Z E T R O N

MODEL 45B Z-PATCH
INSTALLATION MANUAL

#025-9092Q.1

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WARRANTY STATEMENT

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

FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

For 702-9183-1, Revision A and later, the following criteria MUST BE MET to comply with FCC rules:

1. The FCC registration number of this device (EYB5Q5-15387-OT-T) and ringer equivalence number (0.4B) MUST BE REPORTED to the telephone company.

2. 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.

3. This device MUST NOT be installed on coin-operated or multi-party telephone lines.

4. The sum of ringer equivalence numbers for all devices connected to a single telephone line should not exceed 5 for reliable operation.

5. If this unit malfunctions, the telephone company MAY DISCONNECT SERVICE temporarily. If disconnection is necessary, the telephone company MUST ATTEMPT TO NOTIFY the user in advance, if possible. If not, they must notify the user as soon as they are able.

6. Warranty repair work on this device MUST BE DONE BY Zetron, Inc. or an authorized Zetron repair station.

DOC COMPLIANCE

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100. An alphabetic suffix is also specific in the Load Number for the appropriate ringing type (A or B), if applicable. For example, " LN = 20 A " designates a Load Number of 20 and an "A" type ringer.

LOAD NUMBER 71

CERTIFICATE NUMBER C503-5022

CERTIFICATION NUMBER 1153 3025 A

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TRADEMARKS

1. INTRODUCTION

GENERAL

The Model 45B Z-Patch is a microprocessor-based, general-purpose mobile radio-to-telephone interconnect. It is designed to provide low-cost, yet flexible operation as a full-featured telephone patch with selective calling and advanced airtime billing features.

The Model 45B is the interface device required between the telephone system and the radio system for interconnect. It provides two-way communications for mobiles and handheld radios and one-way signaling to pagers. A serial interface provides user-friendly, menu-driven programming of all system and user information. The system and user database can be downloaded and uploaded using the proper software supplied by Zetron. Remote DTMF programming is also supported.

The compact size of the Model 45B allows inconspicuous shelf mounting or installation in a standard 19-inch equipment rack.

First time owners should finish reading this section and then read the sections on installation, programming and operation. Owners with paging or billing options should also read appropriate options subsections. Other information such as specifications, repair and schematic diagrams are found in Sections 6 through 8. The Appendices contain information on serial communications between the Z-Patch and computers, such as the IBM PC and Radio Shack Model 100.

FEATURES

A summary of Model 45B features is provided below.

* Supports full and half duplex as well as simplex VOX and sampling operation.
* Stock unit allows the system and user database to be uploaded and downloaded with the proper software supplied by Zetron.
* Complete paging encoder options available.
* Supports DTMF or pulse dial-out with programmable dialing rates.
* 99 (or optionally 325) users
* Programmable private access/disconnect codes from 1-8 digits.
* Two sets of 4-digit first and second digit toll restrict.
* User selectable times for system variables, including call limit, line activity, VOX hold, COR delay, sampling rate and width, transmitter hold, number entry time-out, etc.
* Full COR/VOR channel monitoring for positive transmitter control.
* Five different, user selectable ring-out sounds.
* Mobile-to-Mobile paging encoder capability.
* User selectable auto-dial phone numbers with up to 9 entries.
* Optional high-accuracy digital delay voice-operated transmitter control.
* Four control relays allow control of devices from either the telephone or mobile.
* All tones (DTMF, etc.) are regenerated for error-free coding.
* 110/220V AC at 50/60 Hz or 12-15V DC operation.
* All features remotely programmable via phone or mobile using special privileged DTMF access codes.
* No cumbersome "DIP switches" to set.
* Two telephones lines provided plus line for local phone.
* Real-time clock for detailed airtime billing.
* Optional internal 300/1200 baud modem for remote computer or terminal programming.
* Optional DID interface.
* Optional dial click detector.

2. SPECIFICATIONS

SPECIFICATIONS

Power	100-130V AC 60 Hz, 7 watts or 12-15V DC, 600 mA.
Temperature	0-65 degrees C.
Size	19W x 7.25D x 1.75H (inches). 19" rack-mount
Weight	7 pounds.
CAPACITY INTERCONNECT	99 or 325 subscribers, up to 999-call detail records.
ANI Length	1 to 8 DTMF digits.
ANI Speed	Up to 14 digits per second.
SIGNALING	
Freq range	67 to 3500 Hz
Freq accuracy	0.1%
Freq stability	0.0005%
Distortion	2% nominal.
Two-Tone Sequential	Motorola/GE all tone groups, code plans, and capcodes.
DTMF	1 to 7 digits per subscriber.
2805	1 to 7 digits per subscriber.
Five/Six-Tone	EIA, ZVEI, CCIR single or dual address.
CTCSS	38 standard EIA tones.
Digital Squelch	104 Codes.
TELEPHONE INTERFACE	Two End to End (B1) phone lines, one Local Phone.
Connector	RJ11-C Modular Jack.
Mode	Full duplex operation, hybrid with fixed-null.
Call progress tones	Dial tone, ringing, interrupted ringing, busy, and reorder.
Dial tone detection	Single tone adjustable, preset to 440 Hz.
END TO END:	
FCC Registration	EYB5Q5-15387-OT-T.
Incoming call	Ring detection on tip-ring pair or dry contact closure to ground. Programmable number of rings to answer.
Call answer	Off-Hook, tip-ring current draw or darlington output (wet).
Call disconnect	Second dial tone for 2 seconds (440 Hz), busy tone (0.5 Hz, 50% duty cycle).
LOCAL PHONE:	
Incoming call	Loop start or dry contact closure, Immediate dial.
Call answer	Darlington output (wet).
Call disconnect	Local phone On-Hook (For connection to 2500 deskset or DID converter.

