Model 8B Serial Number _____ Software Version _____

Z E T R O N

Model 8B
Repeater Programmer / Timekeeper
INSTRUCTION MANUAL

#025-9084G.1

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Please check for change information at the end of this manual.

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WARRANTY STATEMENT

Zetron's warranty is published in the current Zetron *United States Price Book*.

FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

To comply with FCC regulations, the following requirements must be met:

1. This device complies with Part 15 of the FCC rules for a Class A digital device. Operation is subject to the following two conditions:

   a. This device may not cause harmful interference.

   b. This device must accept any interference received, including interference that may cause undesired operation.

2. Repair work on this device must be done by Zetron, Inc. or a Zetron authorized repair station.

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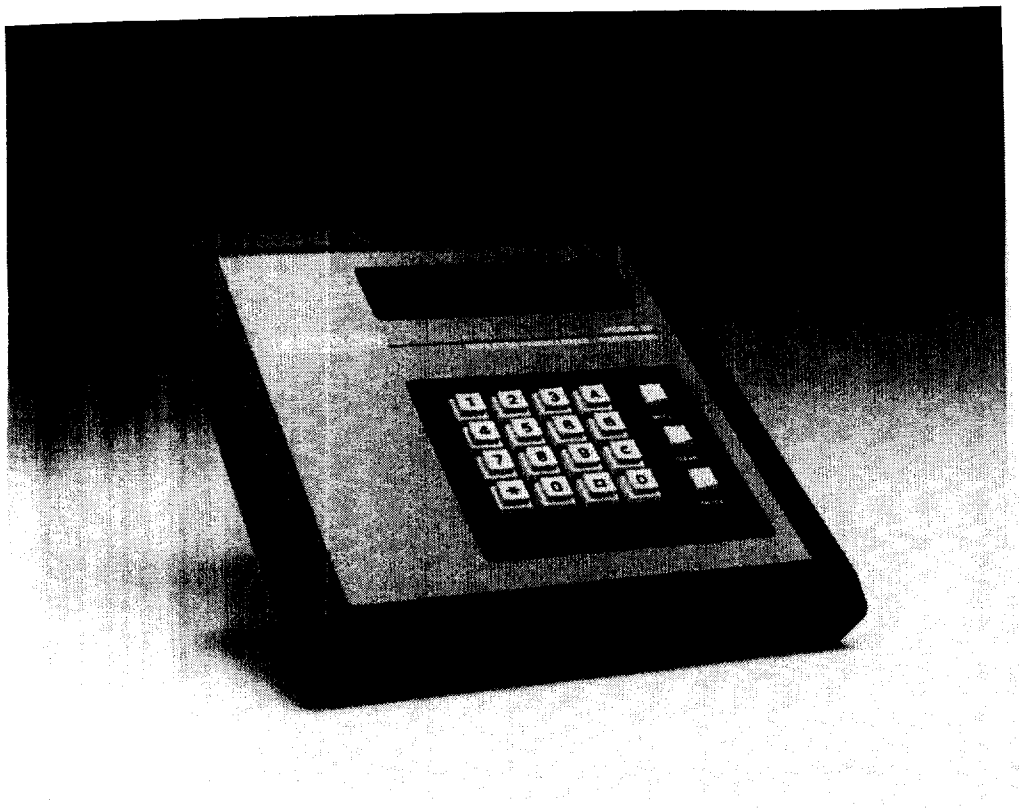
TRADEMARKS

1. INTRODUCTION

FEATURES

* Complete repeater panel management tool
* On-site or remote control of Model 38 repeater tone panel
* Decodes and displays all CTCSS tones and Digital (CDCSS) codes
* Internal airtime accumulator for all CTCSS tones and Digital codes
* Encodes all CTCSS tones and Digital codes
* RS-232 serial port
* Connects to printers for data hard copies
* Decodes site-alarm from Model 38
* Error-free "handshake" communication
* One Model 8 controls many repeater panels
* Compatible with other remote control tone panels
* 120 V AC or 12 V DC operation



GENERAL DESCRIPTION

The Model 8 Repeater Programmer/Timekeeper is much more than a DTMF encoder and decoder. It's a complete repeater panel management tool. A six-digit LED display allows an operator to "see" into a repeater panel's information banks for programming, and advanced features include a "decode" mode that decodes and displays every CTCSS tone frequency or digital code number it detects on the radio channel. The Model 8 has an RS-232 serial port for connection to a printer, it communicates in an error-free "handshake" protocol, and a single Model 8 can control multiple tone panels. Many different operating modes are included:

LIVE--
In this mode the Model 8 is a DTMF encoder and decoder. All 16 tone pairs are available (0-9, *, #, A, B, C, D). Any DTMF detected on the channel is displayed on the LED read-out. RS-232 output provides a hard copy of all DTMF encoding and decoding. Time and date stamp is available with the clock option.

PROG--
This mode enables over-the-air remote programming of the Model 38. All communication between the repeater panel and the Model 8 occurs in an error-free "handshake" protocol.

PANEL--
This mode is used when the Model 8 is connected directly to the Model 38's RS-232 serial port. The Model 8 acts just as if it were in the PROG mode (over-the-air), except that programming can occur without taking the repeater off the air (as if the Model 8 were a directly connected front-panel keyboard and display). This mode is also handy for testing the system during installation. A Model 8 in this mode can display tones and codes as they are decoded by the Model 38 tone panel on the channel.

PRINT--
This mode sends selected data to a printer. The data may be a Model 38 subscriber database or user airtime totals.

PAGING--
This mode allows DTMF paging, selective calling of mobile radios, or remote access to a phone patch. The user first enters the paging digits, then strikes the "Enter" key to forward the digits out over the radio channel.

SETUP--
This mode allows the system manager to change the parameters that determine the technical operation of the Model 8.

DECODE--
This mode decodes and displays any CTCSS tone frequency or digital code number detected on the radio channel. All 38 standard CTCSS tones and 104 digital codes are detected. In the "Decode" mode, the Model 8 will keep track of up to 100 hours of airtime use for each code and tone. This data may be viewed or printed at any time. This mode also allows changing the CTCSS encode tone, or digital squelch code sent to the transmitter.

RDU **and** DI-16--
These modes provide compatibility with older generation panels in a mixed system.

CLOCK--
This mode is only available if the clock option is ordered, and will simply display the current time and date. The clock option is used primarily to supply a time and date stamp for an ANI display if in live mode, or for the tone/code present in the decode mode.

AUX RELAY CONTROL--
An auxiliary relay is provided that can be activated by the decoding of any CTCSS tone or DCS code detected by the Model 8. Setup modes are provided to select which of the 154 possible CTCSS and DCS codes will activate the relay. If enabled, the relay will follow the CTCSS/DCS decoding. One possible use for the relay is to enable a monitor speaker for selected groups of mobiles on a channel.

2. SPECIFICATIONS

SPECIFICATIONS

Operating Modes	
"LIVE"	"Live" DTMF keypad operation, encode and decode.
"PROG"	Model 38 over-the-air programming.
"PANEL"	Front-panel direct connect to Model 38.
"PRINT"	Print Model 38 database or airtime accumulation.
"PAGING"	DTMF paging mode (store and forward).
"SETUP"	Select installation parameters.
"RDU"	Emulate CSI Remote Display Unit.
"DI-16"	Emulate Comm Spec DI-16 Data Interrogator.
"DECODE"	Decodes all CTCSS/Digital codes, stores airtime.
"CLOCK"	Time-of-day display, if clock option is installed.
"ONLINE"	Online with Zetron billing computer.
Display	Six 7-segment 0.4-inch LED digits.
Keyboard	19 keys: 0-9; *; #; A; B; C; D; MODE; CLEAR; ENTER.
Audio Output	Single-ended; adjustable 0 to 3 V peak-to-peak into 600 ohms.
CTCSS/Dig Output	Single-ended; adjustable 0 to 3 V peak-to-peak. All 38 standard CTCSS tones, all possible digital squelch codes (000 to 777), and any frequency from 50.0 to 300.0 in 0.1 Hz steps.
Signaling Format	DTMF encode and decode; all 16 tone pairs available. Handshake protocol for error-free communication.
Audio Input	Unbalanced; 0.5 to 5.0 V peak-to-peak adjustable.
Transmit Control	Contact closure.
Aux Relay	Selectable on/off to follow decoding of any CTCSS tone or DCS code.
Serial Data Port	RS-232 Compatible Levels:
Interface	Tx data, Rx data, common/gnd.
Handshake	Follows XON/XOFF protocol.
Baud Rate	Selectable: 150; 300; 600; 1200; 2400; 4800; 9600.
Configuration	8 bit, 1 stop bit, no parity.
Connections	Main power; Tx audio; Discriminator audio; Direct Mod; PTT.
Power Supply	Wall transformer: 12 VAC, 60 Hz or 12 to 14 VDC at 1.0 A maximum.
Size	2.7 in x 7.6 in x 7.8 in.
Weight	22 ounces.
Operating Temp.	0 to +65 degrees C.

3. OPERATION

OPERATION

The Model 8 is more than just a DTMF encoder and decoder because it performs a variety of functions. The functions are divided up into nine operating modes. The operating mode is selected from the front panel by use of the "Mode" key. The modes are:

Mode	Display	Function
0	Live	Emulating a DTMF keypad and decoder.
1	Prog	"Over-the-air" remote programming of the Model 38.
2	Panel	Direct connect programming of the Model 38.
3	Print	Printing selected data on an RS-232 printer.
4	Paging	DTMF paging or access to a phone patch.
5	Setup	Model 8 configuration and installation tests.
6	Rdu	Emulating a CSI Remote Display Unit.
7	Di-16	Emulating a Comm Spec DI-16 Data Interrogator.
8	Decode	Decode CTCSS/Digital, airtime accum, live DTMF pad
9	Clock	Time-of-day clock (if clock option is installed)

To select an operating mode, depress the "Mode" key repeatedly until the desired mode is displayed (the "Clear" key can be used to back up to the previous mode) then press the ENTER key. A quicker way to select the mode is to simply press a digit between 0 and 8, then "ENTER". Use the chart above to select the mode digit.

The display will flash, then scroll out the mode name. The selected mode is now active. To change to a new mode, simply push the "Mode" key whenever the Model 8 is expecting digits, and the current mode will be displayed. When the unit is powered off then back on, the Model 8 will return to the last selected mode, except in the case of the Live, Prog, Print, and Setup modes.

Site Alarm Decoder (background mode)
The Model 8 is always monitoring for a match to the site alarm decoder address, independent of the selected operating mode. If the code is detected, the Model 8 will halt any functions in process and display "=CALL=" while flashing the display. The "Aux" relay will engage until a key is pressed. This can be used to control an external warning buzzer, or other alerting equipment. The site alarm decoder address is set using the "Setup" mode, and can be from 1 to 8 DTMF digits in length.

