed radio is detected.

Dial Click Decode Test

This test is used to adjust the sensitivity of the dial click decoder circuitry, so it will accurately decode the digits from a rotary dial telephone. When originating this test from a telephone, a rotary dial and a DTMF telephone should be paralleled on the same telephone line. Place a call to the unit with the DTMF telephone. Enter the program mode access code

and enter the command number for this test. You may now switch to the rotary dial phone and begin to slowly enter digits.

When the Dial Click Decode Test is originated by a radio a call may be placed to the unit anytime after program mode has been access but before this diagnostic is executed.

When controlling the test with the Connect Button, place a call with a rotary phone to the unit anytime after diagnostics have been accessed but before the hybrid test begins. That test will take the phone line off hook and leave it off hook for use with this test.

Each time a number is dialed, the 48-Jr will indicate the number it has decoded by returning the Morse code for the number. (see Table 4-2). Adjust R100 until the number returned always matches the number dialed. The test may be ended by entering a "#" from a DTMF phone or radio, by pressing the Connect Button, or by timing out.

Table 4-2. Morse Code Numbers

•– – – – = 1	–•••• = 6
••– – – = 2	––••• = 7
•••– – = 3	–––•• = 8
••••– = 4	––––• = 9
••••• = 5	––––– = 0

96# DIAL CLICK DECODE TEST

Send Database Information

This command will allow the programmer to review the database. When executed, this command will send the selected database information to the programmer in DTMF. This will be sent either over the air or to the phone line as connected. It is assumed that the programmer has a means of decoding and viewing the DTMF sent such as a Zetron Model 8B Repeater Programmer/Timekeeper. When connected to a receiver, the Model 8B can decode and display the information to a connected computer or through it's LED display. This command is only used to view the user database and cannot be used to review any system wide programming parameters. If the Model 48-Jr printer port option is installed and enabled, this information will be sent to the printer as well (as will all other programming commands entered).

After entering the command number and first "#", the programmer is prompted for an additional digit. This tells the command the type of database information the user wishes to view. The options for the this digit are a "0", "1" or "2" followed by "#".

Entering a "0 #" will instruct the 48-Jr to send the entire user database. The database information is sent out at 60 ms DTMF digit time with a 60 ms gap between successive digits

and a 300 ms gap between entries. Sending the entire database takes approximately 5.5 minutes so the user should be cautioned to be sure this will not exceed the duty-cycle of the connected transmitter. A "1" tells the 48-Jr to send the user database information only for enabled users. A "2" requests that only reserved tone entries in the database be sent.

The data is sent with the sequential tone/code number first. This will be two or three digits long (00-154). That is followed with a DTMF "*" as a delimiter. Following that are 12 0's or 1's representing the state of each of the enables for that tone number. The 12 bits are in the same order as programming commands 51#, 52# and 53# with the unused bits of commands 52# and 53# being replaced by enable and reserve bits respectively. Figure 4-1 shows the format and meaning of the data returned. Note that tone number "00" is the enables for carrier repeater mode operation (Command 19#).

This command may be stopped at any time while send information, by entering a DTMF "#" from the radio or phone as appropriate, or by pressing the Connect Button.

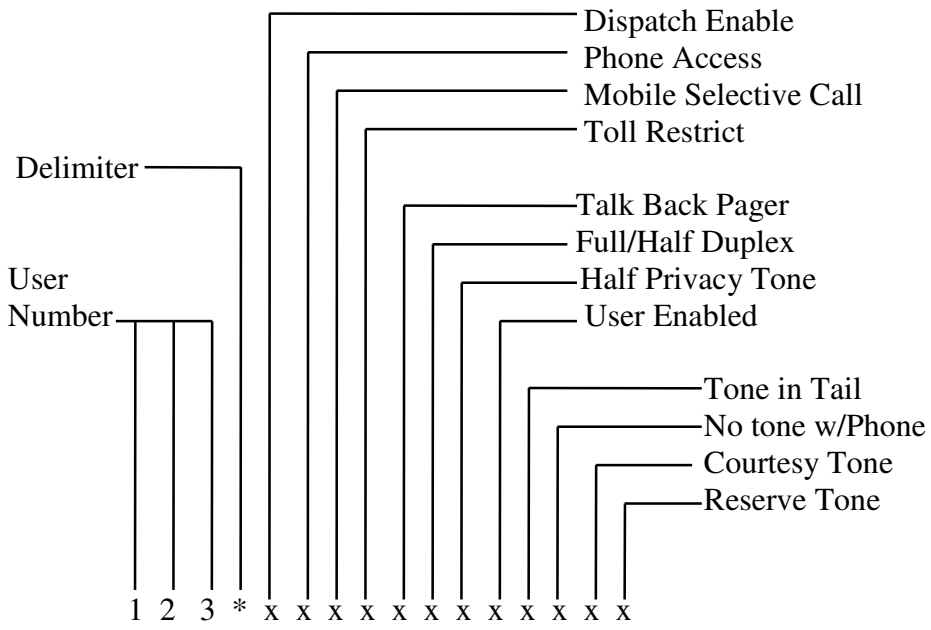


Figure 4-1. User Database Format

97# x# READ DATABASE INFORMATION.

0 = Entire Database, 1 = Enabled users, 2 = Reserved users

As an example, to review the enabled users, the programmer would enter: 97# 1#

The data returned might look something like:

0 7 * 0 1 1 0 0 0 0 1 0 0 1 0

1 3 * 1 0 0 0 1 0 0 1 0 0 0 0

2 0 * 1 1 0 1 0 0 1 1 1 0 1 0

1 0 7 * 1 1 0 1 0 0 1 1 1 0 1 0

As can be seen from this example, 82.5 Hz CTCSS (tone 07) has phone access and mobile-mobile select call enabled. The user also has a courtesy unkey beep enabled. Tone 100 Hz (tone 13) is for dispatch only and has talkback pager enabled. A phone call received for that user would ring once on the channel before placing the caller on the air. Tone 127.3 Hz (tone 20) and DCS-332 (code 107) both have dispatch and phone access enabled. Toll restricted dialing is enabled, half privacy tone, tone-in-tail and courtesy tones are enabled.

Read Software Version

This command will report the software version number in Morse code. The number is sent as the most significant digit, a Morse code period (• – • – • –) and one decimal place digit.

98# REPORT SOFTWARE VERSION (sent in slow Morse Code)

EXIT PROGRAM MODE

This is the final command. When entered, the 48-Jr will exit program mode after first sending a brief ringing tone. The system will hang up the phone line if off-hook, and unkey the transmitter. The system will perform a cold-start and any and all items programmed in the session just completed, will now take affect. If the printer port option is installed, the printer will label the exit from program mode noting the date, time and duration.

99# EXIT PROGRAM MODE

5. INSTALLATION

INSTALLATION WARNING

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. Installation of the Model 48-Jr Repeater Patch should only be attempted by qualified radio service personnel.

GENERAL

Connections to the transmitter, receiver, and power are grouped on a detachable connector on the rear of the unit for ease of installation. The Model 48-Jr includes installation test modes to aid in adjustments made during the installation. Many of the adjustments can be made from the rear of the Model 48-Jr. However internal access is required for dial click decode, hybrid, CTCSS/DCS TX Level, COR and VOX adjustments and possibly for jumper setting. If the printer port option is installed, it must temporarily be removed to access COR and VOX adjustments.

EQUIPMENT REQUIRED

The equipment required for installation includes:

1. A communications service monitor

2. A handheld or mobile radio with DTMF and CTCSS/DCS encode capability

3. A VOM (volt-ohm-meter)

An oscilloscope is highly recommended, but not absolutely required.

INSTALLATION PROCEDURE

The following installation procedure is for connecting the Model 48-Jr to an unspecified radio. As a result, it is generic in nature. It is highly recommended that the installer review the entire installation procedure to get the “big picture” before starting.

1. Power Supply

Locate the 12-volt DC power supply for the radio receiver and transmitter. With a VOM measure the DC voltage. It should be between 10.5 and 15 VDC. Connect the power supply positive supply lead to P1-pin 1, and the ground lead to P1-pin 2. Do not crimp the ground lead connector until step two.

2. Ground Connection

Connect a chassis ground wire from P1-pin 2 to the chassis ground of the receiver/transmitter.

3. Transmitter PTT

Connect a wire from P1-pin 7 (PTT) to the PTT input of the transmitter. Note that this output is an open drain FET pull-down to ground.

4. Transmit Audio Output

Connect P1-pin 5 to the microphone input of the transmitter. Shielded cable must be used for this connection; connect the braid to P1-pin 4 (do not crimp the connector onto the braid until step 5). Do not connect the braid on the radio end of the cable.

5. Discriminator Audio Input

Connect P1-pin 3 to the receiver discriminator output. Shielded cable must be used for this connection; connect the braid to P1-pin 4. Do not connect the braid on the radio end of the cable. In order for the CTCSS/DCS decode circuits of the Repeater Patch to function properly, the audio used for this connection cannot be hi-pass filtered and must pass frequencies down to about 10 Hz.