SECTION 2 - SPECIFICATIONS

RADIO INTERFACE	
PTT	One Form-C relay closures, 100 mA max.
COR	Noise detector, VOX detector or voltage change.
Subaudible output	-40 to +6dBm. Hi/Lo Selector. 600-ohm output.
Tx audio	-40 to +6 dBm. Hi/Lo Selector. 1K-ohm output.
Rx audio	-40 to +10 dBm. Hi/Lo Selector. 50K-ohm input. 25 mV to 6 V P-P.
Direct Modulation	CTCSS/Digital squelch, bipolar adjustable.
Control relays	4 each, Form-A relay closure to ground.
Sense inputs	2 each, Form-A relay closures input.
Channel busy input	Closure input from secondary receiver COR.
COR validation input	Closure input to disable COR operation.
GENERAL	
Modem	300 baud Bell 103J or 1200 baud Bell 212.
Indicators	Linel, Line2, Local, VOX, DTMF, Carrier, CTCSS, Transmit, Page, Power.
Switch	Connect/disconnect.
Station ID	Morse code, fixed 1200 Hz frequency and selectable call sign.
Operating modes	Simplex intelligent VOX, Simplex intelligent sampling, Half-duplex, Full-duplex
Equipment types	Tone only pager, Tone+Voice pager, Talkback pager, Mobile, Direct air.
Prompt tones	Progress tones, error tones, and warning tones sent to phone or mobile.
Programming	Programmable via DTMF phone, DTMF mobile, RS-232 or phone modem.
Data retention	Greater than 5 years with power removed.
Real time clock	Battery backed for at least 5 years with no power.
Secondary protection	Telco high-voltage clamps with protective fusing elements.
Voice delay	0.15 to 0.85 seconds CVSD, w/ Delay Board Option.

3. OPERATION

OPERATION

The Model 45B is designed to operate as a full-featured phone interconnect in full-duplex, half-duplex and simplex radio installations. With the addition of one or more of the optional page formats, the unit also provides the functions of both a dial access paging encoder and a mobile-to-mobile paging encoder, allowing a mix of equipment types in one system.

Duplex Installations

When installed on a repeater (or full-duplex base station), the Model 45B provides audio path control for both full and half-duplex mobiles. In addition, the unit can be provided with repeat audio to handle no-tone (dispatch) or require ANI to access dispatch operations.

Each mobile user may be specified as either a full or half duplex user. When operating full-duplex in patch operation, the audio from the phone line is always output to the transmitter. When operating half-duplex without the repeat audio enabled, the telephone audio is muted whenever the mobile is transmitting, and if selected (per user) a privacy tone is transmitted. If the repeat audio is enabled, either the mobile's audio or the privacy tone is transmitted when the mobile is transmitting.

Simplex Installations

If installed in a simplex system, the Model 45B provides a unique combination of both VOX and sampling operation. Alternately, the unit can be programmed to operate as a pure VOX or sampling patch. VOX is the preferred mode of operation, unless the phone party has a high noise environment such that the VOX is triggered when there is no voice on the phone line, in which case sampling has to be used. When using VOX, the digital delay board option is recommended to prevent clipping of the initial syllable of speech when the phone party talks. The Model 45B uses a sophisticated combination of VOX and sampling in the VOX mode. If the phone party talks too long or background noise locks up the VOX detector (longer than the "into-sampling" time), the Model 45B automatically drops the transmitter and looks for mobile activity. If activity is detected, the conversation direction is switched, otherwise the transmitter is rekeyed and the phone party is still allowed to talk.

In simplex VOX operation, the transmitter is keyed when speech is detected from the phone. If there is no speech, the radio is allowed to revert to receive mode. If speech occurs again, the transmitter will be rekeyed, but if COR is seen, the radio will stay in receive mode until COR goes away. When COR goes away, the transmitter is keyed ("pre-key") and the phone line is examined again to determine if the transmitter should remain keyed. This pre-key is in anticipation of conversation turn-around, which helps eliminate the squelching of the phone party's first syllable. See Figure 1 for a diagram of typical VOX operation.

```
    wwwwwwwwwwTTtTTTtTTttxxwwwRRRRRRRRrrtTTTtTTtTTt ...
    1         2         34 5  6        78

Where:
      w= receiver on, watching for VOX and COR (tx off)
      T= transmitter on, VOX is active
      t= transmitter on, VOX inactive (VOX hold time)
      x= Tx-to-Rx transition time for radio (tx off, rx turning on)
      R= receiver on, COR is active (tx off)
      r= receiver on, COR inactive (COR hold time, tx off)
```

FIGURE 1: Typical VOX operation

Initially neither party is talking (1). The phone party speaks three words (2). The VOX hold time expires (3). The transmit to receive transition occurs (4). The Model 45B looks for COR and VOX (5). COR is seen when the mobile talks (6). The COR hold time expires (7). The transmitter is rekeyed (8).