In order to alert the decoder, there must be a 2 second pause before the first digit of the code is received, and a 2 second pause after the last digit of the code is received (the Model 38 provides the correct timing). This method removes the possibility of false decoding.

LIVE Mode (DTMF Encoder/Decoder)

The "Live" mode turns the Model 8 into a basic DTMF keypad and DTMF decoder. Any DTMF detected on the radio channel will be displayed on the LED readout. The digits are buffered and displayed at a fixed scroll rate to allow better viewing of fast DTMF sequences.

To encode DTMF, simply press the digit to send. All 16 tone pairs are available (0-9, *, #, A, B, C, D). When a key is depressed, the transmitter will be keyed, then the selected "Rx-to-Tx" delay will be met. This delay insures that the transmitter is up to full power before encoding any DTMF. If a digit is encoded prior to the delay, a double digit may be decoded by the receiving equipment (see the "Setup" mode section for Rx-to-Tx delay programming). When a key is released, the Model 8 will stay in transmit until the "T-hold" time expires (see the "Setup" mode section for T-hold programming).

The Model 8 is decoding and buffering received DTMF even while in transmit mode (in case of duplex operation), so that all DTMF on the channel will be decoded and displayed. NOTE: The DTMF digit "D" is shown as a blank in LIVE mode.

Decoded DTMF is routed to both the display and the RS-232 output port. The RS-232 output will add a carriage return after a packet of DTMF is received. This makes the RS-232 output more readable. A setup mode is added to determine when the carriage return is sent, based on the speed of the DTMF packets.

SETUP mode 29

```
  dt-to   (DTMF timeout)
  =2      (shows current state, prompts for new value)
Enter the time in 100-millisecond increments between digits, or ENTER
to leave as is.
```

RS-232 OUTPUT (with clock option)

```
11:57 a.m. 9/13/90 Tx:  123456  --  DTMF Encode Example
11:57 a.m. 9/13/90 Rx:  789D#0  --  DTMF Decode Example
```

PROG Mode (Remote Programming of Model 38)

The Model 8 may be connected to a base station transceiver to program the Model 38 "Over-the-Air". DTMF tones are used to transfer data between the two units.

* * * * * * * * * * * * * * * * N O T E * * * * * * * * * * * * * * * * * *

See Section 7 for a complete list of commands to be used in the prog or panel modes. For more information about the commands, see the Model 38 Repeater Tone Panel Instruction Manual (Part No. 025-9043).

* *

PROG MODE HANDSHAKE PROTOCOL--The Model 38, controlled by the Model 8, makes error-free programming and data-retrieval guaranteed. The 38/8 combination uses an error-prevention "handshake" protocol that protects your system settings, record keeping, and customer billing procedures.

Without the handshake protocol, there is no sure way to know that the information you send to the tone panel is received intact. There are numerous possible origins of interference: a mobile can key up at an inopportune time, wind may whip your antenna, or your tone panel can even receive data from a different operator who is concurrently programming his own nearby tone panel.

Similarly, there is no guarantee that the information you retrieve from your tone panel is in the exact form in which it left the tone panel. Adverse weather conditions, extraneous channel noise, or the transmission of a nearby tone panel could easily distort the data you see on your DTMF display.

These disruptions of your data exchange not only misalign your system settings, but they can also wreak havoc on your billing procedures: a community repeater owner who wants to bill his customers according to the airtime they use per tone can inadvertently charge his subscribers for erroneous amounts due to unsound transmissions.

This is not acceptable for most shared repeater owners; they need to be assured that the information they exchange with their tone panels is true and dependable.

The "handshake" error-prevention protocol used by the 38/8 combination prevents the acceptance of any data that has been distorted. Each data string sent between the units contains additional information that is automatically inserted by the transmitting unit. This added data is comprised of three pairs of characters that are related to the data string and to which the receiving unit will refer in order to verify the accuracy of the data string. Furthermore, each time the Model 8 or 38 sends data to the other unit, it will expect to receive an acknowledgement, or ACK, signal before sending more data strings. As described below, this results in an interactive mode of communication--thus the phrase "handshake."

PROG Mode (Remote Programming of Model 38) (cont.)

PREAMBLE, BYTECOUNT, AND CHECKSUM--The three main features of the error-prevention scheme are the "preamble," "byte-count," and "check-sum" signals added onto each DTMF data string.

When the Model 38 or 8 receives a data string from the other unit, it places it into a "buffer" memory. Then, before accepting the data, it looks at all three of the cross-checks.

First the "preamble" is checked. This is a set of two characters found at the beginning of the string. The preamble in the data string must be exactly what the unit is looking for or the data will be rejected and no ACK signal will be sent.

Next, the "byte-count" is inspected. The byte-count is a 2-character signal that is the sum total of all the characters within the string. If the byte-count deviates from the number of bytes received by the buffer memory, the string is not accepted and no ACK signal returns.

The "check-sum" is looked at next. This is a pair of characters that is the sum total of all of the numeric values contained in the data string. The slightest deviation of information within the rest of the string will result in a discrepancy between the check-sum and the total of numeric values as computed by the receiving unit, and again the data is not acknowledged.

Once the cross-checks have been looked at and found to be compatible with the size and sum of the data string, they are subtracted from the data. Then, the information within the buffer memory is accepted, and an ACK signal is sent.

ACKNOWLEDGEMENT SIGNAL--After the tone panel or Model 8 has received a data string from the other unit, has inspected the cross-checks to ensure that all data is complete and correct, and has decided that the data is acceptable, it sends back an "acknowledge," or ACK, signal. The ACK signal is simply a pair of DTMF digits. Once the confirming signal is received, the next string of data transmits.

If the transmitting unit receives no ACK signal, however, it will send the data again at a slightly slower rate. Re-transmission at a slower rate can overcome interfering radio noise or other factors that inhibit precise data exchange.

If no ACK is received after the second attempt, the data will be sent again. In all, four attempts will be made, each at a slower rate of transmission.

In the unlikely event that the information is not accepted by the fourth attempt, the system operator knows that a serious impediment to transmission exists that must be corrected. The system settings will not have been changed, and no potentially misleading information will have been entered into the operator's records.

PROG Mode (Remote Programming of Model 38) (cont.)

USING THE "PROG" MODE--When the "Prog" mode is entered, the Model 8 will send the DTMF code required to put the Model 38 into the "Program mode". Since the Model 38's program mode access code is user programmable, the Model 8 must be told what the code is. It is set with the "Setup" command (See "Setup" mode, under "A-code" programming). If the Model 8 sends the correct access code to the Model 38, after a short delay, the LED readout should display "READY". The prompt to enter a command is indicated by a blank display with a single "_" prompt character. No transmission of data will take place until the ENTER key is pressed. The "Clear" key may be used to backspace over incorrect data.

When a command is sent to the Model 38, an alphanumeric prompt will be returned along with the requested data. To examine a setting in the Model 38, enter the command, then when prompted to enter a new setting, simply press the ENTER key. The data will not be changed. Some settings may be greater than 6 digits in length. To display these, the Model 8 will scroll the code slowly across the display. For faster operation, when a alphanumeric prompt is displayed, pressing any key will cause the Model 8 will jump to the next phase of programming.

When prompted with a "Yes/No" question, enter a "1" for "Yes" or "0" for "No". When prompted for a value with a decimal place, enter the number ignoring the decimal. Example: Tx-hold = 0.0 to 9.9 seconds, to enter 1.5 seconds, press "15 Enter", or to enter 0.5 seconds, press "5 Enter" or "05 Enter".

IN CASE OF DIFFICULTY--The Prog mode uses high speed DTMF tones to transfer data. The audio into the Model 8 and Model 38 MUST be un-distorted. If data errors are detected, the units will re-send the data at a slower rate (the key-up time of the base station is also slowed down). If the units are working but retries are common, one of two possible problems exist. The most common one is that the key up time of the base station is slow. Try increasing the "Rx-to-Tx" time using the Setup mode. The other possibility is an audio problem. Distorted audio, clipping, and twist are NOT acceptable.

While communicating in the PROG mode, the control station must be able to capture the repeater--have a stronger signal strength into the repeater receiver than a dispatching mobile. If a mobile keys up during the PROG mode and overrides the control station using the Model 8, a communications error will occur. The Model 8 will retry to send the data up to 3 times. If the mobile interrupts the communications each time, the PROG mode aborts. The cure for this is to use the PROG mode during inactive times (weekends or evenings), or use a control station with enough power to capture the repeater.

PANEL Mode (Direct Connect)

The Model 8 may be used in the "Panel" mode for local programming without disrupting the normal operations of the Model 38 tone panel. This mode is provided since the Model 38 does not have a front panel keypad or display. The system operator can add, delete, or modify subscribers, without taking the system "out-of-service". All commands work just like the "PROG" mode (above) except that the functions are not done "over the air". See the Model 38 manual "PROGRAMMING" section for commands.

The direct connect mode is also suitable for installation aids to assist the installer or radio tech when first setting up the system, or for periodic tests and measurements.

Additional "front panel display" modes are available to display real-time system data, some examples are:

1. The current CTCSS tone frequency or digital code being received
2. The active receive, and transmit tones
3. The active user and airtime count

All of the above modes are completely transparent to the normal system operation. There is no need to "access the program mode" or take the system "out-of-operation". The subscribers will not be aware of any monitoring or programming in process.

* * * * * * * * * * * * * * * * N O T E * * * * * * * * * * * * * * * * * *

See Section 7 for a complete list of commands to be used in the prog or panel modes. For more information about the commands, see the Model 38 Repeater Tone Panel Instruction Manual (Part No. 025-9043).

* *

CONNECTION TO THE MODEL 38--When the Model 8 is operating in the "Panel" mode, it is interfaced to the Model 38 through the RS-232 serial port. Simply plug the RS-232 cable out of the Model 8 to the connector on the Model 38. When the Model 38 is powered on, the message "READY _" should be displayed. Pressing the ENTER key should cause the "_" prompt to be displayed.

The "PANEL" mode is really just a full duplex RS-232 terminal operating at 4800 baud with a 6 digit display. The "ENTER" key sends a <CR>, the "CLEAR" key sends a backspace character, and the number digits send the corresponding ASCII number characters.

The Model 8 may be powered through the RS-232 cable by the Model 38 Repeater Tone Panel (units with the RS-232 on the front panel). To use this configuration, first make sure that the power supply to the Tone Panel is capable of driving both units. Connect the wire from pin 6 of the 9-pin RS-232 connector, to pin 1 on the screw terminal board in the Model 8. Refer to the Model 38 schematic diagram to verify that the proper fuse and jumpers are installed to supply +12VDC out the RS-232 connector.