Note

SPEAKER AUDIO MAY NOT BE USED WITH THE MODEL 48-Jr. For proper operation, the CTCSS/DCS decode and internal carrier detection circuits in the Model 48-Jr must be supplied with unfiltered, unsquelched, raw discriminator audio that passes frequencies from about 10 Hz to above 6 kHz. If the only source of receive audio supplied to the radio's auxiliary connector is speaker audio, then you must locate a source of true discriminator audio inside the radio and get your receive audio from there.

6. COR Input

If an external COR signal is to be used, the signal is connected to P1-pin 8. Jumper JP3 is set to the 'B' position. The polarity of the COR signal is set using jumper JP6. If COR is low when a valid signal is present, jumper JP6 should be set to position 'B'. If COR is high when carrier is present, then JP6 should be set to position 'A'.

If no external COR signal is available from the receiver, or the installer chooses not to use it, the Model 48-Jr can be configured to use its own internal carrier detect circuit by setting JP3 to the 'A' position and JP6 to the 'B' position.

7. CTCSS/DCS Encode Output

The CTCSS/DCS encode signal from the Repeater Patch is available on P1-pin 6. Connect a shielded cable to this pin and connect the other end to the external encode modulation input on the transmitter. Connect the braid of the cable only on the radio end.

TESTS, ADJUSTMENTS, AND INITIAL TURN-ON

It is highly recommended that the installing technician review the entire procedure before starting the tests and adjustments. This will give the technician a clearer idea of the

equipment needed, and both the order in which the steps are done and how the adjustments are made.

1. Initial Setting of Receive Level and Carrier Detect

In order to get started with the rest of the adjustments, it is necessary to do a rough set-up of the RECEIVE GAIN and the CARRIER DETECT sensitivity. Connect a VOM to TP1 in the Repeater Patch and set the meter to measure volts-AC-RMS. Supply a full-quieting signal to the receiver with a 1 kHz audio tone at 70% of full deviation (this would be 3.5 kHz of deviation on a channel with 5 kHz maximum deviation, if a service monitor is not available, try using a radio with a DTMF keypad, sending any digit continuously will do). While supplying this signal, adjust the RECEIVE GAIN (R2) for approximately a .35 volt-AC-RMS (1VPP) reading at TP1. If you are not able to reach this level with JP1 in the 'A' position, move it to the 'B' position.

When using the Internal Carrier Detect circuit (JP3 set to position A): Once the RECEIVE GAIN level is set, remove the signal. Now rotate the SQUELCH control (R1) counter-clockwise until the CARRIER LED comes on (if it wasn't already on). Once the CARRIER LED is on, then slowly rotate the control clockwise until the LED goes out again, and a little past that. Supply the modulated signal again and confirm that the CARRIER LED both comes on and stays on while the modulated signal is present. If it flutters or won't stay on while DTMF or voice is present, turn the control clockwise a little more until it stays on solid. When the signal is removed, the LED should turn off smartly. If the CARRIER LED appears to behave backwards from its intended function, check the position of JP6, it should be in the 'B' position for INTERNAL CARRIER.

When using an External Carrier Detect signal (JP3 set position B): The carrier detect signal from the radio receiver should be connected to P1-pin 8. The logic of the signal provided should not go below ground or above +15 volt-DC from ground. Use the VOM to determine both the direction and amount of the voltage change between the squelched and unsquelched conditions. The voltage must change by at least 0.5 volt-DC. Set the position of JP6 to match the direction in which the signal voltage moves when the receiver unsquelches. Use the 'A' position if the signal goes high for unsquelched, and the 'B' position if the signal goes low. Adjust the COR control (R46) until the CARRIER LED on the patch reliably tracks the condition of the receiver. This is the preferred source of carrier detect information.

2. Access the Adjustment Tests

The Connect button on the front of the Repeater Patch can be used to access and select the setup adjustment tests. Accessing the diagnostics this way requires that the unit be in it's idle state with no system activity. Press and hold the front panel button. After approximately 3 seconds, the Phone LED will begin rapidly blinking. The button may now be released and the LED will remain on steady. The 48-Jr is now in an intermediate state and is ready to proceed through the diagnostics. Press the button once more, briefly, to proceed to the first test.

Each diagnostic will run for three minutes before timing out. If allowed to time out, the system will exit diagnostic mode and return to an idle state. The button may be pressed at any time while a diagnostic is running. If the button is pressed briefly (less than 3 seconds), the

unit will proceed to the next diagnostic. If the button is held for 3 seconds or more, the Phone LED will again begin blinking rapidly to indicate that it is ready to exit diagnostic mode. In this case, when the button is released, the unit will return to idle. A diagnostic can also be terminated with a DTMF "#".

The Phone LED will blink during diagnostics, to announce which diagnostic is being run. The blink rate is 300 ms on/300 ms off with a 3 second gap before repeating. The tests are thought of as being numbered sequentially from 1 through 5. The tests are listed in the order then are executed. Tests 4 and 5 require access from the phone line. To accomplish this place a call to the unit under test anytime after diagnostic mode is accessed. The phone line will be answered when the diagnostic is selected. The Hybrid test will leave the phone off-hook for the dial click test. If a diagnostic is allowed to time out, the phone will be placed back on-hook upon exiting.

1 - TRANSMIT 1k HZ. AUDIO TEST

2 - REPEAT AUDIO TEST/RECEIVE LEVEL TEST

3 - CTCSS/DCS TX ADJUST TEST

4 - HYBRID ADJUST

5 - DIAL CLICK DECODE TEST

The programming mode may also be used to access installation tests, for cases where it is not convenient to use the “CONNECT” push button. The following methods may be used to access the program mode:

- FROM A PHONE: While the CARRIER LED is off, dial the number that the Model 48-Jr is attached to from another phone line. After the patch answers the line, wait for the dial tone prompt and key in the program mode access code (default is “12948”). When the program mode is accessed, a five-beep, go-ahead prompt is heard. The Model 48-Jr will not answer the phone line while the CARRIER LED is on.

- FROM A DTMF-EQUIPPED RADIO: If it is more convenient to do so, the programming mode may be accessed over the radio channel from a DTMF-equipped handheld or mobile radio. The program mode access code number is the same for both phone and mobile programming, however, the Model 48-Jr will require that the radio be sending a CTCSS tone or DCS code. It doesn’t matter which one, the panel is going to use it to identify the radio that started the programming session and will only respond to transmissions using that same tone or code for the rest of that programming session.

3. Set Transmit Audio Gain

Start with jumper JP7 in the ‘B’ (LOW gain) position. Enter the DTMF command “92#” (transmit audio test), or, if the adjustment tests were accessed with the Connect button, press it once to proceed to test one. The transmitter will be keyed and a 1 kHz test tone will be generated. Using a service monitor to measure the transmit deviation, adjust the TRANSMIT LEVEL control (R3) for 70% of full channel deviation (typically 3.5 kHz). If the deviation won’t go high enough, move JP7 to the ‘A’ (HI) position and try again. When finished , enter

a "#" to terminate the test and then either return to the programming mode or proceed to the next test.

Note

The level set in step 3 was NOT the REPEAT AUDIO level. The REPEAT AUDIO level will be set in step 4.

4. Set Repeat Audio Gain

Note that the INTERNAL CARRIER detector operates on audio AFTER the point at which the RECEIVE gain is set, so it will react to adjustments to the RECEIVE LEVEL. The CARRIER LED must be on during this test; so if you are setting up the patch to use the INTERNAL CARRIER detect, and it is necessary to get the LED on, adjust control R1 to force it on. Once the RECEIVE LEVEL adjustments are finished, the internal carrier detect sensitivity will be set in the next step. If an external COR signal is being used, then no further adjustment should be necessary.

Enter the command "93#" to start the Repeat Audio test. If accessed with the Connect button, press it once to select test two. Supply a full quieting signal to the receiver with a 1 kHz audio tone at 70% of full channel deviation (typically 3.5 kHz on a channel with 5 kHz maximum deviation), and the transmitter should key. While monitoring the transmit channel with the service monitor set for duplex operation, adjust the RECEIVE LEVEL control (R2) until the transmitter deviation matches the input deviation. If a full duplex capable service monitor is not available, another radio can be used to supply signal to the receiver, as long as you know the deviation level of the signal it is sending. Now insert a 500 Hz, 1000 Hz, and 2000 Hz test tone into the receiver, all at the same deviation. The output deviation should remain flat. If it does not, try moving the position of JP5. If you do move JP5, check the repeat audio for unity gain again. OUTPUT DEVIATION = INPUT DEVIATION

Enter a "#" to return to the program mode, or, if accessed using the Connect button, test three (CTCSS/DCS TX Level) maybe selected now.