If VOX is active for the programmed "into-sampling-time", the transmitter is periodically dropped (at the "sample rate") to check for COR. If COR is not detected, the transmitter is rekeyed, after the "sample width time" plus the "tx-to-rx time", and sampling continues. If COR is detected, the radio party talks and, after COR drops, the VOX mode is re-entered. The VOX mode is also re-entered if VOX activity stops. See Figure 3 for diagram of automatic sampling after VOX is active for the "into-sampling-time". The "sample rate" is how long the phone audio is transmitted and the "sample width" is how long the transmitter is dropped when testing for COR. Note that the "tx-to-rx" time is always added to the "sample width" time.

```
                TTTTTTTTTTsssTTTsssTTTsRRRRRR
                1         2           3

Where:
      T= transmitter on, VOX active
      s= sampling to detect COR (tx off)
      R= COR detected during sampling, receiver active
                                              (tx off)
```

FIGURE 2: Typical auto-sampling after long VOX

The transmitter is keyed when VOX is active (1). After the "into sample time", sampling begins at the "sample rate" (2). Finally, COR is detected and the radio party talks (3). If pure VOX operation is required, the into-sample-time should be set to its maximum value. Alternatively, if pure sampling operation is desired, the into-sample-time should be set equal to the programmed sample rate.

The unit operates with a separate set of programmed sample rates and widths during dial tone activity (before the mobile has completed dialing a phone number), and the into-sample-time does not apply. If dial tone sampling is desired, the sample rate should be set relatively fast (e.g. 1 second) and the sample width set to its minimum value. If VOX operation is desired, the sample rate should be set long (e.g. 4 sec) and the sample width should also be set long (e.g. 10 sec). This will force the unit to transmit 4 seconds of dial tone (after access), and then drop the transmitter to look for mobile activity. If the dial tone sample rate is set to 255 then dial tone will come up, with VOX, for the dial tone sample width. The transmitter will then be dropped and the unit will wait for dial in.

For optimum operation under VOX or sampling, three programmed values must be set: the tx-to-rx time of the station transceiver, the mobile's COR hold-time, and the mobile's tx-to-rx time. The station tx-to-rx time should be set to the minimum time that guarantees that the receivers COR output is valid after unkeying its transmitter. The mobile tx-to-rx time delays the transition from a mobile unkey (and after the COR hold time) until the telephone party's audio is allowed through to the transmitter (the tx is keyed after the COR hold time expires), and the prompt beep is given to the phone party. Normally, the COR hold time needs to be set relatively short (e.g. 0.2 sec), as does the mobile tx-to-rx time (e.g. 0 to 0.1 sec).

Repeater Simplex Installations
If the Model 45B is connected to a simplex base station operating through a repeater, a COR validation signal to the Model 45B should be derived from the COR from the receiver at the repeater.

This is normally accomplished by decoding a CTCSS tone which is encoded whenever the COR is on at the repeater receiver and using the tone decoder output for the COR validation input to the Model 45B.

The COR from the base station radio is not adequate since the repeater transmitter stays keyed for its transmitter hold time and thus is not a true indicator of mobile activity.

VOX simplex is the only reliable mode of simplex operation when working through a repeater. Sampling simplex operation is not practical because the COR sampling time has to be unreasonably long to compensate for the CTCSS decode time (the "into-sampling" time should be set to its maximum).

PHONE-TO-MOBILE/PAGER ACCESS

In phone-to-mobile/pager communication, a caller accesses the Model 45B simply by dialing the Z-Patch's phone number or by taking the local phone off-hook. Line 1 and line 2 of the Model 45B can be programmed for one of three telephone answering modes: answer/beep/ring-out, answer/dialtone/ring-out and no-answer/ring-out. The local phone may only be programmed for the answer/beep/ring-out or answer/dialtone/ring-out mode. In all modes if the caller does not put in a DTMF code the unit can be programmed to do an auto-call.

In answer/beep/ring-out mode, the Z-Patch answers the call with a 400ms beep 750 ms after a programmed number of rings (ring-until-answer). If the caller does not enter a code and the auto-call user number is set to '0', the call will be disconnected. If the auto-call user number is from 1-99(325) normal ring-out occurs for the programmed number of rings (channel ring-outs). If a mobile answers, the call is connected. If the call is unanswered, the line is disconnected. Alternatively, a caller may call a specific user by entering the user's user number (or ANI) after the beep. If a user number is not entered before the Model 45B sends a ring to the caller, the call will be directed to the auto user number for the line receiving the call or disconnected if the auto call user number is '0'.

In answer/dialtone/ring-out mode, the operation is identical to answer/beep/ring-out except that the Model 45B answers the call with 2.5 seconds of dial tone, during or after which, a valid user number (or ANI) can be entered on the caller's phone. As above, ring-out begins and the call proceeds as above. If invalid or if the auto call user number is set to '0' an error tone is heard by the caller and the line is disconnected.