PANEL Mode (direct connect) (cont.)

IN CASE OF DIFFICULTY--The Model 38 serial port operates in one of two configurations; Model 8 mode or CRT mode. If the port is configured for CRT mode, and a Model 8 is connected, garbled data or no data will be seen. This is because the baud rate for the CRT mode is user programmable, and the data is not formatted for the Model 8. Conversely if a CRT terminal is connected to the Model 38, and the port is configured for Model 8 mode, garbled data or no data will be seen.

To change the Model 38 port configuration, the DTMF programming mode (over the radio channel) may be used, or the current selected interface device (CRT or Model 8) can also change the port configuration. Once it has been changed, the power must be cycled or the system reset (via a 20 second long DTMF tone on the repeater receiver channel) to actually update the port configuration.

PRINT Mode (print Model 38 airtime or database)

The "Print" mode is used to print out the Model 38 subscriber database or subscriber airtime counts. A printer or CRT terminal needs to be connected to the RS-232 serial port to log the information. The Model 8 contains a print buffer that can hold up to 1700 characters, so the printer may print at a slower speed than the actual data rate.

PRINTER SETUP--The "Setup" mode should be used to select the printer parameters such as: Baud rate, CR+LF, and Printer Delay. The setup mode also enables the printer to be tested before accessing the "Print" mode. When using the printer test command, the following message should appear:

```
===> Printer Test <===
01234567890123456789012345678 90
This is a test of the Zetron
Model 8 printer output port.
Configuration =
Baud Rate: x
CR+LF    : x
Pdelay   : x
```

If a blank line appeared between all lines, then set the CR+LF to "1" (to trap out the line feed command to the printer). If the data is garbled, check the Baud Rate. If the baud rate is correct but the data is still garbled, add some "Pdelay" (print delay after each character). The delay can be 0 to 99 milliseconds. The "Pdelay" also adds 20 times the amount selected after a carriage return and line feed commands.

PRINTING--To print all subscriber database information, access the "Print" mode. The display will prompt with "DATA=1, CNTS=2, _ ". To print the entire database, enter 1 (press 1, Enter), or to print the Airtime Counts, enter 2 (press 2, Enter).

The Model 8 will access the Model 38's program mode (note the program mode access code must be correct, see the Setup mode for Program Mode Access), then send a command to retrieve the data. The printer should start printing out data in columns. The Display will flash "=PRNT=" before each line is printed.

The Print mode uses the Model 38 DTMF interface protocol for error free data transfer, as in the "PROG" mode. In case of difficulty, see the "PROG" mode commands (above).

PAGING Mode

The "Paging" mode is available for users who need to do DTMF paging or selective calling of mobiles (or DTMF decoders). The basic mode of operation is "Store-and-forward", that is the user enters all of the digits to send (store), then presses the ENTER key to forward the digits out over the radio channel.

The A, B, C, and D keys have special functions in the Paging mode.

The "A" key will substitute the programmed "ANI" in place of the "A" in the display when sent. This is valuable when accessing a phone patch or sending a specific DTMF sequence many times over. The ANI is set in the "Setup" mode, and can be any of the 16 DTMF tones, and up to 12 digits in length.

The "B" key currently has no special function.

The "C" key will cause the transmitter to unkey, then flash the display until any key is depressed. When a key is hit, the transmitter will be keyed again and the remainder of the digits sent. This allows the user to listen to the channel for dial tone or other prompting.

The "D" key will insert a fixed two-second delay in the digit stream.

Setup mode command 21 may be used to selectively disable the "special function" A, C, & D keys. When disabled the normal DTMF digits A, C, & D will be sent.

To send the DTMF tones (which can be up to 30 digits in length), press the ENTER key. The transmitter will be keyed, then after the "P-delay" (paging-delay, keyup delay before sending tones, see "Setup" mode) is done the tone sequence will be sent. The ENTER key can be pushed again to repage.

The DTMF timing is set in the "Setup" mode. Default timing is 125 msec on and 75 msec gap.

The RS-232 port will output the paging information along with the date and time (if clock option is installed). For example:

10:23 a.m. 9/14/90 Page: 1234ABCD#*567

SETUP Mode

The Setup mode is provided to set up the programmable functions in the Model 8. To program an item, enter the one or two digit command code from the table below, then press ENTER. A prompt will indicate which command is selected, followed by a message or data. To examine a setting, simply enter the command. The data will be displayed, then an underscore prompt will appear. To leave the data intact, just press ENTER, or to change the data, key in the new value and press ENTER. If the new value is out of range, "-OOPS-" will flash on the display.

Notes: To speed up the operation, while a prompt is on the display, a key can be hit to jump to the next prompt. When the prompt is initially displayed, to abort the command press "CLEAR".

SETUP MODE COMMANDS-- [SEtuP]

Cmd	Description	Range / defaults
1	Transmitter hold time	(0.1-9.9 sec, default=2.0)
2	Paging mode keyup delay	(0.01-2.50 sec, def=0.75)
3	Model 38 Program Mode Access Code	(0-999, sends 12xxx)
4	DTMF timing "On duration" for Paging mode	(0.035-0.250, def=0.125)
5	DTMF timing "Off duration" for Paging mode	(0.015-0.250, def=0.075)
6	Base station Transmit to Receive time	(0.01-2.50, def=0.30)
7	Base station Receive to Transmit time	(0.01-2.50, def=0.08)
8	No function	
9	Send retry limit when in prog mode	(1-9, def=3)
10	ANI code for use in paging mode	
11	Site alarm decoder address	
12	Printer/Computer port baud rate	(1-7, def=2) {1=150, 2=300, 3=600, 4=1200 5=2400, 6=4800, 7=9600}
13	Trap out line feeds sent to printer yes/no	(0-1, def=0)
14	Printer delay after each character	(0-99, def=0 msec)
15	Printer test mode	
16	Default CTCSS/Digital Encode	(C0 to D777, def = C0)
17	PTT on	
18	PTT off	
19	Aux relay on	
20	Aux relay off	
21	Disable paging mode special functions	
22	Set clock (if installed)	
23	Test tone, DTMF digit 5	
24	Turn off test tone	
25	LED display test	
26	Erase (setup) all memory	
27	Display the software configuration number	
28	Copyright warning display	
29	Live mode DTMF timeout	(0.1 - 8.0 sec, def=2)
30	List users with airtime count greater than 1 min	
31	View a count	
32	Print all counts	
33	Clear all counts	(password=14325)
34	Digital polarity for decode (rx) and encode (tx)	(0-1, 1=invert)
35	Enable DTMF decode during DECODE mode	(0=no 1=yes)
36	Disable digital squelch decode	(0 = normal, 1 = disable digital)
37	Aux relay state for each CTCSS/Digital user	

RDU Mode (emulates CSI Remote Display Unit)

The RDU mode simulates the functions of the Communication Systems Inc, Remote Display Unit (RDU). The Zetron Model 38 repeater tone panel can also be set to transpond data formatted for the RDU mode. This allows both the Zetron and the CSI panels to send compatible data, removing the need for two different remote display units.

The decimal places are used to indicate "Hz", "Hr/Mn", and "Hits". Hits are indicated by a decimal point after the four digits, "Hz" and "Hr/Mn" are more obvious:

100.0 = Hz
12.32 = 12 hours, 32 minutes
4567. = Hits

When encoding DTMF, the programmed "Tx-hold" time will keep the base station keyed between digits (refer to the Setup section).

As with the CSI counterpart, the encoded digits are not displayed.

DI-16 Mode (emulates CommSpec DI-16)

The DI-16 mode is very similar to the RDU mode explained previously. It simulates the Communication Specialists model DI-16 Data Interrogator functions. As with the RDU mode, the Zetron Model 38 repeater tone panel can be set to transpond data in the DI-16 compatible mode. Only the Model 8 need be used to program and retrieve airtime counts from both the Zetron and Comm-Spec tone panels.

The Model 8 supports the printer output when retrieving airtime counts. Note the printer baud rate and other associated functions must be set for the specific printer attached to the Model 8.

When stray DTMF data is received by the Model 8, the digits will be printed on the printer rather than the "ERROR" printed by the Comm-Spec DI-16.

The decimal points are used as in the RDU mode above for indicating "Hz", "Hr/Mn", and "Hits".

100.0 = Hz
12.32 = 12 hours, 32 minutes
4567. = Hits

When encoding DTMF, the programmed "Tx-hold" time will keep the base station keyed between digits (refer to the Setup section).

As with the Comm-Spec counterpart, the encoded digits are not displayed.

SAMPLE PRINTOUT FROM MODEL 8 RECEIVING DATA FROM A COMM-SPEC TP-38

250.3Hz 00Hr 00Mn 0000 Hits
241.8Hz 00Hr 00Mn 0000 Hits
233.6Hz 00Hr 00Mn 0000 Hits
225.7Hz 00Hr 00Mn 0000 Hits
103.5Hz 00Hr 00Mn 0000 Hits
100.0Hz 00Hr 00Mn 0000 Hits
97.4Hz 00Hr 00Mn 0000 Hits
94.8Hz 00Hr 00Mn 0000 Hits
91.5Hz 00Hr 00Mn 0000 Hits
77.0Hz 00Hr 00Mn 0000 Hits
74.4Hz 00Hr 00Mn 0000 Hits
71.9Hz 00Hr 00Mn 0000 Hits
67.0Hz 00Hr 00Mn 0000 Hits

DECODE Mode (decodes CTCSS and digital squelch)

The Decode mode does more than the word implies. The following functions are supplied all in one mode:

1. DISPLAYING A RECEIVED CTCSS TONE OR DIGITAL CODE-- When a CTCSS tone frequency is detected, the Model 8 will display the letter "t" (for Tone) then the frequency. When decoding a Digital code, the unit will display "d" (for Digital) followed by the code number. All 50 standard CTCSS tones and 104 Digital codes are detected.

2. AIRTIME ACCUMULATION (REPEATER TIMEKEEPER)-- The airtime is accumulated for all 50 CTCSS tones and 104 Digital codes. It is recorded in hours:minutes:seconds for up to 99 hours, 59 minutes, and 59 seconds for each user. The times may be examined, printed, or cleared using the "SETUP" mode. User number 155 will record airtime for "carrier only" (no decode).

3. LIVE DTMF KEYPAD-- The keypad operates as a "Live" DTMF encoder. Simply press any digit 0 thru 9, or A, B, C, or D. This mode is similar to the "LIVE" mode (transmit hold time, etc).