5. Carrier Adjust

Note

This step is necessary only if you are using the INTERNAL CARRIER DETECT circuit. If you are using the EXTERNAL COR input, the carrier threshold should already be set and you go on to step 6.

After the receive level has been set, supply and then remove a 6 dB sinad signal to the receiver while adjusting the CARRIER LEVEL control. The CARRIER LED should be on when the signal is present. The adjustment should be set just like the "squelch" control on a receiver.

Since the INTERNAL CARRIER detector operates after the receive audio amplifier, any changes to the RECEIVE LEVEL will effect the operation of the INTERNAL CARRIER detector.

6. CTCSS/DCS TX Level Adjustments

To set the CTCSS/DCS modulation level, the cover of the Model 48-Jr must be removed (if not already done).

The subaudible encoding signal level adjustment is located on the attached daughter board situated near the hybrid transformers. Select the TX CTCSS/DCS test with Command 94# if executing with DTMF or by selecting test 3 using the Connect button. The Repeater Patch will key the transmitter and send the CTCSS tone 67 Hz.

Adjust R7 on the CTCSS/DCS board for 750 Hz deviation. If unable to achieve sufficient deviation, move jumper JP1 from position "A" to position "B". JP1 is located on the daughter board close to R7. Either from a radio or telephone as appropriate, press any DTMF digit except "#". The test will cycle from transmitting 67 Hz to 131.8 Hz. Continuing to press digits will select 254.1 Hz and finally DCS 023, before looping back to 67 Hz and starting again. Adjust R7 to achieve the best level between all tones from lowest to highest and DCS level provided your transmitter is capable of sending DCS.

If relatively flat deviation cannot be obtained between the CTCSS tones, it may be necessary to solder-jumper position "E" on JP4 of the encoder/decoder board to add de-emphasis to the tone output.

While the unit is sending the DCS code ”023”, monitor the transmission with a DCS capable service monitor or radio to verify that the code is being properly decoded. It may be necessary to solder a jumper in JP4-position A, on the CTCSS/DCS board, to invert the DCS encode. The DCS decode can be inverted by soldering a jumper in JP4-position B.

7. Adjusting the Hybrid

This test must be controlled from the radio site. Set up your service monitor to measure deviation on the repeater transmit channel, or connect an oscilloscope to the TX output, on either side of the ferrite bead E2 or P1-pin 5. Use your radio to place the Repeater Patch in the program mode. Now have someone call the patch from another telephone and, while the line is ringing, from the radio enter “95#”. If selecting tests from the Connect button, press the button again to select test four. The patch will answer the phone and send a 400/2500 Hz tone out to the phone line, and key the transmitter. The caller should remain quiet for the remainder of the test. Adjust R95 and R96 to obtain the lowest deviation on the channel or the lowest signal at P1-pin 5. The patch is producing two tones during the hybrid test: 400 Hz and 2500 Hz. Keep repeating the adjustments on both controls until you have the minimum output on the channel. Enter a “#” to exit the test. Should it be necessary to communicate with the party on the phone during this adjustment, the installer may key their handheld radio and speak to the caller. The tones will temporarily stop while the radio is keyed. The phone parties response may be heard over the generated tones.

8. Dial Click Decode Test

This test needs to be done in order to ensure that the Model 48-Jr is decoding the overdial from rotary and pulse telephones correctly. If this test is done by entering the program mode from the telephone, you will need to have both a DTMF telephone and a rotary telephone attached to the same line you are calling from. Call the Model 48-Jr and enter the program mode using the DTMF telephone, then enter a "96#" to start the dial click test.

Now you switch over to the rotary phone. When you enter a digit from the rotary phone, the patch will respond by returning the digit it decodes in slow Morse code. Continue to dial digits on the rotary phone and then adjust R100 until the Morse code number returned always matches the number you dialed. You can terminate the test by entering a "#" from the DTMF phone and then a "99#" to exit the program mode.

When the Dial Click Decode test is to be originated by a radio, keyup and enter the programming mode. Next place a telephone call to the patch from a rotary phone. The phone line will be answered when the test command ("96#") is entered from the radio. You may now enter numbers from the phone and complete the adjustments. The test will end and the phone line will be hung up when you enter a "#" from the radio.

If selecting tests from the Connect button, press the button again to select test five. The phone line will remain off-hook from test four to permit continuation to this adjustment. Enter digits from a rotary phone and adjust R100 as described above. When complete, pressing the Connect button will return the Repeater Patch to operating more.

See Table 4-2 for Morse code numbers.

9. Setting the Telephone VOX Threshold

The VOX detector is used to detect dial tone and a busy signal from the C.O. or switch. When placing mobile originated calls, dial tone must be detected by the unit before dialing digits can be regenerated onto the phone line. Dial tone detection is also used before autodials are sent. Additionally, busy signals are detected through the VOX circuit when busy disconnect is selected. This adjustment must be set correctly to assure these functions operate reliably.

The cover must be removed in preparation for this adjustment. Locate the VOX control adjustment control (R43). Also locate pin 7 of U4. This is situated next to the connector end of the CTCSS/DCS encoder/decoder daughter board. Place a scope probe on this pin (U4-7) and set the scope for 5 Volts per division. The Repeater Patch should already be out of test mode. Briefly press and release the Connect button on the front of the 48-Jr. The Repeater Patch will take the phone line off-hook. Monitor the units transmit frequency with a radio or the service monitor. Note that dialtone is being sent from the phone line. Adjust R43 until the signal on the scope switches from a low level (near 0 Volts) to a high level (about 12 Volts) when dial tone is present.

It is common for the telephone C.O. or switch to make the phone line busy after several seconds of dial tone with no dialing heard. If this is the case with the connected line, you may continue to adjust the line for busy detection. If the line does not go busy, it may be

necessary to place a mobile to phone call back to the Model 48-Jr to hear busy tones. Note, even if the unit has not yet been programmed, so no users are enabled, a mobile may dial the phone line after first pressing the Connect button.

Once busy tone is heard, continue to adjust R43 until U4-7 toggles reliably in cadence with the busy tone. This completes this adjustment.

10. Exit the Test Mode

Enter the command "99#" to exit the program mode and return to the normal operating mode.

That completes the adjustments. See Section 4 for programming information on the Repeater Patch's features.

OPTIONAL PRINTER PORT

These instructions apply to the installation, programming, and operation of the printer adapter for a Model 48-Jr.

The Model 48-Jr Printer Interface is used to record all call activity associated with user accessed to the telephone. All information generated by the printer interface can be recorded on a Centronics-compatible parallel printer. The information recorded includes the user number, the access type (Phone-to-Mobile, Mobile-to-Phone, or Mobile-to-Mobile), the calendar date and time-of-day, and the duration of the call. This information is used by the system operator for system management and billing purposes. In addition to providing call detail records, the printer interface, once enabled, records all programming activity in the form of DTMF commands and all the information entered during a programming session. The printer interface labels the entry to and exit from a programming session, also noting the day, date, and duration. This is useful for documenting programming activity.

The printer interface uses a DB-25S connector for its external connection. The pin out of this connector is the same as the pin out for the parallel printer port of an PC-compatible computer. Cabling to a printer requires a PC-compatible printer cable. The connecting cable should be a shielded type and secured to both the printer interface and the printer during installation.

Installation

Before using the Model 48-Jr Printer Interface, all connections, installation, and adjustments of the Repeater Patch should be complete.

To install the printer interface board in the field, first remove the power to the Repeater Patch. Then remove the top cover of the unit by removing the four screws that hold it on. Locate the break-away section at the rear of the chassis (right above P1) and remove it. Be careful not to damage the PCB or chassis while doing so.

The printer interface board is connected to the mother board of the Repeater Patch by plugging it into P2 on the mother board. The printer adapter is secured on the end nearest the transformers on the mother board by a 4-40 screw into a threaded spacer. The other end of

the board is secured by the hardware that attaches the DB-25S connector to the rear of the chassis.

The “CLK BATT” battery jumper (JP1) may now be moved from OFF to ON. The top cover of the Model 48-Jr may now be replaced. A PC-compatible printer cable is used to connect the Model 48-Jr to a printer. The cable should be secured at the printer, and on the patch end with DB lock (jack) screws.

Programming

The Model 48-Jr is now ready to be re-installed and programmed for printer operation. Once operational, refer to the programming section of this manual, Section 4. Enter the program mode and enable the printer using command 44#. Set the date on the printer adapter by using command 48# xxxxxx# (dd mm yy). For example, for July 17, 1995, enter “48# 170795#”. Set the time-of-day for the printer port by using command 49# xxxxxx# (hh mm ss, 24-hour format). For example, for 2:45 PM, enter “49# 144500#”.