In no-answer/ring-out mode, ringing is detected on the phone line and after rings-until-answer, channel ring-out to the auto call user begins. If a mobile answers, the line is answered and the call is connected. If a mobile does not answer, the line is briefly answered to disconnect the call. This answer mode is not available for the local phone. If ringing on the phone line stops, after a brief inter-ringing time, ringing on the channel will stop. If the auto call user number is set to '0' or if the auto call user is disabled the answer mode will be forced to answer/dialtone/ring-out.

There are four modes of decode from the phone line. In all modes the Model 45B will decode DTMF, during dial or after tone or after the beep. Modes 0 and 3 are DTMF only. Mode 0 is the normal DTMF overdial operation. Mode 3 is for operation with an external dial click decoder. In mode 3, the quiet time after the beep or dial tone drops is extended to 15 seconds.

When using dial click decode, modes 1 or 2, the Model 45B will decode clicks on the phone line and turn them into digits. In mode 1 the phone party just enters the number, from a DTMF or pulse phone, they wish to dial. In mode 2 the telephone callers must first dial a '0', if from a pulse phone, before entering the user's number or access code. The leading '0' in mode 2 is only required from pulse phones. CAUTION: When the call is from a dial pulse phone the caller must first wait for dial tone from the unit to drop or after the beep before dialing. The local phone must always generate DTMF.

The type of ring-out is programmable for each user for one of seven ring-out styles: normal ringing, double ringing, triple ringing, ding-dong, singer, warbler or, optionally, repeat paging tones. These different ring-out styles are used so mobiles may easily determine who incoming calls are for if the unit does not have any of the paging tone options installed for selective calling, or if multiple users are on the same CTCSS tone.

After entering a valid user number (or ANI) in both the answer/ring-out and answer+access modes, the phone party will hear either a normal ring, or a broken ring. Broken rings indicate that the channel is busy, and that channel ring-out is not occurring.

If the channel is quiet, the unit will key up the transmitter and issue the appropriate users ring-out or page. The number of rings that occur on the channel is user selectable, from one of two system values. The phone party will continue to hear rings until disconnected or the mobile answers. The call will be disconnect after channel ring-outs occur or channel busy rings, whichever is greater.

If the channel is busy the caller will hear broken rings until channel busy rings for the line the call is on occurs, then the line will be disconnected. If the channel becomes quiet before channel busy rings occurs the unit will key up the transmitter and issue the appropriate users ring-out or page until channel ring-outs occur then the line will be disconnected.

If a mobile does not answer a call, the phone line will be placed back on-hook (or in the case of the no-answer/ring-out mode momentarily taken off-hook) disconnecting the phone party, after the programmed number of channel ring-outs or busy channel rings which ever is greater.

If the calling party hangs up and the unit detects dial tone it will discontinue the ring-out in the case of answer modes 0 and 1. In mode 2 the unit will discontinue ring-out if the ringing on the phone line stops.

Answering a Call to a Mobile
One of three call answer modes may be selected for each mobile: COR-to-answer, *-to-answer, or ANI-to-answer (*-to-answer = no). If a user is programmed with COR-to-answer, the mobile simply keys the mobile transmitter to answer an incoming call. Users programmed as *-to-answer need only enter a long (0.8 sec) DTMF "*". Users with *-to-answer set to no, must enter their DTMF access code sequence. If ANI is required to answer, the mobiles answer sequence depends on the sign on mode. With Zetron sign on the answer code is *+ANI, for RCC mode 1 is ANI+*, for RCC mode 2 it is *+ANI+*. Note that the trailing '*' can be any digit. If the courtesy tones are enabled for the user being called, the phone party will hear a single beep when the mobile answers and each time the mobile unkeys.

If a user is set up with ANI-to-answer, the supervisors ANI will answer the call.

Phone-to-Mobile/Pager Paging Access
If the Model 45B has an optional paging format installed users may be selectively called. This allows the user to leave his radio squelched and not have to listen to all of the other calls on the channel and try to determine which ones are his. Paging to 'tone-only' and 'tone and voice' pagers may also be done.

Access to the Model 45B for dial-access paging is identical to that for phone-to-mobile communication. The Z-Patch answers the call using one of the methods described above. The page code for that user will then be broadcast.

After the page code is sent, operation is determined by the type of equipment specified, and the ring-out style, for the user. If a two-way mobile is called the unit will issue a ring-out or repeat the paging tones until the call is answered or disconnected.

If a tone-only pager is called, the phone party will hear a string of 5 beeps after completion of the page, and the phone line will be placed back on-hook.

If the equipment type is a tone+voice pager, the phone party will hear 2 prompt beeps after the page has been issued, indicating that the voice message may be given. After the programmed talk time (or if the phone party doesn't speak, 2 times the VOX hold time), 3 beeps will be issued, and the call will be disconnected.

If the equipment type is a talkback pager, operation is similar to tone+voice pager operation, however, after the page is issued the phone party will hear any channel activity present, allowing the "mobile" to reply to a voice message. Note that once a talkback page is in process, the call is only aborted by normal mobile disconnect procedures (see "Mobile-to-Mobile/Pager" section below).