4. CTCSS AND DIGITAL SQUELCH ENCODE-- The ENTER key may be used to select any CTCSS tone or Digital code for encoding on the channel. Press and hold the ENTER key until the display goes blank, then release the key. The display will then show the current tone or code being encoded (C0=none). To change the encode, press a "C" for CTCSS, or "D" for Digital, then the tone or code. CTCSS tones are entered as tone numbers from 1 to 50 (see the table below), or any frequency from 50.0 to 300.0 may be output. Just enter the frequency without a decimal (250.3 Hz = C2503 ENTER). For Digital Squelch, Enter the digital code directly (DPL 023 = D023 ENTER). To leave the encode as is, simply press ENTER. Examples:

   C 1000 = CTCSS 100.0 Hz
   D 023 = Digital code 023
   C 6 = CTCSS 79.9 Hz

   A new feature allows fast callback of a dispatch user on a community repeater. While in the DECODE mode, the CTCSS/Digital encode may be changed by pressing the CLEAR key to set the encode to whatever the current or last decoded CTCSS or Digital code was. The display will show what tone/code is being encoded.

5. DTMF DECODER-- The DTMF decoder may be enabled while showing active CTCSS and Digital squelch. If enabled any decoded DTMF will be displayed after a mobile unkeys (when CTCSS/Digital decode goes away), or may be viewed instantly by pressing the "CLEAR" key.

6. AUX RELAY FUNCTION-- The Aux relay can be programmed to follow specific CTCSS or Digital Squelch code decodes. This feature may be used for a variety of functions, some possibilities are: controlling the speaker of a radio to monitor specific customers on a community repeater, tape recording specific users, and honking a horn for specific tones.

   When a tone or code is decoded and displayed, the Model 8 will check the programmed on/off state for the relay. If the relay is programmed "On", the relay will close for the duration that the tone/code is decoded. Additional SETUP mode command 37 is available for selecting the relay.

SETUP COMMANDS FOR DECODE MODE--Additional **Setup modes** are as follows. Use the cross reference table provided when checking the airtime of a selected user.

-- 30 ** **List users with greater than one min. of accumulated airtime.**
Select the Setup mode, then press 30 (Enter). The display will show all user numbers with accumulated airtime. The numbers will be displayed for two seconds at a time. To speed the display, press the Enter key during the 2 second period to display the next number. Use the cross reference table to find the actual tone frequency or digital code. To abort the display, press "MODE".

-- 31 ** **View a user's airtime count.**
Select the Setup mode, then press 31 (Enter). A prompt will appear to enter the user to display. Enter a number (from the cross reference table provided) then press Enter. The tone frequency or digital code will appear, then the airtime count will be displayed in Hours:Minutes:Seconds format. Press any key to get a new prompt. To exit the mode, press Enter at the prompt.

-- 32 ** **Print all airtime counts.**
Select the Setup mode, then press 32 (Enter). The Model 8 will printout all airtime accumulation out the RS-232 port. Note: The printer baud rate and mode must be set prior to the printout. To abort the printout, press the "Clear" key.

-- 33 ** **Clear all airtime accumulation counts.**
To clear all counts, select the Setup mode, then press 33 (Enter). The Model 8 will require a password to continue. The password is 14325 (Enter). To abort the mode, press the ENTER key.

-- 34 ** **Invert the digital decode and/or encode polarity.**
The polarity must be properly set to decode the correct digital code. To invert the polarity, select the Setup mode, then press 34 (Enter). "r-inv" is the prompt for receive polarity, and "t-inv" is the prompt for transmit polarity. Enter a 0 for normal or 1 for inverted polarity. The encoded digital code must also be the proper polarity. Select "0" for normal, or "1" for inverted digital.

-- 35 ** **Enable DTMF decoding.**
The DTMF decoder may be enabled or disabled for DECODE mode. If enabled, the DTMF will be displayed when a mobile unkeys (when the CTCSS tone decode drops out). Select "0" at the "d-dt" prompt for no decoding of DTMF, or "1" to enable decoding of DTMF.

-- 36 ** **Disable digital squelch decode.**
The DECODE mode normally decodes both CTCSS and Digital Squelch codes. When using the keypad to encode DTMF in the DECODE mode, the first digit is slow to respond due to the time required to decode digital codes. On systems not using digital codes, the Model 8 may be set to ignore digital. This will cause the keypad to respond faster, as well as decode CTCSS faster. The command to disable Digital decode is:

```
SETUP mode 36
  d-diS   (digital-disable)
  =0 _    (shows current state, prompts for on/off)
Enter 0 to enable, 1 to disable, or ENTER to leave Digital
decode as-is.
```

-- 37 ** **Aux relay on/off per decode.**
The Aux relay may be set on or off while each tone or code is decoded.

```
  d-rly   (decode-relay prompt)
  User=   (prompts for a user number between 1-154, see DECODE mode)
  100.0   (shows cross reference from user number to freq/code)
  On/Off  (shows existing state of relay)
Enter 0 to disable relay, 1 to enable relay, or ENTER to leave as-is.
```

The following example shows text sent to the serial port of the Model 8 when in decode mode, with and without clock.

DECODE MODE RS-232 PRINTOUT:

```
Without clock option;
   CTCSS Rx: 100.0            ( CTCSS decode )
   CTCSS Rx:  71.9
   CTCSS Rx: 254.1
   DCS   Rx:   047            ( DCS decode )
   DCS   Rx:   023
   DTMF  Rx: 1234567890*#     ( DTMF decode )
   DTMF  Rx: 2068206363
   DTMF  Tx: 8207031          ( DTMF keypad encode )

With clock option;
 8:54:27am 11/18/92  DTMF  Tx: 8207031
 8:54:40am 11/18/92  DCS   Rx:   116     8:54:42am
 8:55:06am 11/18/92  DTMF  Rx: 2068206363
 9:00:46am 11/18/92  DCS   Rx:   025     9:00:47am
 9:03:15am 11/18/92  DCS   Rx:   116     9:03:18am
 9:03:18am 11/18/92  DTMF  Rx: 2068206363
 9:05:13am 11/18/92  CTCSS Rx: 225.7     9:05:14am
```

DECODE Mode (Decodes CTCSS and Digital Squelch) (cont.)

USER NUMBER TO FREQ/CODE CROSS REFERENCE TABLE

NOTE: Used only for number conversion with Setup commands 30 and 31.

---- CTCSS USERS ----

User	Freq	User	Freq
1.	67.0	26.	156.7
2.	69.4	27.	159.8
3.	71.9	28.	162.2
4.	74.4	29.	165.5
5.	77.0	30.	167.9
6.	79.7	31.	171.3
7.	82.5	32.	173.8
8.	85.4	33.	177.3
9.	88.5	34.	179.9
10.	91.5	35.	183.5
11.	94.8	36.	186.2
12.	97.4	37.	189.9
13.	100.0	38.	192.8
14.	103.5	39.	196.6
15.	107.2	40.	199.5
16.	110.9	41.	203.5
17.	114.8	42.	206.5
18.	118.8	43.	210.7
19.	123.0	44.	218.1
20.	127.3	45.	225.7
21.	131.8	46.	229.1
22.	136.5	47.	233.6
23.	141.3	48.	241.8
24.	146.2	49.	250.3
25.	151.4	50.	254.1

---------- DIGITAL USERS ----------

User	DCS code	User	DCS code	User	DCS code
51.	023	91.	306	131.	734
52.	025	92.	311	132.	743
53.	026	93.	315	133.	754
54.	031	94.	331	134.	036
55.	032	95.	343	135.	053
56.	043	96.	346	136.	122
57.	047	97.	351	137.	145
58.	051	98.	364	138.	212
59.	054	99.	365	139.	225
60.	065	100.	371	140.	246
61.	071	101.	411	141.	252
62.	072	102.	412	142.	255
63.	073	103.	413	143.	266
64.	074	104.	423	144.	274
65.	114	105.	431	145.	325
66.	115	106.	432	146.	332
67.	116	107.	445	147.	356
68.	125	108.	464	148.	446
69.	131	109.	465	149.	452
70.	132	110.	466	150.	454
71.	134	111.	503	151.	455
72.	143	112.	506	152.	462
73.	152	113.	516	153.	523
74.	155	114.	532	154.	526
75.	156	115.	546	155.	000
76.	162	116.	565		
77.	165	117.	606	NOTE: 155 = COR user	
78.	172	118.	612		
79.	174	119.	624		
80.	205	120.	627		
81.	223	121.	631		
82.	226	122.	632		
83.	243	123.	654		
84.	244	124.	662		
85.	245	125.	664		
86.	251	126.	703		
87.	261	127.	712		
88.	263	128.	723		
89.	265	129.	731		
90.	271	130.	732		

Normal/Inverted Digital Codes

Normal	Invert	Normal	Invert	Normal	Invert
023	047	223	134	445	043
025	244	225	122	446	255
026	464	226	411	452	053
031	627	243	351	454	266
032	051	244	025	455	332
036	172	245	072	462	252
043	445	246	523	464	026
047	023	251	165	465	331
051	032	252	462	466	662
053	452	255	446	503	162
054	413	261	732	506	073
065	271	263	205	516	432
071	306	265	156	523	246
072	245	266	454	526	325
073	506	271	065	532	343
074	174	274	145	546	132
114	712	306	071	565	703
115	152	311	664	606	631
116	754	315	423	612	346
122	225	325	526	624	632
125	365	331	465	627	031
131	364	332	455	631	606
132	546	343	532	632	624
134	223	346	612	654	743
143	412	351	243	662	466
145	274	356	212	664	311
152	115	364	131	703	565
155	731	365	125	712	114
156	265	371	734	723	431
162	503	411	226	731	155
165	251	412	143	732	261
172	036	413	054	734	371
174	074	423	315	743	654
205	263	431	723	754	116
212	356	432	516		

CLOCK Mode

If the clock option is installed in the Model 8, then it can be made to display the time of day continuously by putting it in the clock mode. To do this, press the Mode key until the prompt "CLOCH" is displayed. Then press the Enter key. The display will change to something like " 1.09 P ", which indicates a time of 1:09 PM.

Pressing any key other than the Mode key for about a second will cause the unit to display the current date (" 12.01.92 " stands for December 1, 1992) for about four seconds.

This mode is exited by pressing the Mode key for about a second. To set the time and/or date, go to the setup mode and use command #22. You will be prompted for the year, the month, and the day (in that order). Use two digits for each entry. Next you will be prompted for the hour (24-hour format), the minutes, and the seconds. If you use this command, you must enter the value for each prompt; the Model 8 will NOT retain its current setting and move on just by pressing the Enter key, the way it does in other commands or modes.

The clock mode only works to display the current time and date on the Model 8, it has nothing to do with the output of the serial port. To obtain a time/date stamped decode record for CTCSS/DPL or DTMF decode, the Model 8 needs to be the decode mode.