By default, the printer port will record only phone-to-mobile, mobile-to-phone and mobile-to-mobile selective calling. If desired, the printer port can be set to record all dispatch activity and any keyup attempts on un-enabled or reserved tones. This is done by setting dispatch recording to on using command 46#. This may be later disabled with command 47#. One word of caution when using dispatch activity recording; the output from the printer port is in real-time to a connected printer. This is not a buffered memory record. Any problems with the printer (such as out of paper) will result in the loss of information for any activity that occurs while the printer is off-line. Depending on channel activity, dispatch recording may consume paper at a fast rate.

After making these entries, exit the program mode by using command 99#. The clock on the printer interface is battery backed, so it will keep the correct time even with power removed.

Operation

The printer interface will send a line feed character with a carriage return so a connected printer should not be configured to automatically add a line feed whenever it receives a carriage return. The printer interface uses space character for positioning the information correctly so a non-proportionally spaced font should be selected on the printer. Courier or Draft fonts are usually fixed-space-type fonts and will position the information correctly. The printer interface assumes 80 columns across and 60 lines per page.

The printer adapter will now record all of the activity for the Model 48-Jr. The unit will print records showing system resets (including the date and time they occurred), program mode activity (all commands along with the date and time executed), and all user activity.

When the system is first turned on, or any time the system is reset, the printer interface assumes that the printer is at the top-of-form position. The unit will print that the system has been reset along with the date and time. Following that on the next line, the printer interface will print out a header labeling the columns of information. Upon applying power, the user should see:

```
System reset.  00/00/00  00:00
USER TYPE DIALED         DATE      TIME      DURATION
-----------------------------------------------------
```

The date is always printed in a day-month-year format. After 60 lines of information, the printer interface will issue an ASCII form-feed and again print the header.

MODEL 48-JR JUMPERS, POTENTIOMETERS, AND TEST POINTS

Jumpers

JP1 = Selects HI/LO range for the Receive gain adjustment. The ‘A’ position is LO and the ‘B’ position is HI.

JP2 = Routes the RX audio past header P5. Not used in the Model 48-Jr.

JP3 = Selects the source for the carrier detect signal. The ‘A’ position selects INTERNAL CARRIER detect, and the ‘B’ position selects EXTERNAL COR.

JP4 = Selects the valid decode polarity for the external tone decoder input on P1-pin 9. The ‘A’ position is for valid LOW, and the ‘B’ position is for valid HI. The input is internally pulled high, so the default position for this jumper is ‘B’.

JP5 = Selects the proper de-emphasis network for the receive audio source. The ‘A’ position is for SPEAKER audio, and the ‘B’ position is for DISCRIMINATOR audio. The jumper should always be in the ‘B’ position.

JP6 = This sets the polarity for a valid carrier detect signal. The ‘A’ position is for active HIGH carrier signals and the ‘B’ position is for active LOW signals. When using EXTERNAL COR, the position of JP6 will be determined by the carrier signal supplied by the receiver. When using INTERNAL CARRIER detect, the jumper should be in the ‘A’ position.

JP7 = Selects the HI/LO range for Transmit gain. The ‘A’ position is HI and the ‘B’ position is LO.

JP8 = Routes the transmit audio past header P5. Not used in the Model 48-Jr.

Potentiometers

R1 = Used to set the threshold for the INTERNAL carrier detector circuit.

R2 = Used to set the receive gain level. The range over which this control acts is set by JP1.

R3 = Used to set the transmit gain level. The range over which this control acts is set by JP7.

R43 = This control is used to set the VOX circuit threshold in responding to audio from the telephone.

R46 = This control is used to set the threshold on the EXTERNAL COR input circuit.

R95 = This control is the “R” balance potentiometer and is used to balance the hybrid.

R96 = This control is the “C” balance potentiometer and is used to balance the hybrid.

R100 = This control is used to adjust the sensitivity of the Dial Click decoder circuit.

Test Points

TP1 = Receive audio, at the output of the first gain stage, U2-pin 14.

TP2 = Power Up Reset circuit, a reading of +5 volt-DC = in Reset, and a reading of 0 volt-DC = out of Reset.

TP3 = Dial Click Decode circuit, after R100.

TP4 = Phone-in audio / Transmit audio, just after the hybrid circuit.

TP5 = This is the “VP” bias voltage used in audio circuits, it should read +2 volts-DC.

CTCSS/DCS BOARD JUMPERS and POTENTIOMETERS

Jumpers

JP1 = Encode Level Range. Position "A" is LO and the "B" position if HI.

JP2 = Reserved

JP3 = Reserved

JP4 = Position A off TX DCS normal

Position A on TX DCS invert

Position B off RX DCS normal

Position B on RX DCS invert

Position C Reserved

Position D Reserved

Position E off CTCSS levels flat

Position E on CTCSS levels De-emphasized

Potentiometers

R7 = Subaudible Encode level adjustment.

IN CASE OF DIFFICULTY

In case of installation difficulty, call Zetron, Inc., at (425) 820-6363 and ask for technical support on the Model 48-Jr. Please have the serial number of the unit and/or the sales order number available in case the order needs to tracked. If the call is made from the site by the installer or radio service technician, the problem can often solved over the phone, saving another trip to the site.

6. REPAIR

MODEL 48-JR TOP ASSEMBLY (024-0203A)

MODEL 48-JR (702-9717E)

Parts List

LEGEND:
= NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY
+ = OPTION (INSTALLED PER CUSTOMER ORDER)

Item	Quantity	Reference	Part	Description	Part Reference
1	1	R58	101-0025	RESISTOR,10 OHM,1/4W,5%,CARBON FILM	10
2	3	R28,R32,R59	101-0047	RESISTOR,47 OHM,1/4W,5%,CARBON FILM	47
3	6	R26,R64,R111,R112,R114, R115	101-0057	RESISTOR,220 OHM,1/4W,5%,CARBON FILM	220
4	1	R65	101-0061	RESISTOR,330 OHM,1/4W,5%,CARBON FILM	330
5	3	R41,R78,R86	101-0065	RESISTOR,470 OHM,1/4W,5%,CARBON FILM	470
6	2	R34,R96	101-0066	RESISTOR,510 OHM,1/4W,5%,CARBON FILM	510
7	2	R101,R87	101-0067	RESISTOR,560 OHM,1/4W,5%,CARBON FILM	560
8	4	R29,R56,R68,R109	101-0077	RESISTOR,1.3K OHM,1/4W,5%,CARBON FILM	1.3K
9	3	R31,R76,R89	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
10	2	R27,R61	101-0083	RESISTOR,2.7K OHM,1/4W,5%,CARBON FILM	2.7K
11	1	R39	101-0087	RESISTOR,3.9K OHM,1/4W,5%,CARBON FILM	3.9K
12	2	R36,R12	101-0089	RESISTOR,4.7K OHM,1/4W,5%,CARBON FILM	4.7K
13	2	R15,R90	101-0090	RESISTOR,5.1K OHM,1/4W,5%,CARBON FILM	5.1K
14	1	R94	101-0093	RESISTOR,6.8K OHM,1/4W,5%,CARBON FILM	6.8K
15	1	R75	101-0095	RESISTOR,8.2K OHM,1/4W,5%,CARBON FILM	8.2K
16	13	R17,R24,R48,R49,R70,R71, R73,R77,R82,R83,R93,R106, R108	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
17	1	R9	101-0099	RESISTOR,12K OHM,1/4W,5%,CARBON FILM	12K
18	3	R21,R72,R74	101-0101	RESISTOR,15K OHM,1/4W,5%,CARBON FILM	15K
19	2	R42,R55	101-0103	RESISTOR,18K OHM,1/4W,5%,CARBON FILM	18K
20	7	R10,R13,R30,R35,R40,R84, R85	101-0105	RESISTOR,22K OHM,1/4W,5%,CARBON FILM	22K
21	1	R95	101-0109	RESISTOR,33K OHM,1/4W,5%,CARBON FILM	33K
22	10	R7,R8,R14,R33,R37,R46, R47,R52,R100,R102	101-0113	RESISTOR,47K OHM,1/4W,5%,CARBON FILM	47K
23	1	R38	101-0117	RESISTOR,68K OHM,1/4W,5%,CARBON FILM	68K
24	15	R4#,R18,R19,R20,R23,R43, R45,R50,R54,R60,R62,R63, R66,R67,R91,R99	101-0121	RESISTOR,100K OHM,1/4W,5%,CARBON FILM	100K
25	2	R81,R80	101-0123	RESISTOR,120K OHM,1/4W,5%,CARBON FILM	120K
26	1	R105	101-0125	RESISTOR,150K OHM,1/4W,5%,CARBON FILM	150K
27	4	R51,R92,R103,R110	101-0129	RESISTOR,220K OHM,1/4W,5%,CARBON FILM	220K
28	1	R11	101-0131	RESISTOR,270K OHM,1/4W,5%,CARBON FILM	270K
29	1	R98	101-0138	RESISTOR,510K OHM,1/4W,5%,CARBON FILM	510K
30	1	R57	101-0141	RESISTOR,680K OHM,1/4W,5%,CARBON FILM	680K
31	5	R16,R44,R53,R104,R113	101-0145	RESISTOR,1.0M OHM,1/4W,5%,CARBON FILM	1.0M
32	1	R79	101-0160	RESISTOR,10M OHM,1/4W,5%,CARBON FILM	10M
33	1	R69 **NOTE 2**	103-0175	RESISTOR,75 OHM,2W,5%,METAL OXIDE,FLAMEPROOF	75 2W
34	1	RV1	105-0001	VARISTOR,250VAC,70J	250VAC
35	2	R5,R6 **NOTE 3**	106-0047	RESISTOR,FUSIBLE,4.7 OHM,1/2W,5%	4.7-1/2F