Direct-air operation is similar to talkback pager operation, however, no page or channel ring-outs occur; the phone party is immediately allowed on to a quiet channel.

DIAL CLICK

Dial click allows a phone party caller to overdial user numbers or access codes with a rotary dial (dial pulse) telephone. There are 2 modes of dial click decode, one that requires a 0, mode 2, to be dialed to calibrate the dial click decode software to the telephone, or mode 1 which does not require the calibrating '0'. After dialing the initial 0, the caller dials the user's number or user's code as without dial click. The leading '0' is not required from a DTMF phone.

See the Installation Section for hookup of the Dial Click Board Adjustments.

MOBILE-TO-PHONE ACCESS

A user is programmed to sign-on to the Model 45B using one of three formats: Zetron style, RCC style 1 or RCC style 2. Note that the sign on mode can affect the way a mobile answers a call, see above. Each method is discussed below.

Each user may be assigned line 1 or line 2 as the "default" phone line, with the other line being the user's "alternate" line. Access to the alternate line may be inhibited.

Tone/Code Drop Modes

When calling a mobile with more than one user on a tone or digital code it is some times desirable to only have the tone or code issued until the page is finished or until the mobile answers. Each user may be set up to have the tone/code for the duration of the call, drop after the page (or first ring), or drop after the mobile answers. If multiple users are on the same tone this would allow the other mobiles to resquelch and not have to listen to the duration of the call. See the user operation menu for more information.

Zetron-Style Sign-On

The Zetron-style sign-on format uses a leading DTMF digit to determine the type of access, see below. The following DTMF digits are used to determine the type of access a user wants:

"*" = Access user's default phone line.
"0" = Access repeater (if allowed and option installed).
"1" = Mobile-to-mobile access (if allowed).
"2" = Access alternate phone line (if allowed).

After typing the DTMF digit to determine the type of access, the user must enter their programmed access code. When a user accesses either phone line, the line is taken off-hook, and the telephone audio is sent to the transmitter, allowing the mobile to hear dial tone (if present). The mobile may then enter the desired phone number. Mobile-to-mobile and repeater access are discussed below.

RCC-Style Sign-On

The RCC style 2 sign-on format uses the DTMF "*" followed by the calling party's access code, followed by an additional DTMF steering digit which determines the type of access. The RCC steering digits are given below:

"9" = Default phone line access.
"8" = Alternate phone line access (if allowed).
"7" = Mobile-to-mobile access (if allowed).
"5" = Repeater access (if allowed and option installed).

RCC style 1 sign-on is the same as style 2, however, the leading DTMF "*" is not used.

Access Codes
The access code portion of sign-on is allowed to be any sequence of DTMF digits, from one to eight digits in length including "*", "#", and the "4th column" digits of "A", "B", "C", and "D". Since variable length codes are allowed, the system operator must be careful not to enter access codes that are subsets of other codes. For example, if a code of "12" is entered for user 1, and "123" is entered for user 2, user 2 will always sign-on as user 1, when using Zetron sign-on, since "*12" will be validated before the final "3" is entered, and the "3" will be treated as the start of phone number dialing. For this reason the Model 45B looks for ANI conflicts. If an ANI conflict exists, the user will be prompted to enter another ANI code.

Short Sign-On
If enabled, mobiles can access the unit using the Zetron style steering digits (*, 0, 1, 2). If a long digit (0.3 sec) is entered and no further digits are received for 1.5 seconds, the mobile is validated as user 1. Note that the same digits are used regardless of the sign-on mode chosen.

Dialing
After completing a valid mobile access, dial-out operation to the phone line is dependent upon the privileges assigned to the user. If allowed, the mobile may immediately begin entering the phone number to be called. As DTMF digits are received from the mobile, they are regenerated out the phone line in either DTMF, slow pulse or fast pulse. If DTMF dialing is selected, the regenerated digits will "follow" the mobile's transmitted digit duration.

If the mobile is designated as half-duplex, the unit will stop regenerating the digits and allow the mobiles audio through to the phone line when the mobile unkeys, and one of the following conditions is met:

{1} The programmed DTMF time-out has been exceeded.
{2} A DTMF "*" is received.
{3} A specified number of digits have been received.

If the mobile is designated as full-duplex, regeneration ceases upon condition {1} or {2} only (unkeying is not required, and has no effect).

In addition to the normal dialing described above, the mobile may be allowed to use the units nine auto-dial (previously stored) phone numbers. After mobile access, the user selects an auto-dial by entering a "*", followed by the desired auto-dial number ("1" through "9"). Entering a "0" instead, will cause the unit to redial the last entered phone number.

Alternatively, a mobile user may not be allowed to do normal dialing, but instead may be restricted to only using the auto-dial numbers. If this mode is selected for the user, after sign-on, the mobile simply enters a "1" through "9" to choose the desired auto-dial number (the "*" is not required or allowed). Caution: auto-dial numbers are not toll restricted.

Finally, a mobile may not be allowed to make any dialing selections at all; upon access, the unit may be set to immediately dial one of the nine auto-dial numbers.