4. COMPUTER INTERFACE

INTRODUCTION

Zetron offers a communications utility software package for use with the Model 38 Repeater Panel. The package supports multiple devices including Model 38 repeater panels, Model 45 telephone interconnects, Model 48 repeater managers, and additional products.

Refer to the ZCU User's Guide (Part No. 025-9132) and the Model 38A Repeater Tone Panel Instruction Manual (Part No. 025-9043) for detailed information.

The computer interfaces directly to a tone panel through the RS-232 port. When the tone panel is at a remote site without phone lines (modem operation), or packet radio controllers (to move RS-232 data), the Model 8 may be used to download airtime accumulations.

For proper communication to exist between the devices, the RS-232 baud rate must be set the same on both the Model 8 and the computer. 4800 baud is recommended. The timeout in the ZCU Edit Devices menu must be set to 30.

Select the Upload/Download menu in ZCU. Then select Download Billing Data.

IN CASE OF DIFFICULTY

First check the cable connections between the computer and the Model 8. Only three wires (Tx, Rx, and signal ground) are required. The RS-232 connections are different on each computer based on the type and manufacturer of the serial communications card that is installed in the computer. Many brands and types are available, all with different connectors and pinouts. See Section 7, Model 8 Serial Port Cable Connections subsection for three typical configurations.

To check the serial communications between the Model 8 and the computer, access the terminal mode with the computer, and set the baud rate to 4800. Now select the PANEL mode on the Model 8 and press ENTER. Press the number keys on the Model 8, the digits should appear on the computer screen. Press the number keys on the computer and they should appear on the Model 8. This tests the communication both ways.

If nothing happens, short the transmit data to the receive data on the Model 8. When pressing keys on the Model 8, the digits should appear on the Model 8 display. If they appear, the Model 8 is functioning properly.

If Rx, Tx, and signal ground are correctly connected, then short the RTS and CTS lines together and short DTR and DSR together on the computer connector. This satisfies any hardware handshakes the computer is looking for.

Next access the SETUP mode in the Model 8 and check the baud rate. Execute the "Printer" test, and watch the screen on the computer. The printer test banner should appear. This tests the user selectable baud rate in the Model 8.

If the RS-232 tests work but the computer won't communicate with the Model 38, first check the password. The password in the ZCU device entry for the site must be set to 21nnn, where nnn is the Model 38 password between 000 and 999 (the default is 123). The password is entered in the "1st Code" field.

The Model 8 may be in any mode except DECODE and PANEL. When the access code is recognized in the Model 8, the display will show "OnLine". When communications has ended, the display will show ".....".

If you are trying to collect airtime billing data from the Model 38 via the Model 8 and every time that the computer sends the request via the serial port to the Model 8, the Model 8 shows "OnLine" but aborts, then put the Model 8 in PROG mode and see if you can get into programming on the Model 38 and read back settings from the tone panel.

If you get errors from the Model 8 (such as SndErr), then the problem is in the DTMF communications over the radio channel between the Model 8 and the Model 38. These problems could include audio levels, twist, clipping, Tx-to-Rx and Rx-to-Tx delays, etc.

For more information on over-the-radio communications problems between the Model 8 and the Model 38, refer to Section 3, PROG mode (page 3-5). See also the Section 4, Remote Programming via the Model 8 subsection in the Model 38A Repeater Tone Panel Instruction Manual (Part No. 025-9043). To see a typical device entry screen for the Model 8, see the Section 5, Model 8 subsection of the ZCU User's Guide (Part No. 025-9132).

5. INSTALLATION

INSTALLATION HARDWARE CONNECTIONS

1. POWER SUPPLY: Connect the two leads from the 12 VAC wall transformer to pins 1 and 2 on the terminal strip inside the Model 8. If DC operation is desired, connect the positive lead (11.5 to 13.6 VDC) to pin 1 and ground to pin 5. Note: Pin 1 is internally fused.

2. GROUND CONNECTION: Connect a wire from pin 5 to the chassis ground of the base station or power supply.

3. TRANSMITTER PTT: For most transmitters, a contact closure to ground will cause the transmitter to key up. Connect a wire from pin 10 to the PTT input of the transmitter. If PTT is activated by a closure to ground, no other PTT connections are necessary, just check that JP4 is installed. For transmitters that require a control voltage or other method of keying, connect a wire from pin 11 to the PTT common of the radio. JP4 should be out. Connect the control voltage to pin 10 for normally open, or pin 12 for normally closed contact configuration. If an additional contact is needed for PTT, see the "AUX RELAY" below.

4. TRANSMITTER AUDIO: Connect pin 3 through shielded cable to the audio input of the radio transmitter. The output impedance is selected by the value of R57. A 620 ohm resistor is used for low impedance, or remove R57 for high impedance mic input.

5. RECEIVER AUDIO: Connect pin 13 to the receiver audio output. If the "Decode" mode is to be used, pin 13 MUST be connected to the receiver discriminator. The discriminator is generally the best audio source to use for the Model 8. If the Decode mode is not to be used, the Model 8 may be connected to speaker audio. This is not a very good method since the receiver volume control will determine how well the Model 8 functions. It is preferable to find audio that is not affected by a volume control or other user accessible controls. JP7 will select the input gain for the Model 8. Position "A" is for high level input from receiver, "B" for low level audio input. Note: Input level must not exceed 5.0 volts peak-to-peak.

6. AUX RELAY OUTPUT: The auxiliary relay is used to indicate a site alarm condition. Its output is a contact closure that can be normally open, JP3 "B", or "C" for normally closed. The relay common connection is on pin 4 of the connector, and is normally grounded by JP6. When using a common lead, JP6 should be removed. If an additional PTT contact pair is needed and no site alarm contact, install JP13 in position "B". This will parallel the relays.

7. RS-232 PORT: The RS-232 tx-data is on pin 17, and rx-data on pin 15. A ground is supplied on pin 16. See Section 7 for typical cable connections.

8. CTCSS/DIGITAL OUTPUT: Connect pin 9 to the direct modulation input of the transmitter using shielded cable. R34 will adjust the output level.

9. CARRIER INPUT (Optional): Connect a carrier signal from the receiver squelch circuit to TB1 pin 7. The signal must be capable of driving the base of a transistor, and must switch between ground (less than 0.2 volts) and greater than 2 volts between carrier and no carrier conditions. Jumper JP17 selects the COR polarity. If the COR input is not connected, leave JP17 in position "B". JP1 position "A" provides a pull-up resistor for active low COR input.

Tests and Adjustments

1. AUDIO INPUT GAIN FROM RECEIVER: With a 1 kHz tone at 3 kHz deviation on the receiver frequency, adjust R14 for 1 volt peak-to-peak at TP1. Jumper JP7 will determine the input range (A=low gain, B=hi gain). If this method is not available, use the "LIVE" DTMF decode mode to determine if the proper digits are reliably being displayed. Note: Use a range of DTMF levels since not all sources of DTMF will be the same.

2. AUDIO OUTPUT GAIN:
   a. Press MODE until SETUP is displayed, then press ENTER.
   b. Press 23 ENTER, then 17 ENTER (DTMF digit 5 and PTT-ON).
   c. Set the deviation to 3 kHz with R26.
   d. Press 18 ENTER (PTT-OFF) to unkey the transmitter.

3. CTCSS and DIGITAL SQUELCH ENCODE GAIN:
   For direct FM transmitters (not phase modulated), remove capacitor CX1 (attached to the right side of R44). This will make sure the low frequency CTCSS tones (67 Hz) are the same deviation as the high frequency CTCSS tones (250.3), and that Digital Squelch may be encoded.

   a. Press MODE until SETUP is displayed, then press ENTER.
   b. Press 16 ENTER, C12 ENTER, 17 ENTER.
   c. Adjust R34 for 750 Hz (or desired) deviation.
   d. Press 18 ENTER (PTT-OFF) to unkey the transmitter.

Direct Connect to Model 38 Repeater Tone Panel

DIRECT CONNECT TO A MODEL 38: Connect the "DB-9" RS-232 plug to the J2 port on the Model 38. The only other connection required is main power into the Model 8.

The Model 8 may be powered thru the RS-232 cable by the Model 38 Repeater Tone Panel (units with the RS-232 on the front panel). To use this configuration, first make sure that the power supply to the Tone Panel is capable of driving both units. Connect the wire from pin 6 of the 9-pin RS-232 connector, to pin 1 on the screw terminal board in the Model 8. Refer to the tone panel schematic for proper jumper and fuse settings.

6. REPAIR

MODEL 8 TERMINAL SPARE PARTS KIT LIST (951-9008B)

ITEM	QTY	ZETRON P/N	DESCRIPTION	MFR. PART #
1.	1	107-0501	5K POT 1T	
2.	1	107-0502	50K POT 1T	
3.	1	107-0504	200K POT 1T	
4.	1	119-0006	10K x 9 R-PAK	
5.	1	152-0040	4.7 UF/50V POLY	
6.	1	154-0025	1 UF/35V TANT	
7.	1	154-0100	10 UF/16V TANT	
8.	1	155-0050	10 UF/25V ALUM AX	
9.	1	155-0055	22 UF/25V ALUM AX	
10.	1	155-0078	100 UF/6.3V ALUM	
11.	1	155-0140	3300 UF/25V ALUM AX	
12.	1	311-0030	DUAL LED 7-SEG	
13.	1	314-4373	OCTAL LATCH	74HCT373
14.	1	316-0004	TONE FILTER	MF4CN-50
15.	2	316-0353	OP-AMP, DUAL BIFET	LF353
16.	1	316-3403	QUAD OP-AMP	MC3403P
17.	1	316-7660	VOLTAGE CONVERTOR	ICL7660CPA
18.	1	316-7805	5V REGULATOR	LM340T-5
19.	1	316-7808	REGULATOR +8V	LM78L08CZ
20.	1	317-5406	DUAL RS-232 DRIVER	MC145406
21.	1	321-2090	DTMF XCVR	20C90
22.	1	321-6264	8Kx8 RAM	HM6264 LP-1
23.	1	321-6522	VIA	6522
24.	1	321-6804	MICROPROCESSOR W/RAM	6803U4CP
25.	1	323-4015	DUAL SHIFT REG	MC14015B
26.	1	323-4053	3PDT SWITCH	MC144053
27.	1	323-4066	QUAD ANALOG SWITCH	MC144066
28.	1	324-4139	DUAL 2-4 LN DECODER	74HC139
29.	1	324-7400	QUAD NAND	74HC00
30.	1	324-7414	HEX SCHMIDT	74HC14
31.	1	340-0014	DARLINGTON	MPSA14
32.	1	340-2003	DARLINGTON PACK	ULN2003
33.	1	340-3904	NPN	2N3904
34.	4	342-0001	SILICON 1A/100V	1N4002
35.	1	342-3009	SILICON	1N4148
36.	1	343-3030	1W/6.2V +-5%	1N4735A
37.	1	343-3102	1W/10V +-5%	IN4740A
38.	1	371-0002	KEYSWITCH	
39.	1	373-0116	16 KEY PAD	
40.	1	376-0245	2.4567 MHZ XTAL	
41.	1	376-0358	3.58MHZ XTAL	
42.	1	380-0030	RELAY SPDT	DSZE-M-DC12V
43.	1	416-1202	FUSE, 2A	
44.	1	416-1214	28-PIN SKT/BATT 8K/15K	DS1213C
45.	1	416-3040	FUSE CLIP	