MODEL 48-Jr PARTS LIST (702-9717E)

(Continued)

Item	Quantity	Reference	Part	Description	Part Reference
36	1	R1	107-0003	POT,2K OHM,1 TURN,R/A	2K
37	1	R3	107-0004	POT,500 OHM,1 TURN,R/A	500 OHM
38	1	R2	107-0015	POT,50K OHM,1 TURN,R/A	50K
39	1	R22	107-0202	POT,2K OHM,1 TURN	2K
40	1	R97	107-0501	POT,5K OHM,1 TURN	5K
41	1	R25	107-0502	POT,50KOHM,1 TURN	50K
42	1	R88	107-0504	POT,200K OHM,1 TURN	200K
43	1	R107	107-3085	POT,10K OHM,1 TURN	10K
44	1	RP1	119-0021	R-NETWORK,R/2R,100K/200K,SIP-10	100K/200K
45	1	RP3	119-0025	R-NETWORK,10K OHM x 4,ISOLATED,SIP-08	10K
46	1	RP2	119-0026	R-NETWORK,2K OHM x 4,ISOLATED,SIP-08	2K
47	1	C10	150-0096	CAP,1000pF,1KV,10%,CERAMIC DISC,Y5P	.001 1KV
48	2	C50,C16	151-0020	CAP,.001uF,100V,10%,CERAMIC X7R	.001
49	2	C55,C48	151-0033	CAP,33pF,100V,10%,CERAMIC NPO	33pF
50	1	C6	151-0047	CAP,470pF,100V,10%,CERAMIC NPO	470pF
51	1	C67	151-0089	CAP,330pF,100V,10%,CERAMIC NPO	330pF
52	2	C36,C37	151-0100	CAP,.033uF,50V,10%,CERAMIC X7R	.033
53	16	C7,C8,C9,C11,C12,C17,C33, C42,C46,C47,C51,C53,C54, C69,C70,C78	151-0120	CAP,.01uF,50V,10%,CERAMIC X7R	.01
54	9	C13,C18,C19,C20,C34,C35, C52,C58,C73	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1
55	2	C44,C59	151-0199	CAP,.47uF,50V,5%,POLYESTER	.47
56	6	C1,C23,C24,C31,C72,C76	152-0012	CAP,.1uF,50V,5%,POLYESTER	.1
57	1	C21	152-0021	CAP,.47uF,250V,10%,POLYESTER	.47 250V
58	1	C4	152-0040	CAP,4.7uF,50V,20%,NON-POLAR ELECTROLYTIC,AXIAL	4.7
59	1	C45	152-0050	CAP,10uF,100V,20%,NON-POLAR ELECTROLYTIC,RADIAL	10 100V
60	7	C32,C43,C63,C64,C65,C68, C74	152-0080	CAP,.22uF,50V,5%,POLYESTER	.22 50V
61	2	C22,C5	152-0085	CAP,.01uF,50V,5%,POLYESTER	.01
62	4	C29,C30,C66,C75	152-0089	CAP,.001uF,50V,5%,POLYESTER	.001
63	0	C39#	152-0250	CAP,.047uF,50V,5%,POLYESTER	.047
64	2	C49,C15	154-0025	CAP,1uF,35V,10%,TANTALUM	1 TANT
65	4	C2,C3,C60,C61	154-0050	CAP,4.7uF,16V,10%,TANTALUM	4.7 TANT
66	6	C14,C25,C38,C62,C71,C77	154-0100	CAP,10uF,16V,10%,TANTALUM	10 TANT
67	2	C28,C26	155-0052	CAP,10uF,35V,20%,RADIAL,Al-E	10
68	2	C56,C57	155-0055	CAP,22uF,35V,20%,AXIAL,Al-E	22
69	3	C27,C40,C41	155-0083	CAP,470uF,10V,RADIAL,Al-E	470 10V
70	4	E1,E2,E3,E4	305-0001	BEAD,3B FERRITE,W/LEADS	
71	2	T1,T2	305-1540	XFMR,TELCO HYBRID,SMALL SIZE	
72	4	DS1,DS2,DS3,DS4	311-0011	LED,RED,DIFFUSED,5mm CYLINDRICAL	
73	1	DS5	311-0012	LED,GREEN,DIFFUSED,5mm CYLINDRICAL	
74	1	U1	311-1001	OPTO ISOLATOR,BI-POLAR	H11AA1
75	2	U14,U7	316-0324	IC,OP-AMP,BIPOLAR,358 EQUIVALENT,QUAD	324
76	1	U3	316-0358	IC,OP-AMP,BIPOLAR,DUAL	358

MODEL 48-Jr PARTS LIST (702-9717E)

(Continued)

Item	Quantity	Reference	Part	Description	Part Reference
77	3	U2,U4,U15	316-3074	IC,OP-AMP,HF,EXT. TEMP.,QUAD	33074
78	2	VR1,VR2	316-7805	REGULATOR,+5V,1.5A	7805
79	1	U16	321-0204	IC,RCVR,DTMF	75T204
80	0	U13^	321-6806	IC,8 BIT CMOS OTP 40 PIN DIP (68HC705A)	ASIC 009
81	0	U10^,U11^	322-9346	IC,EERPOM,1024-BIT,SERIAL	93C46N
82	2	U8,U9	323-4053	ANALOG SWITCH,TRIPLE SPDT	4053
83	3	U5,U6,U12	324-7414	IC,HEX SCHMIDT,MOTOROLA THRESHOLDS	74HC14
84	3	Q1,Q2,Q6	340-3904	XSTR,NPN,40V/200MA,TO92	2N3904
85	4	Q3,Q4,Q5,Q7	340-7000	XSTR,MOSFET,N-CHANNEL,60V/ 0.2A,5 OHMS,TO-92	2N7000
86	1	CR4	342-0001	DIODE,SILICON,1A,100V,DO-41	1N4002
87	4	CR13,CR15,CR16,CR17	342-0103	DIODE,SCHOTTKY,0.37V @ 1MA TYP	SD103A
88	5	CR5,CR7,CR10,CR11,CR12	342-3009	DIODE,SILICON,100V,250MW	1N4148
89	1	CR3	342-5400	DIODE,SILICON,3A,50V	1N5400
90	1	CR2	343-3017	DIODE,ZENER,6.2V,1/2W,5%	6.2V 1/2W
91	1	CR14	343-3100	DIODE,ZENER,8.2V,1W,5%	8.2V
92	4	CR1,CR6,CR8,CR9	343-3110	DIODE,ZENER,20V,1W,5%	20V
93	1	SW1	371-0024	SWITCH,PB,SPST,MOM,R/A,PWB MNT	
94	1	Y2 **NOTE 1**	376-0358	XTAL,3.579545MHZ,CL=18pF,HC-49	3.58MHZ
95	1	Y1	376-3686	XTAL,3.6864MHZ,CL=18,20pF,HC-49	3.6864MHZ
96	1	K1	380-0030	RELAY,DPDT MINI-DIP,12 V COIL	
97	1	J1	401-0080	6-PIN LO PRO R/A TELCO	
98	1	P1	401-0202	10 PIN X .156 R/A CONN	
99	0	P5#	401-2648	8-POS MALE .156" CTRS SQR	
100	0	TP1#,TP2#,TP3#,TP4#,TP5#	403-0001	01 OF 401-0052	
101	0	JP8#,JP2#	403-0002	02 OF 401-0052	
102	7	JP1,JP3,P4,JP4,JP5,JP6, JP7	403-0003	03 OF 401-0052	
103	1	P3	403-0008	08 OF 401-0052	
104	1	P2	404-1006	06 OF 401-1364	
105	1	F1	416-1576	FUSE AGC 1 A FAST-BLOW	1A
106	1	XY1	236-0005	XTAL INSULATOR	
107	4	XR5,6 **(2 EA) NOTE 3**	251-9000	SPACER, 1/4 RESISTOR LEAD	
108	6	XJP1,3,7 **(POS A)** XJP4,5,6 **(POS B)**	402-3040	MINI JUMPER	
109	1	XU1	407-0006	SKT, 06 PIN DIP	
110	3	XU3,10,11	407-0008	SKT, 08 PIN DIP	
111	9	XU2,4-7,12,14-16	407-0014	SKT, 14 PIN DIP	
112	2	XU8,9	407-0016	SKT, 16 PIN DIP5	
113	1	XU13	407-0040	SKT, 40 PIN DIP	
114	1	PCB	410-9565B	CONTROL BOARD	
115	2	XF1	416-3040	FUSE CLIP	
116	4	XDS2-5	417-0010	LED MOUNT RA	

NOTES: Notes are for production use only.