Toll Restriction
Each user may be assigned to none or one of two sets of system defined toll restricts. Each set of restricts may define up to four restricted digits for both the first and second digits of a number to be dialed. The length of the number dialed may also be restricted. 911, 1-800 and the auto-dial numbers are not toll restricted, but last number redials are.

Disconnecting a Call
At the completion of a phone call, it is generally the mobile's responsibility to terminate the patch operation. Three disconnect modes are available: "#" to disconnect, "#"+ANI to disconnect or ANI to disconnect. The requirement for the leading "#", when ANI is required to disconnect, is a system question. If "#" to disconnect is selected for a user, the mobile enters a long DTMF "#" (0.5 sec.). If "#"+ANI for disconnect is required, the mobile enters a "#", followed by his ANI code. If just ANI to disconnect is selected the mobile just enters his ANI code. Therefore if the system question '#+ANI to disconnect' is set to yes, all users that are set up to disconnect with ANI require the leading "#". The telephone party may disconnect any calls whenever the mobile is not keyed up by entering a long DTMF "#" (0.5 sec).

If a "#" is detected during the dialing sequence (before the unit has stopped regenerating digits), the call is immediately terminated. Note that a long digit is not required, nor is the ANI required.

Calls will also terminate if the mobile activity timer expires or if the call length exceeds the user's call limit timer. Impending mobile activity time-outs are indicated by single beeps transmitted 12, 9, 6, and 3 seconds before disconnect, while call limit time-outs are indicated by double beeps 15, 12, 9, 6, and 3 seconds before disconnect. In simplex systems, the unit drops the transmitter after a mobile activity time-out for an additional 10 seconds before disconnecting the call. If enabled, a 2nd dial tone (due to the telephone party hanging up) will also terminate the call.

If the users are programmed with ANI to disconnect, the ANI code of the supervisor can always disconnect the call.

MOBILE-TO-MOBILE/PAGER OPERATION

After entering a valid mobile-to-mobile access code, the unit keys up the transmitter and issues a dial tone. In duplex systems the dial tone lasts 6 seconds. The mobile must dial before the duration of the DTMF time-out after the dial tone has dropped. In simplex systems the dial tone will last the dial tone sample rate, then the transmitter will be dropped. After the transmitter is dropped the Z-Patch will wait for the DTMF time-out for the mobile to enter the access code for the other mobile. At any time during the dial tone in duplex systems (or after the transmitter has dropped in simplex), the mobile may enter the user number of the mobile to be called (or ANI if selected). The unit will drop the dial tone upon receipt of the first digit in duplex systems. If an invalid user number (or ANI) is entered, or if no number is entered, the unit will issue an error tone and drop the transmitter.

After receiving the called mobile's code, the unit will begin ring-out, in the same manner as for phone-to-mobile calls. Ring-out may be terminated by either mobile's disconnect codes, or may be answered (which also terminates ring-out) by entering their sign-on codes. If the repeat audio option is installed and the call is answered, the unit will issue a single prompt beep and drop into repeater operation (described below) with a long (25-second) hold time. At the end of ring-out, if the call is not answered or terminated or answered in units without repeat audio or if the system is simplex, five beeps will be issued and the transmitter will be dropped.

When placing a mobile-to-pager call, operation differs depending on pager type. If a talkback or tone+voice pager is called, a prompt issues after the page (2 beeps for talkback, 1 for tone+voice). If the repeat audio is enabled, the unit drops into repeat; otherwise, the unit drops the transmitter and operation is complete. If a tone-only pager is called, the operation is completed immediately after the page is issued, and the transmitter is dropped.

REPEATER DISPATCH OPERATION

Two forms of repeater operation may be selected; ANI-for-dispatch or carrier controlled dispatch. If ANI-for-dispatch is selected, the mobile must enter a valid access code to enable the dispatch function, the repeat audio is turned off until a valid code is entered. If carrier controlled dispatch is selected, the unit will key the transmitter whenever COR (mobile) activity is detected.

Dispatch operation is regulated by the dispatch hold timer and the dispatch time-out timer. The unit will hold the transmitter active for the duration of the hold time, if mobile activity is not present. If the transmitter remains keyed for the duration of the dispatch time-out timer, an error tone is issued and the transmitter is forced to drop until mobile activity ceases, at which point it may be rekeyed. Impending dispatch time-out is indicated by single beeps at 15, 12, 9, 6, seconds before time-out.

ANI-for-dispatch operation is ended if either of the above timers expires, if the mobile's call limit timer expires, or if the mobile sends its disconnect code. Call limit time-out operation is the same as for phone calls. If operation is ended by hold timer expiration or disconnect code, the unit issues five beeps to indicate repeater drop. If either the call limit or dispatch time-out timers expire, the error tone will be issued. Once the repeater drops, ANI sign-on is required to rekey the transmitter.

If a mobile wishes to send live DTMF over the air, the mobile must first key up for the DTMF timeout without sending any DTMF. After the DTMF timeout has passed the Z-Patch allows DTMF to pass from the receiver to the transmitter. The Z-Patch mutes any DTMF audio for the DTMF timeout of valid COR. This is to prevent ANI codes from being sent out over the channel which could set off another mobiles decoder. This also adds security to the system by not allowing mobiles to hear each other sign on to the system.