MODEL 8B REPEATER PROGRAMMER/TIMEKEEPER PARTS LIST (702-9126B) 1 OF 3

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF	MFR. PART #
1.	1	101-0033	22 OHM	R79	
2.	5	101-0049	100 OHM	R30 37 45 46 77	
3.	1	101-0065	470 OHM	R21	
4.	1	101-0068	620 OHM	R57	
5.	1	101-0069	680 OHM	R44	
6.	5	101-0073	1K	R6 7 22 24 55	
7.	3	101-0085	3.3K	R10 75 76	
8.	1	101-0092	6.2K	R58	
9.	1	101-0094	7.5K	R38	
10.	18	101-0097	10K	R1 2 4 5 16 17 28 36 41-43 50 66-70 80	
11.	1	101-0100	13K	R19	
12.	1	101-0102	16K	R13	
13.	3	101-0103	18K	R18 25 29	
14.	1	101-0105	22K	R51	
15.	5	101-0113	47K	R8 61 62 73 74	
16.	9	101-0121	100K	R3 15 20 27 47-49 52 53	
17.	1	101-0129	220K	R12	
18.	4	101-0145	1M	R9 11 65 71	
19.	1	107-0501	5K POT 1 TURN	R23	
20.	2	107-0502	50K POT 1 TURN	R26 34	
21.	1	107-0504	200K POT 1 TURN	R14	
22.	2	150-0024	24 PF 1KV DISC	C30 31	
23.	1	151-0010	100 PF 50V TS	C11	
24.	1	151-0199	.47 UF 50V TS	C8	
25.	14	152-0012	.1 UF 50V POLY	C3-5 14 23 28 32 34 36 38 45-48	
26.	3	152-0040	4.7 UF 50V NON-POLAR	C16 17 CX1 NOTE 2	
27.	4	152-0085	.01 UF 50V POLY	C9 12 18 26	
28.	5	152-0089	.001 UF 50V POLY	C6 10 21 33 40	
29.	4	152-0250	.047 UF 50V POLY	C2 19 22 29	
30.	1	154-0025	1 UF 35V TANT	C27	
31.	1	154-0100	10 UF 16V TANT	C15	
32.	6	155-0050	10 UF 25V ALUM AX	C13 39 41-44	
33.	1	155-0055	22 UF 25V ALUM AX	C7	
34.	1	155-0078	100 UF 6.3V ALUM	C1	
35.	1	155-0140	3300 UF 25V ALUM AX	C35	
36.	1	210-0001	440 NUT	XVR1	
37.	1	220-0102	440x3/8 PH SCREW	XVR1	
38.	3	311-0030	DUAL LED 7-SEG AMBER	DS1-3	
39.	2	311-3213	REC. RED LED	DS4 5	
40.	1	316-0004	TONE FILTER	U17	MF4CN-50

MODEL 8B REPEATER PROGRAMMER/TIMEKEEPER PARTS LIST (702-9126B) 2 OF 3

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF	MFR. PART #
41.	3	316-0353	OP-AMP, DUAL BIFFET	U1 2 9	LF353
42.	1	316-3403	QUAD OP-AMP	U10	MC3403P
43.	1	316-7660	VOLTAGE CONVERTER	U27	ICL7660CPA
44.	1	316-7805	REGULATOR +5V 1.5A	VR1	LM340T-5
45.	1	316-7808	REGULATOR +8V	VR2	LM78L08CZ
46.	1	317-5406	DUAL RS-232 DRIVER	U23	MC145406D
47.	1	321-2090	DTMF XCVR	U20	20C90
48.	1	321-6264	8Kx8 RAM	U19	HM6264 LP-4
49.	1	321-6522	VIA/TIMER	U21	R6522
50.	1	321-6804	MICROPROCESSOR W/RAM	U15	6803U4CP
51.	6	323-4015	DUAL 4-BIT SHIFT REG.	U3-8	MC14015B
52.	1	323-4053	3PDT SWITCH	U12	MC144053
53.	1	323-4066	QUAD ANALOG SWITCH	U11	MC140664
54.	1	324-4139	DUAL 2-4 LN DECODER	U24	74HC139
55.	1	324-7400	QUAD NAND	U26	MC74HC00
56.	1	324-7414	HEX SCHMIDT	U25	74HC14
57.	1	325-4373	OCTAL LATCH	U14	74HCT373
58.	1	340-2003	RELAY DRIVER 50V/.5A	U16	ULN2003
59.	1	340-0014	NPN DARLINGTON	Q2	MPSA14
60.	3	340-3904	NPN 40V/200MA	Q1 3 4	2N3904
61.	4	342-0001	SILICON 1A/100V	CR6-9	1N4002
62.	5	342-3009	SILICON	CR3 4 10-12	1N4148
63.	1	343-3030	1W 6.2V +-5%	CR5	1N4735A
64.	1	343-3102	1W 10V	CR1	1N4740A
65.	3	371-0002	SINGLE KEY	SW1-3	
66.	1	376-0245	2.4576 MHZ HC33/HC18	Y1	
67.	1	376-0358	3.58 MHZ HC 18 CASE	Y2	
68.	2	380-0030	DPDT 12V COIL MINI	K1 2	
69.	1	381-0010	HEATSINK	XVR1	
70.	1	401-0009	12 POS THRU PCB	J1	
71.	35	401-0052	STAKE PINS	TP1 2 3 (1 EA) XJP4 5 (2 EA) XJP1 2 7-10 13 17 (3 EA) XJP3 (4 EA)	
72.	2	401-0112	12-POS 45DG SCR TERM	TB1 2	
73.	12	402-3040	MINI JUMPER	JP1 2 7-10 13 17 POS A JP3 POS A & C JP4 5 IN	
74.	5	407-0008	SKT, 08 PIN DIP	XU1 2 9 17 27	
75.	4	407-0014	SKT, 14 PIN DIP	XU10 11 25 26	
76.	10	407-0016	SKT, 16 PIN DIP	XU3-8 12 16 23 24	
77.	1	407-0020	SKT, 20 PIN DIP	XU14	
78.	1	407-0022	SKT, 22 PIN DIP	XU20	
79.	2	407-0028	SKT, 28 PIN DIP	XU18 19	
80.	2	407-0040	SKT, 40 PIN DIP	XU15 21	

MODEL 8B REPEATER PROGRAMMER/TIMEKEEPER PARTS LIST (702-9126B) 3 OF 3

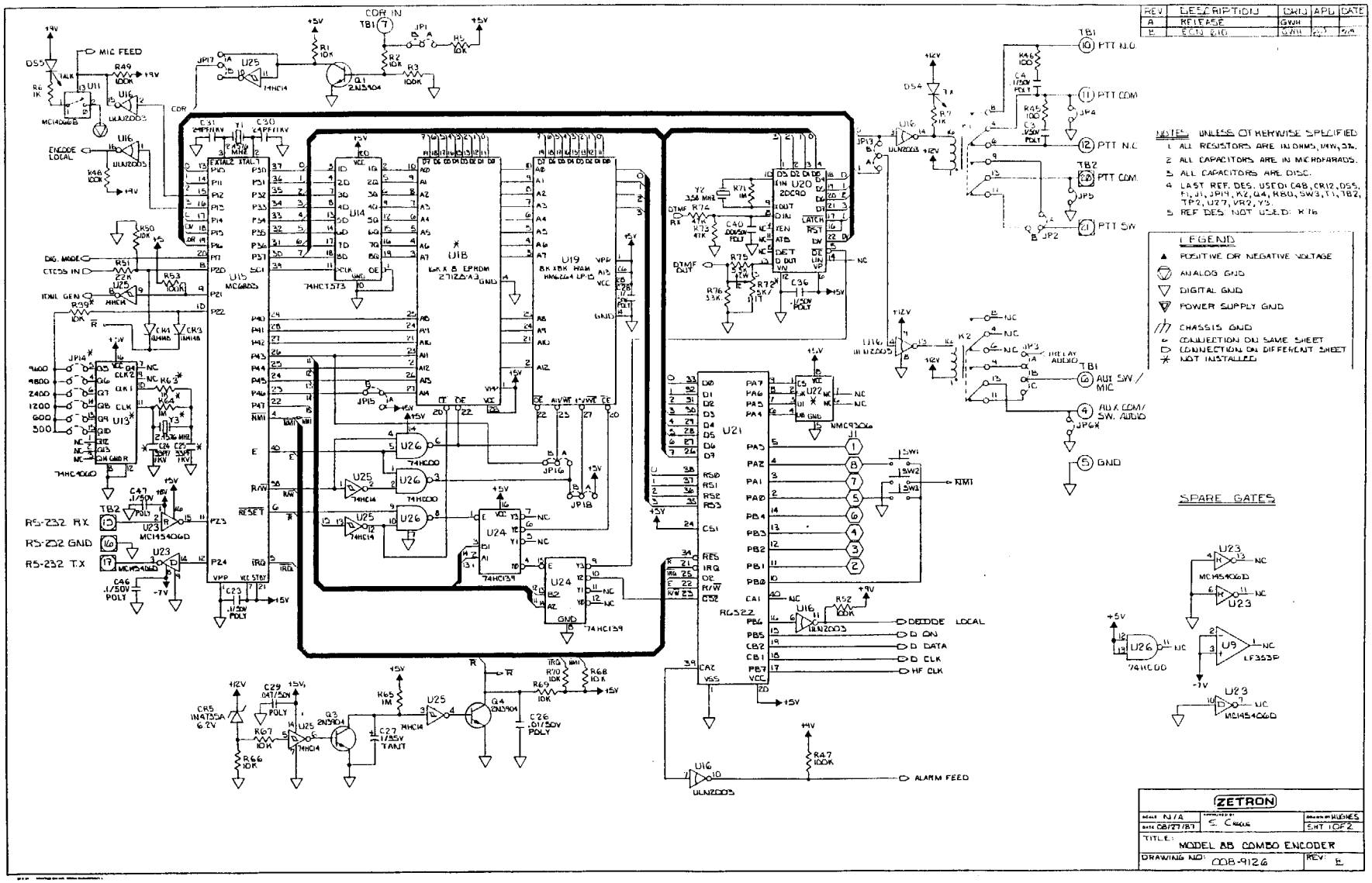
ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF	MFR. PART #
81.	2.0"	408-0012	22 GA BARE WIRE	XJP11 15 16 18 POS B	
82.	1	410-9125A	PCB, BARE		
83.	1	416-1202	FUSE, AGA 2A	F1	
84.	1	416-1213	28 PIN SKT/BATT	XU19	
85.	2	416-3040	FUSE CLIP	XF1	
86.	A/R	561-0001	THERMAL COMPOUND	XVR1 (NOTE 1)7	