MODEL 48-JR SCHEMATIC (008-9717E)

Schematic

MODEL 48-JR (008-9717E)
(Continued)

MODEL 48-JR (008-9717E)
(Continued)

MODEL 48-JR (008-9717E)
(Continued)

MODEL 48-JR (702-9717E)

Silkscreen

CTCSS/DCS ENCODER/DECODER (702-9666A)

Parts List

LEGEND:
= NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY
+ = OPTION (INSTALLED PER CUSTOMER ORDER)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
1	1	R15	101-0073	1K 1/4W 5% CARBON FILM	
2	2	R11,R12	101-0085	3.3K 1/4W 5% CARBON FILM	
3	1	R8	101-0090	5.1K 1/4W 5% CARBON FILM	
4	1	R14	101-0097	10K 1/4W 5% CARBON FILM	
5	1	R3	101-0101	15K 1/4W 5% CARBON FILM	
6	1	R5	101-0113	47K 1/4W 5% CARBON FILM	
7	3	R2,R4,R16	101-0121	100K 1/4W 5% CARBON FILM	
8	1	R1	101-0123	120K 1/4W 5% CARBON FILM	
9	1	R18	101-0125	150K 1/4W 5% CARBON FILM	
10	1	R10	101-0129	220K 1/4W 5% CARBON FILM	
11	1	R13	101-0133	330K 1/4W 5% CARBON FILM	
12	1	R9	101-0145	1M 1/4W 5% CARBON FILM	
13	1	R17	101-0160	10M 1/4W 5% CARBON FILM	
14	1	R7	107-0500	500 POT 1 TURN	
15	2	RP1,RP3	119-0006	10K x 9 BUSSED 10-PIN SIP	
16	1	RP4	119-0008	10K x 7 BUSSED 8-PIN SIP	
17	1	RP2	119-0021	R/2R 100K/200K 10 PIN SIP	
18	2	C22,C23	151-0022	22PF 100V/200V +-10%/5% CERAMIC NPO	
19	1	C11	151-0047	470PF 100V/200V +-10%/5% CERAMIC NPO	
20	5	C2,C3,C7,C16,C19	151-0180	.1UF 50V +-20% CERAMIC Z5U	
21	2	C10,C20	152-0012	.1 UF 50V +-5% POLYESTER	
22	1	C21	152-0015	.015 UF 50V +-5% POLYESTER	
23	2	C18,C13	152-0085	.01 UF 50V +- 5% POLYESTER	
24	1	C14	152-0089	.001 UF 50V +-5% POLYESTER	
25	1	C12	152-0122	.022 UF 50V 5% POLYESTER	
26	2	C8,C9	154-0050	4.7UF 16V TANTALUM +-10%	
27	4	C1,C6,C15,C17	154-0100	10 UF 16V TANTALUM +-10%	
28	2	C4,C5	155-0077	100UF 25V +-20% RADIAL ALUMINUM ELECTROLYTIC	
29	2	VR1,VR2	316-0005	REGULATOR 5V LOW POWER	78L05
30	1	U1	316-0324	OP-AMP, QUAD BIPOLAR, 358 EQUIVALENT	324
31	1	U2 **NOTE 3**	321-6805	ASIC 008	ASIC 008
32	1	CR1	342-3009	SILICON .50 SP	1N4148
33	1	Y1 **NOTE 1**	376-4032	XTAL, 4.032 MHz HC-49 CL=18,22 PF ESR<100	4.032MHz
34	0	JP5#	403-0002	2 OF 401-0052	
35	1	JP1	403-0003	3 OF 401-0052	
36	0	P1#	403-0004	4 OF 401-0052	

CTCSS/DCS ENCODER/DECODER (702-9666A)

(Continued)

Item	Quantity	Reference	Part	Description	Part Reference
37	0	JP4#	403-0205	10 OF 401-0052 (2 X 5)	
38	0	JP3#,JP2#	403-0208	16 OF 401-0052 [2 X 8]	
39	1	J1 **NOTE 2**	407-0108	SKT, 8 PIN SIP	
40	1	XJP1 (POS A)	402-3040	MINI JUMPER	
41	1	XU1	407-0014	SKT, 14 PIN DIP	
42	1	XU2	407-0044	SKT, 44 PIN PLCC	
43	1	PCB	410-9666A	CTCSS/DCS DECODER/ENCODER	

REFERENCE DESIGNATOR NOT USED: R6

NOTES: Notes are for production use only.

CTCSS/DCS ENCODER/DECODER (008-9666A)

Schematic

CTCSS/DCS ENCODER/DECODER (702-9666A)

Silkscreen

AA. PROGRAMMING LOG

OVERVIEW

This appendix is provided as an aid to proper record keeping for operators who are not using Repeater Patches with the printer interface option installed. These pages can be copied and used as log sheets to record the programming done when a system is initially set up, or at any time the programming is changed. The programmable features are divided into System Programming items and User programming items.

Throughout these forms, the default value for the parameter, if there is one, will be shown in bold letters next to the blank for your entries.

SYSTEM PROGRAMMING

CONNECT CODE (1-to-9 digits, **"*"**) 01# [_____]#

DISCONNECT CODE (1-to-9 digits, **"#"**) 02# [_____]#

MOBILE ANSWER TYPE 03# [_____]#
(**0 = Connect code**, 1 = PTT + Tone to answer)

DTMF or PULSE DIAL-OUT 05# [_____]#
(**0 = DTMF**, 1 = 61/39 pulse ratio, 2 = 67/33 pulse ratio)

DIAL REGENERATION INTER-DIGIT TIME-OUT 06# [_____]#
(0-to-60 seconds, **3 seconds**)

NUMBER of TELCO-RINGS (before answering) 07# [_____]#
(0-to-10, 0 = No Phone-Mobile, **1 ring**)

PHONE-to-MOBILE AUTOCALL (tone/code) 08# [_____]#
(0-to-154, 0 = Overdial, 1-to-154 calls tone/code, **default = 0**)

MOBILE RING-OUT TIME 10#, **11#,** 12#, 13# [_____]
(15, **30**, or 60 seconds, or ring-out once and wait 60 seconds)

MAXIMUM NUMBER of DIGITS DIALED 14# [_____]#
(0-to-99, **0 = No limit**)

TOLL RESTRICTED NUMBERS for 1st Mobile Dialed Digit 15# [_____]#

TOLL RESTRICTED NUMBERS for 2nd Mobile Dialed Digit 16# [_____]#
(from 1 to 4 digits can be entered in each slot)

HOOKFLASH ENABLE (ON, **OFF**) 17#, **18#** [_____]

CARRIER REPEAT ENABLE (ON, **OFF**) 19#, **20#** [_____]

REPEATER HOLD TIME (0-to-9 seconds, **3 seconds**) 21# [_____]#

OFF-HOOK during Mobile-to-Mobile calls (ON, **OFF**) **23#**, 24# [_____]

MORSE CODE STATION ID/Call Sign 25# [_____]#
MORSE ID TYPE (**0 = No ID**, 1 = After activity, 2 = Interval) 26# [_____]#
MORSE ID INTERVAL (1-to-99 minutes, **15**) 27# [_____]#

ANTI-KERCHUNKER FILTER (ON, **OFF**) 28#, **29#** [_____]

CALL LIMIT TIMER (0-to-10 minutes, **3 minutes**, 0 = disabled) 30# [_____]#
ALLOW CALL LIMIT RESET by MOBILE (ON, **OFF**) 31#, **32#** [_____]

COURTESY TONE MORSE CHARACTER (default = **E**) 34# [_____]#

MORSE CODE SPEED (**0 = 20 WPM**, 1 = 25 WPM) 35#[_____]#

MOBILE ACTIVITY TIME (**30**-to-99 seconds) 36# [_____]#

ENABLE PRINTER (ON, **OFF**) 44#, **45#** [_____]
PRINT DISPATCH AIRTIME RECORDS (ON, **OFF**) 46#, **47#** [_____]
SET PRINTER PORT CALENDAR 48# [_____]#
SET PRINTER PORT CLOCK 49# [_____]#

CONNECT BUTTON SET TO CONVERSATION MODE **58#** [___]
CONNECT BUTTON SET TO PHONE-ANSWER MODE 59# [___]

PASSWORD for AUX OUTPUT CONTROL (up to 5 digits) 83# [_____]#

AUTOMATIC DISCONNECT ON BUSY TONE) 85#, **86#**, 87# [___]