SENSE LINE INPUTS

There are four sense inputs. Two can be used to page a user number and two are used for transmitter control.

Sense one, J6 pin 9, is used to validate COR. This input is pulled high internally so if left open the COR validation polarity question should be answered yes, if answered no or if the input is pulled low the normal operation of COR is terminated. See Section 9, Connections and Jumpers for more information.

Sense two, J2 pin 8, is used to monitor the transmit channel activity, Channel Busy. This input is also pulled high and if left open the Channel busy question should be answered no. When this input is active the COR LED will flash. See Section 9, Connections and Jumpers for more information.

Sense three and four, J2 Pin 10 and 12 respectively, can be used to send out a page. When grounded for at least 2 seconds, the sense lines will send a page three times in a row. If a sense line is continuously grounded, it will page again in 10 minutes. Sense three uses the page format and page code of user one and sense four uses user two. See Section 9, Connections and Jumpers for more information.

CONTROL RELAYS

Four control relays are provided in the Model 45B for external control. Two relays are for system level controls: Control 1 (J6 Pin 8, pulls to ground, JP16 sets N.O. or N.C.), and Control 2 (J2 Pins 1 & 2). The other two are for user level controls: Control 3 (J2 Pins 3 & 4), and Control 4 (J2 Pins 5 & 6). System relay access may be done from a phone or a mobile. The system relays are controlled by entering the system relay access code in place of a normal access ANI (or user number). The unit will respond with four prompt beeps, after which two digits are entered, with the first digit controlling relay 1 and the second digit controlling relay 2. If a "0" is entered, the appropriate relay is turned off; if a "1" is entered, the relay is turned on, if a "2" is entered the relay is left unchanged. When accessing from the phone side just enter the system relay access code, when accessing from a mobile a leading '*' is required in sign on modes 0 and 2. In sign on modes 1 and 2 a trailing digit is required. So when accessing the system relays from the mobile, access is as follows: *+ANI code with Zetron sign-on mode, ANI+* with RCC mode 1 or *+ANI+* with RCC mode 2. Note that the trailing '*' can be any digit.

Operation of the two-user relays is independently controlled, with each being set to one of the following modes:

Mode 0: ON at mobile originate....OFF at disconnect
Mode 1: ON at mobile answer.....OFF at disconnect
Mode 2: ON at telco access.....OFF at mobile answer
Mode 3: ON at telco access.....OFF at disconnect
Mode 4: ON at telco access
or mobile originate....OFF at disconnect

Note: The above modes are system level selections, while under each user, each of the relays may be enabled or disabled. If disabled, the appropriate relay will not be energized when that user accesses the system. If enabled, the relay is energized under one of the above sets of conditions.

FRONT PANEL INDICATORS

The Model 45B has ten front panel indicator LEDs (Figure 1). Each indicator is discussed below.

1-LINE 1	On when line 1 is off-hook or ringing.
2-LINE 2	On when line 2 is off-hook or ringing.
3-LOCAL	On when local phone is active.
4-VOX	On when phone audio is detected.
5-DTMF	On when DTMF digits are detected.
6-CARRIER	On when COR is detected or flashing when Channel busy is detected.
7-CTCSS	On when a subaudible tone or Digital code is encoded.
8-TRANSMIT	On when the transmitter is keyed.
9-POWER	On when system power is applied.
10-PAGE	On when a page is broadcast. Also blinks periodically to verify normal system operation.

Line 1, Line 2, VOX, CARRIER, CTCSS, and PAGE indicators are lit when the system is being reset.

FRONT PANEL CONTROLS

CONNECT/DISCONNECT	Connects the Model 45B to the default phone line specified for user one (factory set to line one) when the unit is idle. This button also disconnects any call/access in process.

4. PROGRAMMING WITH A CRT OR COMPUTER

INTRODUCTION

The Model 45B contains many variables for the entire system and for each user. These variables are set by the system operator using the programming features of the Z-Patch. The Model 45B is programmed in one of two ways; from a CRT or computer, or by DTMF from a phone or mobile. Since CRT programming is the much preferred method, it will be discussed first. This section of the manual covers programming the Model 45B from a CRT or computer. DTMF programming (next section) is used mainly for small adjustments to the system "on-the-fly."

The system and user database is contained in low power RAM which is plugged into a smart socket which has a battery in it. This allows the unit to retain the programming even without power applied. Once the unit is programmed and operating the database may be downloaded to your PC using the ZCOM software which can be obtained from Zetron. This feature allows you to download the database from one unit and upload it to another unit or if the unit ever needs to be reprogrammed, all you have to do is upload it.

The Model 45B may be programmed from a CRT or computer, functioning as a "dumb terminal." Once this method of programming is chosen, there are two ways to connect the CRT (or computer) to the Model 45B. One connection method is directly through the Model 45B's serial port. This method is simple and quick, but it requires that the CRT and Model 45B be within 100 feet of each other. Since this is not always possible, the Model 45B's programming features may be accessed over the phone line and through its (optional) internal, 300/1200 baud modem.