DO NOT INSTALL:

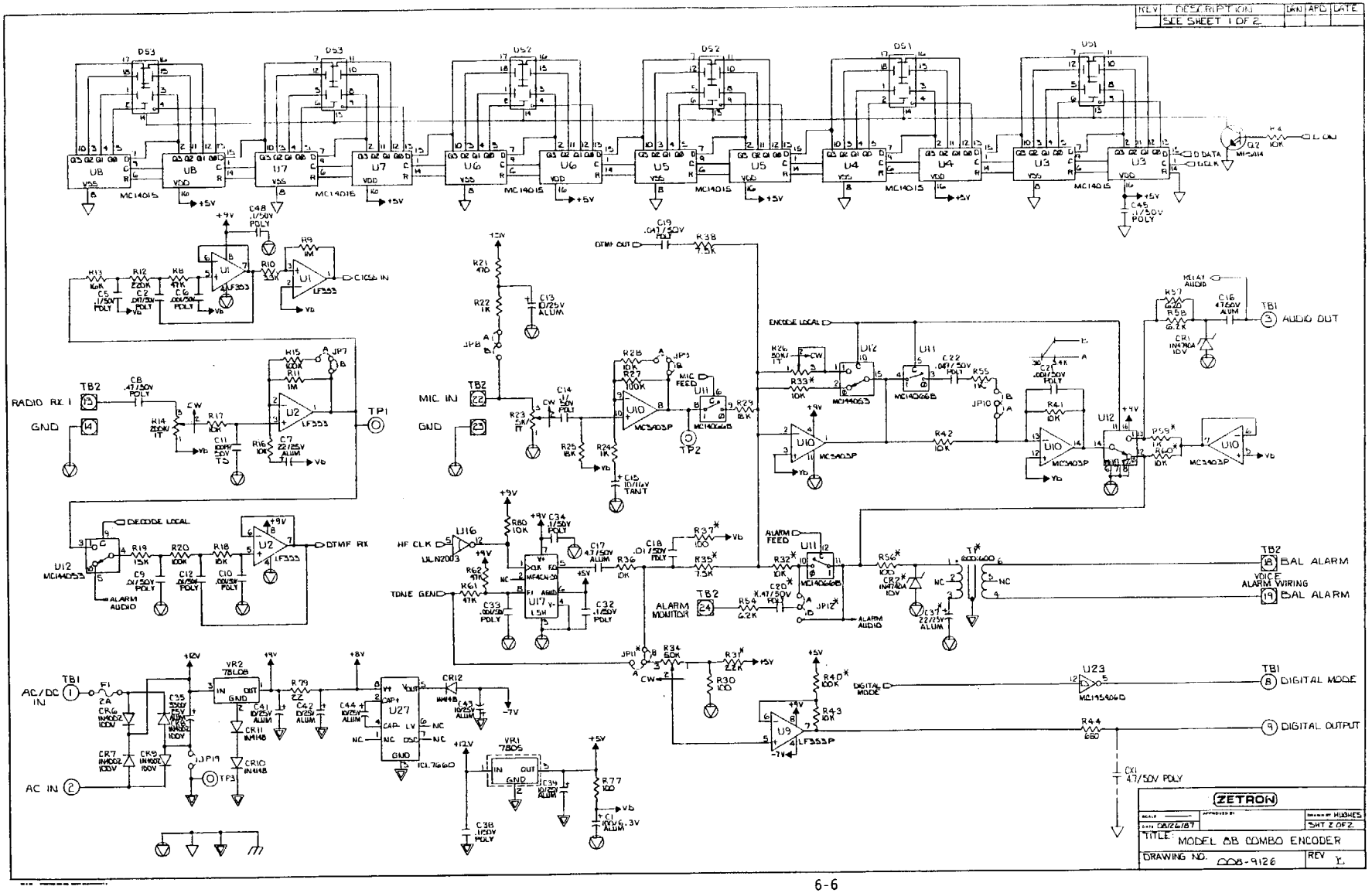
R31-33 35 39 40 54 56 59 60 63 64 72
U13 18 22
JP6 12 14 19
C20 24 25 37
Y3
CR2
T1

NOTES:
1. APPLY BETWEEN VR1, ITEM 43 AND HEATSINK, ITEM 68.
2. CONNECT CX1 FROM RIGHT SIDE OF R44 TO TRACE GOING TO - SIDE OF C13, ON COMPONENT SIDE OF PCB.

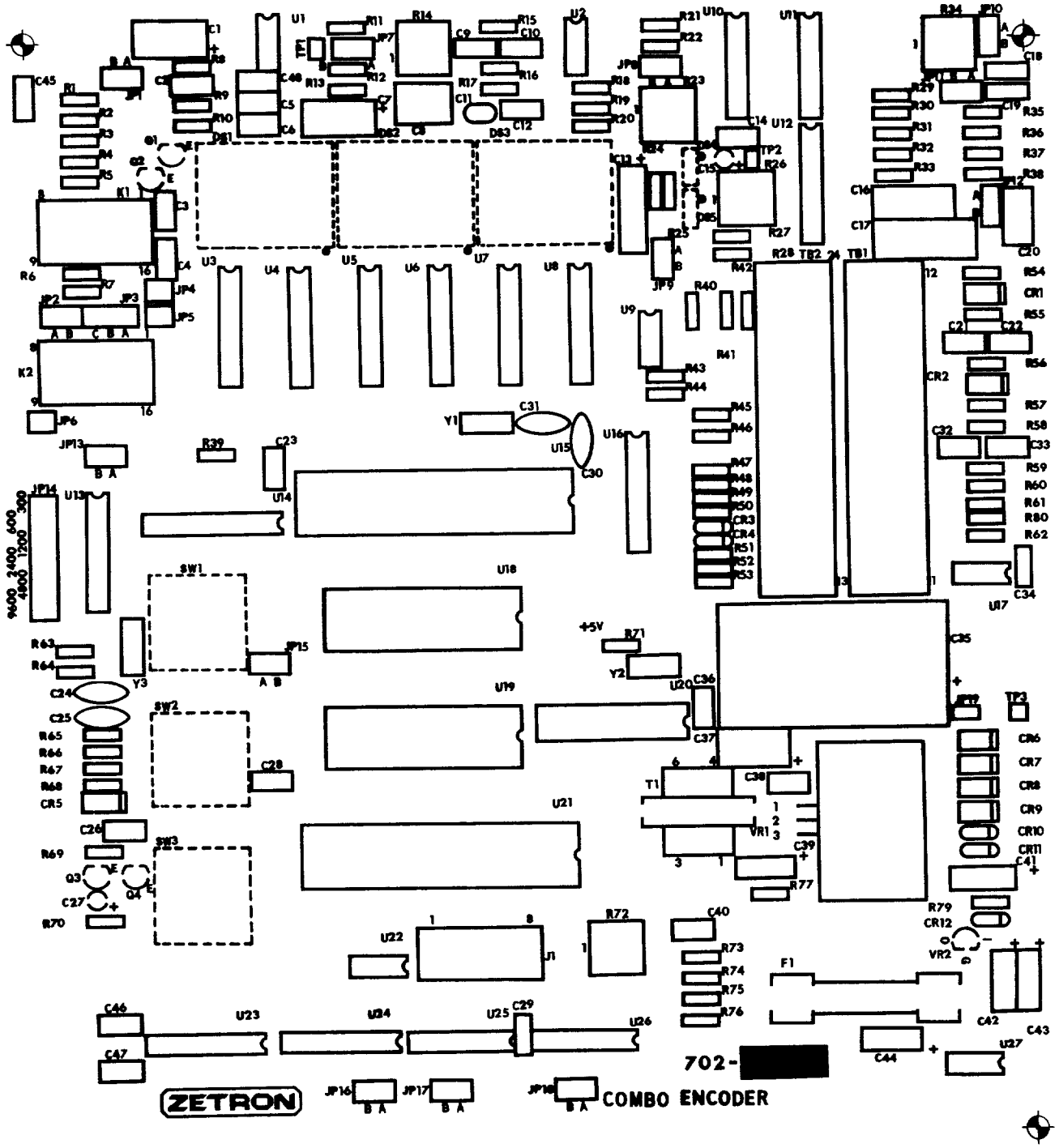
MODEL 8 TERMINAL SCHEMATIC (008-9126B) SHT 1 OF 2



MODEL 8 TERMINAL SCHEMATIC (008-9126B) SHT 2 OF 2



MODEL 8 TERMINAL SILKSCREEN (702-9126B)



7. QUICK REFERENCE

MODEL 8 SETUP MODE COMMANDS (Model 8 in "SETUP" mode)

Cmd	Description	Range / defaults
1	Transmitter hold time	(0.1-9.9 secs, default=2.0)
2	Paging mode keyup delay	(0.01-2.50 secs, def=0.75)
3	Model 38 Program Mode Access Code	(0-999, sends 12xxx)
4	DTMF timing "On duration" for Paging mode	(0.035-0.250, def=0.125)
5	DTMF timing "Off duration" for Paging mode	(0.015-0.250, def=0.075)
6	Base station Transmit to Receive time	(0.01-2.50, def=0.30)
7	Base station Receive to Transmit time	(0.01-2.50, def=0.08)
8	No function	
9	Send retry limit	(1-9, def=3)
10	ANI code for use in paging mode	
11	Site alarm decoder address	
12	Printer/Computer port baud rate	(1-7, def=2) {1=150, 2=300, 3=600, 4=1200 5=2400, 6=4800, 7=9600}
13	Trap out line feeds sent to printer yes/no	(0-1, def=0)
14	Printer delay after each character	(0-99, def=0 ms)
15	Printer test mode	
16	Default CTCSS/Digital Encode	(C0 to D777, def=C0)
17	PTT on	
18	PTT off	
19	Aux relay on	
20	Aux relay off	
21	Disable paging mode special functions	
22	Set clock (if installed)	
23	Test tone, DTMF digit 5	
24	Turn off test tone	
25	LED display test	
26	Erase (setup) all memory	
27	Display the software configuration number	
28	Copyright warning display	
29	Live mode DTMF timeout	(0.1-8.0 sec, def=2)
30	List users with airtime count greater than 1 min	
31	View a count	
32	Print all counts	
33	Clear all counts	(password=14325)
34	Digital polarity for decode (rx) and encode (tx)	(0-1, 1=invert)
35	Enable DTMF decode during DECODE mode	(0=no 1=yes)
36	Disable digital squelch decode	(0 = normal, 1 = disable digital)
37	Aux relay state for each CTCSS/Digital user	