(1st 20 seconds, **OFF**, for the whole call)

AUTO-DIAL NUMBER MEMORY (up to 16 digits each)

format is: 89# n# Number# (where n = the memory slot to store number in)

"0" Number = [_____]

"1" Number = [_____]

"2" Number = [_____]

"3" Number = [_____]

"4" Number = [_____]

"5" Number = [_____]

"6" Number = [_____]

"7" Number = [_____]

"8" Number = [_____]

"9" Number = [_____]

PROGRAM MODE PASSWORD (Must be five digits, **12948**) 90# [_____]#

USER PROGRAMMING

USER #	Tone/Code	A	B	C	D	E	F	G	H	I	J	K	L
0	Carrier												
1	67.0 Hz												
2	69.4 Hz												
3	71.9 Hz												
4	74.4 Hz												
5	77.0 Hz												
6	79.7 Hz												
7	82.5 Hz												
8	85.4 Hz												
9	88.5 Hz												
10	91.5 Hz												
11	94.8 Hz												
12	97.4 Hz												
13	100.0 Hz												
14	103.5 Hz												
15	107.2 Hz												
16	110.9 Hz												
17	114.8 Hz												
18	118.8 Hz												
19	123.0 Hz												
20	127.3 Hz												
21	131.8 Hz												
22	136.5 Hz												
23	141.3 Hz												
24	146.2 Hz												
25	151.4 Hz												
26	156.7 Hz												
27	159.8 Hz												
28	162.2 Hz												
29	165.5 Hz												
30	167.9 Hz												
31	171.3 Hz												
32	173.8 Hz												
33	177.3 Hz												

A= Dispatch, **B**= Phone Access, **C**= Mobile Selective Call, **D**= Toll Restrict, **E**= Talkback, **F**= Full/Half Duplex, **G**= Privacy, **H**= User Enabled, **I**= Tone in tail, **J**= No Encode for interconnect, **K**= Courtesy Tone, **L**= Reserved

USER #	Tone/Code	A	B	C	D	E	F	G	H	I	J	K	L

34	179.9 Hz												
35	183.5 Hz												
36	186.2 Hz												
37	189.9 Hz												
38	192.8 Hz												
39	196.6 Hz												
40	199.5 Hz												
41	203.5 Hz												
42	206.5 Hz												
43	210.7 Hz												
44	218.1 Hz												
45	225.7 Hz												
46	229.1 Hz												
47	233.6 Hz												
48	241.8 Hz												
49	250.3 Hz												
50	254.1 Hz												
51	023												
52	025												
53	026												
54	031												
55	032												
56	036												
57	043												
58	047												
59	051												
60	053												
61	054												
62	065												
63	071												
64	072												
65	073												
66	074												
67	114												

A= Dispatch, **B**= Phone Access, **C**= Mobile Selective Call, **D**= Toll Restrict, **E**= Talkback, **F**= Full/Half Duplex, **G**= Privacy, **H**= User Enabled, **I**= Tone in tail, **J**= No Encode for inter-connect, **K**= Courtesy Tone, **L**= Reserved

USER #	Tone/Code	A	B	C	D	E	F	G	H	I	J	K	L

68	115												
69	116												
70	122												
71	125												
72	131												
73	132												
74	134												
75	143												
76	145												
77	152												
78	155												
79	156												
80	162												
81	165												
82	172												
83	174												
84	205												
85	212												
86	223												
87	225												
88	226												
89	243												
90	244												
91	245												
92	246												
93	251												
94	252												
95	255												
96	261												
97	263												
98	265												
99	266												
100	271												
101	274												

A= Dispatch, **B**= Phone Access, **C**= Mobile Selective Call, **D**= Toll Restrict, **E**= Talkback, **F**= Full/Half Duplex, **G**= Privacy, **H**= User Enabled, **I**= Tone in tail, **J**= No Encode for inter-connect, **K**= Courtesy Tone, **L**= Reserved

USER #	Tone/Code	A	B	C	D	E	F	G	H	I	J	K	L

102	306												
103	311												
104	315												
105	325												
106	331												
107	332												
108	343												
109	346												
110	351												
111	356												
112	364												
113	365												
114	371												
115	411												
116	412												
117	413												
118	423												
119	431												
120	432												
121	445												
122	446												
123	452												
124	454												
125	455												
126	462												
127	464												
128	465												
129	466												
130	503												
131	506												
132	516												
133	523												
134	526												
135	532												

A= Dispatch, **B**= Phone Access, **C**= Mobile Selective Call, **D**= Toll Restrict, **E**= Talkback, **F**= Full/Half Duplex, **G**= Privacy, **H**= User Enabled, **I**= Tone in tail, **J**= No Encode for inter-connect, **K**= Courtesy Tone, **L**= Reserved

USER #	Tone/Code	A	B	C	D	E	F	G	H	I	J	K	L

136	546												
137	565												
138	606												
139	612												
140	624												
141	627												
142	631												
143	632												
144	654												
145	662												
146	664												
147	703												
148	712												
149	723												
150	731												
151	732												
152	734												
153	743												
154	754												

A= Dispatch, **B**= Phone Access, **C**= Mobile Selective Call, **D**= Toll Restrict, **E**= Talkback, **F**= Full/Half Duplex, **G**= Privacy, **H**= User Enabled, **I**= Tone in tail, **J**= No Encode for interconnect, **K**= Courtesy Tone, **L**= Reserved

NOTES

BB. CTCSS/DCS AND MORSE CODE

Tables B-1 and B-2 provide a quick reference to be used by technicians while programming the Model 48-Jr. Table B-1 provides a listing of the user numbers versus CTCSS tone or DCS code numbers, and Table B-2 provides the DTMF number pairs used when programming the station Morse ID code.

Table B-1. User Numbers versus CTCSS Tones/DCS Codes

CTCSS FREQ.	USER NO.	CTCSS FREQ.	USER NO.	DCS CODE	USER NO.	DCS CODE	USER NO.
Carrier	0	203.5	41	145	76	413	117
67.0	1	206.5	42	152	77	423	118
69.4	2	210.7	43	155	78	431	119
71.9	3	218.1	44	156	79	432	120
74.4	4	225.7	45	162	80	445	121
77.0	5	229.1	46	165	81	446	122
79.7	6	233.6	47	172	82	452	123
82.5	7	241.8	48	174	83	454	124
85.4	8	250.3	49	205	84	455	125
88.5	9	254.1	50	212	85	462	126
91.5	10			223	86	464	127
94.8	11			225	87	465	128
97.4	12			226	88	466	129
100.0	13	**DCS CODE**	**USER NO.**	243	89	503	130
103.5	14			244	90	506	131
107.2	15			245	91	516	132
110.9	16	023	51	246	92	523	133
114.8	17	025	52	251	93	526	134
118.8	18	026	53	252	94	532	135
123.0	19	031	54	255	95	546	136
127.3	20	032	55	261	96	565	137
131.8	21	036	56	263	97	606	138
136.5	22	043	57	265	98	612	139
141.3	23	047	58	266	99	624	140
146.2	24	051	59	271	100	627	141
151.4	25	053	60	274	101	631	142
156.7	26	054	61	306	102	632	143
159.8	27	065	62	311	103	654	144
162.2	28	071	63	315	104	662	145
165.5	29	072	64	325	105	664	146
167.9	30	073	65	331	106	703	147
171.3	31	074	66	332	107	712	148
173.8	32	114	67	343	108	723	149
177.3	33	115	68	346	109	731	150
179.9	34	116	69	351	110	732	151
183.5	35	122	70	356	111	734	152
186.2	36	125	71	364	112	743	153
189.9	37	131	72	365	113	754	154
192.8	38	132	73	371	114		
196.6	39	134	74	411	115		
199.5	40	143	75	412	116		

Table B-2. Morse Code to DTMF Conversion, Station ID Cross-Reference

Digits	#	Code	Digits	Letter	Code	Digits	Letter	Code
00	0	– – – – –	12	A	• –	26	N	– •
01	1	• – – – –	22	B	– • • •	36	O	– – –
02	2	• • – – –	32	C	– • – •	17	P	• – – •
03	3	• • • – –	13	D	– • •	10	Q	– – • –
04	4	• • • • –	23	E	•	27	R	• – •
05	5	• • • • •	33	F	• • – •	37	S	• • •
06	6	– • • • •	14	G	– – •	18	T	–
07	7	– – • • •	24	H	• • • •	28	U	• • –
08	8	– – – • •	34	I	• •	38	V	• • • –
09	9	– – – – •	15	J	• – – –	19	W	• – –
			25	K	– • –	29	X	– • • –
30	/	– • • – •	35	L	• – • •	39	Y	– • – –
#	END		16	M	– –	20	Z	– – • •

Example: To set the call sign to "WNCR414, enter DTMF:

25 # 19 26 32 27 04 01 04 #

To remove (erase) an ID enter: "25 # #".