MODEL 8 PROG AND PANEL MODE COMMANDS

Cmd	Description	Range	Prompt
System Commands			
2	Timeout Timer	(1-9 minutes)	t-out=
3	CTCSS hold time	(0.1-2.5 seconds)	C-hold=
4	Hog mode idle time	(1-99 seconds)	HoG-I=
6	Hog mode penalty time	(1-999 *10 seconds)	HoG-P=
7	DTMF Timeout	(1-9 seconds)	Dt-to=
8	Beep tone frequency	(400-4000 Hz)	bEEP-F=
9	Morse ID Tone frequency	(400-2000 Hz)	Id-F=
10	Morse ID interval	(1-99 minutes)	Id-int=
11	Site Alarm code	(1-8 digits)	S-codE=
12	Site alarm CTCSS encode tone	(0-38) or (1000-1777)	S-tonE=
13	Site alarm on power up	(on/off)	S-Pron=
14	List number of active users		tONES=
15	List the active user numbers		USErS=
16	Clear all counts	(password=12345)	CLEAr=
17	Timeout ID	(on/off)	To-id=
18	Program mode access code	(12nnn#) or (1000-32000)	A-codE=
19	Select CRT (or Model 8) mode	(on/off)	Crt=
	(Crt=off =Model 8 in direct connect "Panel" mode)		
20	Digital Sq. encode polarity	(on=inv. off=norm.)	d-inv=
21	Digital Sq. decode polarity	(on=inv. off-norm.)	r-inv=
22	Morse readback speed	(4-25 words/min)	Id-SP=
23	Tx-hold beeps every second	(on/off)	t-bip=
24	Anti-kerchunker filter	(0-50 *0.1 seconds)	Chunk=
25	Set CRT mode baud rate	(1=150 .... 6=4800)	bAud=
26	Set System ID user number	(0-60)	Id-S=
27	Set open repeat (COR) user	(0-60)	cor-r=
28	Accumulate Airtime during Tx Hold	(on/off)	d-bill=
29	Remote PTT tone/code	(0-38) or (1000-1777)	r-Ptt=
User Commands			
30nn	Enable User number "nn"	(on/off)	ENAblE=
31dd	Tone translation for user "dd"	(00-38 or 1000-1777)	EncodE=
32uu	Encode during Tx hold time	(on/off)	tAIL=
33uu	Privacy mode	(on/off)	Priv=
34uu	Reserve mode	(on/off)	Res=
35uu	Courtesy beep tone	(on/off)	CUE=
36uu	Last user ID	(on/off)	LU-id=
37uu	Hog mode	(1.0-25.0 minutes 0=off)	HoG-L=
38uu	DTMF commands enable	(on/off)	dt=
39uu	Set user time	(hh.mm.s)	Air=
	(Note: Times can only be set in 10 second increments minimum)		
40uu	Prepay airtime mode	(on/off)	PrEPAY=
41uu	Set Digital decode	(000-777)	dEcodE=
42uu	Auxiliary Relay	(on/off)	rElAY=
	(If Aux. Relay option is installed.)		
43uu	Transmit Hold Time	(0-25.0 seconds)	t-hold=

MODEL 8 PROG AND PANEL MODE COMMANDS (Continued)

Cmd	Description	Range	Prompt
Diagnostic Commands			
60	Site alarm test, do it?	(yes/no)	SitE-A
61	** Repeat audio	(yes/no)	rEPEAt
62	** Encode DTMF digit "n"	(0-15 or 99=off)	dt=
63	Encode Tone or code	(01-38, 1000-1777, 0=off)	SQ=
64	** Encode freq. "n"	(400-4000 Hz, 0=off)	bEEP=
65	Encode sub-audible freq. "n"	(50.0-300.0 Hz)	Ct-F=
66	CTCSS tone sweep	(yes/no)	C-test
70	List the number of program mode accesses		P-Cnt=
71	List the number of resets		R-Cnt=
72	List the number of power fails		PF-Cnt=
73	List the system error number		SYSErr=
74	List how many users have memory errors		t-Err=
75	List the User numbers with errors		tn-Err=
76	Clear reset, pwr fail & prog cntrs	(password=12345)	C-SYS=
77	Clear all memory, setup defaults	(password=25327)	ErASE
Direct Connect (Front Panel) Commands			
80	** Display received tone or code	(example 100.0)	
81	** Display Rx and Tx user number	(example r12.t12)	
82	** Display tone timer for active User	(12 -- hhh.mm.s)	
99	Exit the remote program mode		

** = These commands available only in direct connect panel mode.

Notes:

1. Once a user has been selected, it need not be re-entered.

   Example: 3012 <enter> = check enable/disable status of User number 12
   31 <enter> = check the encode frequency of User number 12

2. A full list of serial port baud rates is:

   1= 150, 2= 300, 3= 600, 4= 1200, 5= 2400, 6= 4800, 7= 9600

MODEL 8 SERIAL PORT CABLE CONNECTIONS

There are three typical configurations.

1. Model 8 directly connected to a Model 38A or a Model 39

Model 8 on TB-2			DB-9 connector to Model 38A	
Rx Data	Pin-15	<——	Pin-3	Tx Data
Signal Gnd	Pin-16	<——>	Pin-5	Signal Gnd
Tx Data	Pin-17	——>	Pin-4	Rx Data

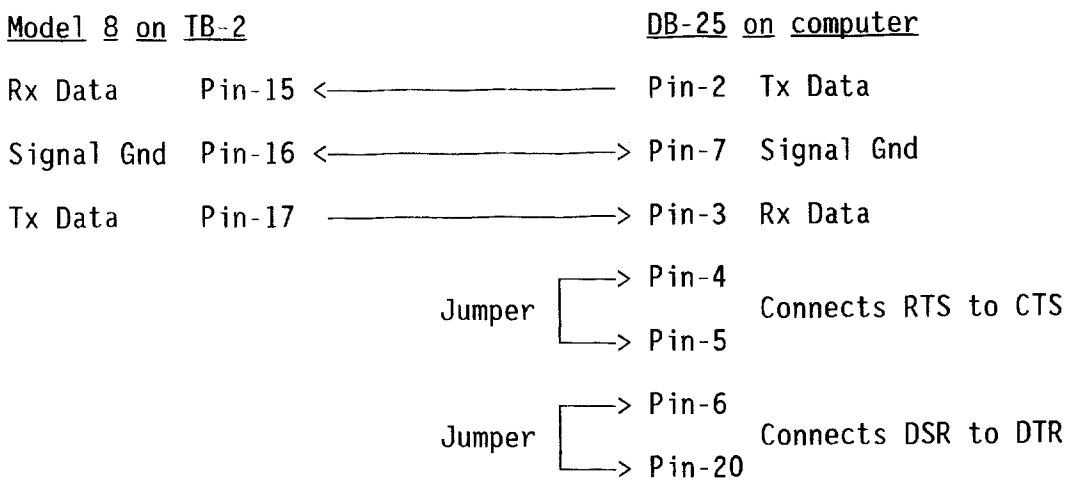
2. Model 8 connection to computer serial port using DB-9 connector

Model 8 on TB-2			DB-9 on computer	
Rx Data	Pin-15	<——	Pin-3	Tx Data
Signal Gnd	Pin-16	<——>	Pin-5	Signal Gnd
Tx Data	Pin-17	——>	Pin-2	Rx Data

Jumper ——> Pin-4 and ——> Pin-6 — Connects DSR to DTR

Jumper ——> Pin-7 and ——> Pin-8 — Connects RTS to CTS

3. Model 8 connection to computer serial port using DB-25 connector



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The DSR/DTR and RTS/CTS jumpers are not strictly necessary, but they provide an easy way to get the computer/terminal to work if it provides no easy way to turn off hardware handshaking. This information is correct for most computers. Consult your computer manual for more details on its port.

* *

PRODUCT QUALITY CUSTOMER FEEDBACK FORM

Please fill out and return this form after you have had a chance to install and operate your Zetron device.

Product:_____ Today's Date:_____

How long did it take to install?_____

How long did it take to program?_____

Did you have to call Zetron for technical assistance? y n

If yes, why?_____

Which brand radio/repeater is it interfaced to?_____

How many products of this type do you purchase in a year?_____

Reason for choosing Zetron:_____

RATING OF PRODUCT	Excellent	Good	Average	Below Avg.	Poor
Ease of Install	1	2	3	4	5
Ease of Programming	1	2	3	4	5
Number of Features	1	2	3	4	5
Reliability of Operation	1	2	3	4	5
Price for Performance	1	2	3	4	5
Met your Expectations	1	2	3	4	5
Confidence in Product	1	2	3	4	5
Call-In Technical Support	1	2	3	4	5

Suggestions (use second sheet if necessary):_____

_____

New Product Ideas:_____

_____

How many Zetron products have you purchased: 1 2-5 6-10 10-20 20-more

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MAIL TO: B&I Marketing
Zetron, Inc.
12034 134th Court N.E.
P.O. Box 97004
Redmond, WA 98073-9704

OPTIONAL

Name/Title:_____

Company:_____

Address:_____

City:_____

State/Zip:_____

Phone/FAX:_____

Thank you for your help.

PRODUCT MANUAL CUSTOMER FEEDBACK FORM

Please provide us with suggestions on how we can improve this manual. Your opinions are important to us.

Product:_____ Manual No.: #025-_____ Date:_____

RATING OF MANUAL	Excellent	Good	Average	Below Avg.	Poor
Understandability	1	2	3	4	5
Technical Completeness	1	2	3	4	5
Explanation of Operation	1	2	3	4	5
Installation Instructions	1	2	3	4	5
Programming Instructions	1	2	3	4	5
Schematics/Diagrams	1	2	3	4	5
Overall Ease of Use	1	2	3	4	5
As a Quick-Reference Tool	1	2	3	4	5

Suggestions (use second sheet if necessary):_____

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Specific Edits/Changes (include page no.):_____

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Thank you for your help.

CHANGE INFORMATION

At Zetron, we continually strive to improve our products by updating hardware components and software as soon as they are developed and tested.

Due to printing and shipping requirements, this manual may include information about the latest changes on the following pages.