CC. DTMF PROGRAMMING

OVERVIEW

This appendix is provided as a convenience for experienced technicians. It is placed just inside the back of the manual to save time in looking up command numbers. It is not intended to replace reading Sections 3 and 4 of this manual to fully understand how to use the commands.

DTMF PROGRAMMING COMMANDS

01# _____# Connect Code (1 to 9 digits, "*" default)

02# _____# Disconnect Code (1 to 9 digits, "#" default)

03# _# Mobile answer type (0 = connect code, 1 = PTT + tone)

05# _# DTMF or Pulse Dial-out Mode (0 = DTMF [default], 1 = 61/39 pulse ratio, 2 = 67/33 pulse ratio)

06# __# Dial regeneration inter digit timeout (Range 0 to 60 seconds) ("*" or timeout will end regeneration)

07# __# Number of telco rings (0 to 10) before answering telephone (0=No Phone-Mobile, default = 1)

08# ___# Phone-to-Mobile Ringout tone/code (Range 0 to 154, 0 = overdial, 1 to 154 tone/code, default = 0)

10# Mobile ringout for 15 seconds (3 rings)

11# Mobile ringout for 30 seconds (5 rings) (default)

12# Mobile ringout for 60 seconds (10 rings)

13# Ringout once, wait 60 seconds for answer

14# __# Maximum number of digits dialed (1 to 99, 0 = No limit)

15# ____# Toll Restricted numbers for 1st mobile dialed digit (1 to 4 digits)

16# ____# Toll Restricted numbers for 2nd mobile dialed digit (1 to 4 digits)

17# Hookflash enable ON. ("*0" after dial regeneration to flash hook)

18# Hookflash enable OFF. (disable) (default)

19# Enable carrier repeat audio and control (no tones)

20# Disable carrier repeat, enable tone repeat only (default)

21# _# Set repeater hold time (Value 0 to 9 seconds) (default = 3 seconds)

23# Off Hook during Mobile-to-Mobile calls

24# On Hook during Mobile-to-Mobile calls (default)

25# _____# Morse code station ID/call sign

26# _# Morse ID type (0=No ID, 1=After activity, 2=Interval)

27# __# Morse ID interval (Range 1 to 99 minutes) (default = 15 Minutes)

28# KerChunk Filter ON

29# KerChunk Filter OFF (default)

30# __# Set Call limit timer (Range 0 to 10 minutes, 0 = Disabled)(default = 3 minutes)

31# Allow call-limit reset using DTMF "*"

32# Disallow call limit reset (default)

34# __# Courtesy Tone Morse Character (default = E)

35# __# Morse code speed (0 = 20 WPM, 1 = 25 WPM)

36# __# Set Mobile activity time (Range 30 to 99) (default = 30 seconds)

44# Enable printer (Option card required)

45# Disable printer (default)

46# Print Dispatch airtime record

47# Disable Dispatch airtime record printing

48# _____# Set Printer port (dd mm yy)

49# _____# Set Printer clock (hh mm ss)

For the purposes of the following commands, 50 through 53, the term "user#" will imply the following:

User # = 0 for Carrier Repeat (see also Command 19#)
1 to 50 for CTCSS tones (See Table in Appendix B)
51 to 154 for DCS codes (See Table in Appendix B)
999 for ALL Users (1 through 154 inclusive, do **not** use with 50#)

50# User# Mode# Set user mode. (Mode: 0=Disable, 1=Enable, 2=Reserve)
(default = 0 = disabled)

51# User# Attrib# Set User Attributes Set #1 (four digits must be entered for the attribute field, a "*" means don't change current entry)

first attribute =	Dispatch Enable Y/N	**1**/0/*
second "	Phone Access Y/N	1/**0**/*
third "	Mobile Select Call Y/N	1/**0**/*
fourth "	Toll Restrict Y/N	1/**0**/*

52# User# Attrib# Set User Attributes Set #2 (four digits must be entered for the attribute field, a "*" means don't change current entry)

first attribute =	Talk Back Enabled Y/N	1/**0**/*
second "	Full/Half Duplex	1/**0**/*
third "	Half Privacy Enabled Y/N	1/**0**/*
fourth "	Not Used (Don't care)	

53# User# Attrib# Set User Attributes Set #3 (four digits must be entered for the attribute field, a "*" means don't change current entry)

first attribute =	Tone in Tail Enabled Y/N	1/**0**/*
second "	No Tone Phone Y/N	1/**0**/*
third "	Courtesy Tone Y/N	1/**0**/*
fourth "	Not Used (Don't care)	

58# Connect button to Conversation Mode (default)

59# Connect button to Phone Answer Mode

83# Password# Optional password for Aux Ctrl access. (up to 5 digits)

84# _# Set AUX OUTPUT state during program mode (0 = FET off, and 1 = FET on)

85# Automatic disconnect on busy tone (during first 20 seconds of call)

86# Busy tone detector disable (default)

87# Automatic disconnect on busy tone (during the whole call)

88# Enable High speed phone programming upload (***DO NOT USE THIS COMMAND***)

89# 0# Number# Program autodial 0 (up to 16 digits each)

89# 1# Number# Program autodial 1 (up to 16 digits each)

89# 2# Number# Program autodial 2 (up to 16 digits each)

89# 3# Number# Program autodial 3 (up to 16 digits each)

89# 4# Number# Program autodial 4 (up to 16 digits each)

89# 5# Number# Program autodial 5 (up to 16 digits each)

89# 6# Number# Program autodial 6 (up to 16 digits each)

89# 7# Number# Program autodial 7 (up to 16 digits each)

89# 8# Number# Program autodial 8 (up to 16 digits each)

89# 9# Number# Program autodial 9 (up to 16 digits each)

90# Password# Change Program mode access password. (Must be five digits)
(default = 12948)

91# Password# Reset all program and database values
(Requires Program access password to confirm)

(All diagnostics are also accessable through front panel button)

92# Transmit audio test

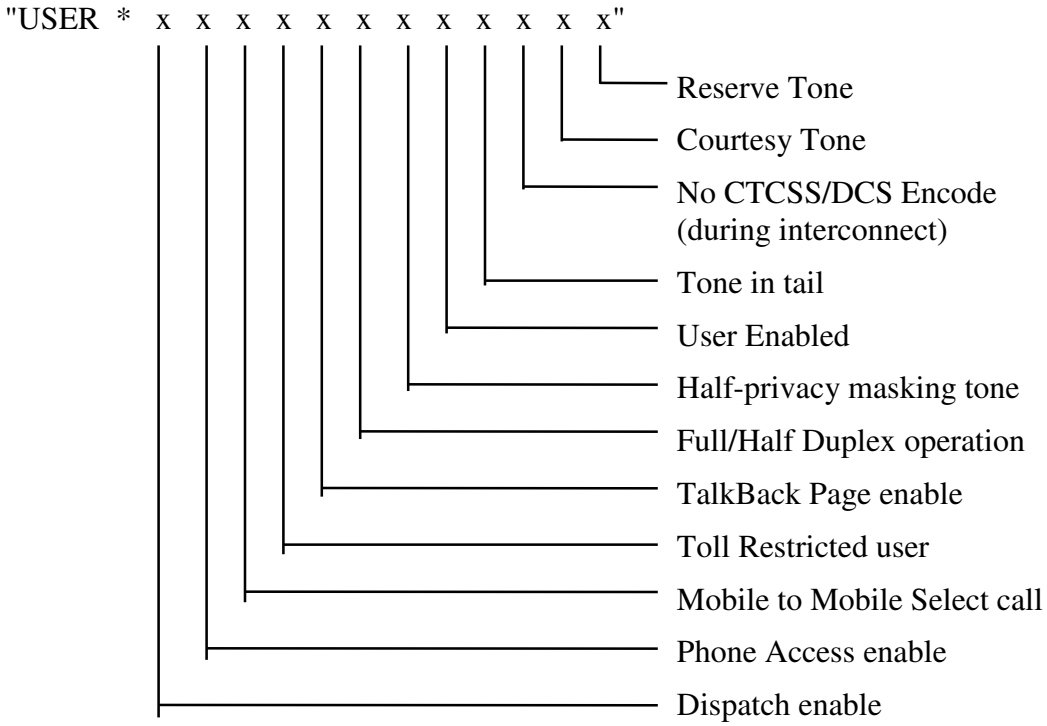
93# Repeat audio test

94# TX CTCSS/DCS test (67, 131.8, 254.1, DCS 023)

95# Hybrid adjust

96# Dial click decode test

97# _# Read User Database Info. (0=Read All, 1=Read Enabled, 2=Read Reserved)
Information is sent as DTMF digits. Format is:



98# Software version (sent in slow Morse as: *Major# period(•–•–•–) Minor#*)

99# Exit program mode, reset and return to operation