ACCESSING PROGRAMMING MODE USING DIRECT CONNECT

Before attempting to program the Model 45B with a directly connected CRT or computer, follow the cabling instructions found in the installation section. If a computer is being used, its dumb terminal emulator program must be running (see also Appendices 1-3). When the CRT or computer is properly connected to the Model 45B's serial port and configured with the proper communication protocol (4800 baud, 8 data bits, 1 stop bit, no parity), Model 45B programming may begin. Press reset on the Model 45B. A power-on message should appear on your screen, (see below). If not, check all of your connections. You may have to connect DTR (data terminal ready) to DSR (data set ready) and CTS (clear to send) to RTS (ready to send) on the connector that goes to your CRT/computer.

Press the RETURN key on your CRT or computer to "bring-up" and display the Model 45B sign-on message and Top Menu selections (Figure 3). If the Z-Patch does not respond, it may be processing a call or page. The Model 45B must be idle before direct connect programming may commence. Instructions on actual programming are continued in "CRT Programming Menus and Commands" in Section 3. When programming is finished, be sure to EXIT PROGRAMMING or the Model 45B will not detect subsequent call activity until the programming mode activity timer expires (5 min).

ACCESSING PROGRAMMING MODE VIA MODEM (Option)

The Model 45B's programming may be accessed without any additional connections by using a standard phone line to the device, coupled with the unit's optional installed internal modem. This method is slightly more involved than the direct connect method because the Model 45B must know that you want to do CRT programming and not DTMF programming or place an actual call or page. The steps for accessing CRT programming over a phone line are outlined below.

1. SET UP YOUR COMPUTER OR CRT. Your computer or CRT must have a modem and be running a terminal emulation program that will send data to the modem and over the phone lines. Start your terminal emulator and set the correct communication protocol.

2. CALL THE MODEL 45B. You may do this either by dialing the number on your phone and then switching the modem to that line, or if you have a Hayes (compatible) modem, you may instruct the modem to dial the number for you, like this:

   ATDT123-4567; RETURN

   The AT gets the modem's Attention, the D is for Dial and the T is for Touch-Tone dialing. The number comes next and may contain hyphens or parentheses which are ignored or commas which insert delays. Finally, press the RETURN key to dial the number entered.

3. ENTER THE PROGRAMMING ACCESS CODE. After the Model 45B is called, it will answer the line after a predetermined number of rings. After the prompt tone, enter the program access code using DTMF (factory set to 00098). The program access code may be entered with a Hayes compatible modem by typing ATDT00098. The Model 45B will issue modem carrier for about 20 seconds, after which it will go into DTMF programming (see "Programming via DTMF"). If the Model 45B detects modem carrier before the time-out, the "Top Menu" (Figure 3) will be displayed if a RETURN is entered from the keyboard. Note that answer mode 2 does not answer the line and allow you to overdial, so programming access is not possible.

4. PROGRAM THE DEVICE. See "CRT Programming Menus and Commands."

5. EXIT PROGRAMMING MODE. Press E from the "Top Menu" to exit programming mode. Failure to do this may result in non-recognition of subsequent call activity for the programming activity time. From a Hayes compatible modem, typing ATH followed by RETURN hangs up the phone. Detection of dial tone, loss of carrier or detection of a break will cause the Model 45B to hang up the phone.

```
Model 45B
Copyright, 1987, ZETRON INC.

LOG ON MESSAGE

TOP MENU

S. SYSTEM           U. USERS
V. SUPERVISOR       A. ACCOUNTING
T. TEST             O. OPTIONS
E. EXIT

Please select:
```

FIGURE 3: Model 45B sign-on and "Top Menu" for programming

CRT PROGRAMMING MENUS AND COMMANDS

The Model 45B's CRT programming is accomplished through a hierarchy of menus. The first and most general menu is the "Top Menu". From the Top Menu, the operator may access system, user and supervisor programming as well as access accounting information, test functions, list installed options and exit the programming mode. To select any menu option, simply type the letter which appears to the left of the option description. When entering data, a "Y" or "N" may be entered for yes/no or enable disable questions. The letter pressed may be upper or lower case. For example, when programming is complete, press "E" or "e" to exit programming. This ensures that all subsequent calls will be processed. Since the supervisor information is the simplest, it will be discussed first, followed by system and user programming. Before actual programming is discussed, a few words about menus in general is in order.

USING MENUS

When menu options are selected (by pressing the corresponding letter), the menu name is displayed. To view the list of that menu's options, press the RETURN key. This method is employed to speed programming once the operator is familiar with the menu options. To return to the Top Menu from a lower level menu, type an exclamation mark "!". To return to the previous menu, type a period ".". Pressing the period while entering data returns to the top of the current menu after accepting the data. Pressing RETURN while entering data, accepts the current data and displays the next item in the menu. Pressing the RETURN without entering in any data will leave the selection unchanged and advanced to the next menu selection.

PROGRAMMING SUPERVISOR INFORMATION

Pressing "V" followed by the RETURN key from the Top Menu, displays seven supervisor variables (Figure 4). To change a supervisor variable, type the letter (A, N, S, U, I, M or L) corresponding to the variable to be changed. For example to change the program mode ANI to 00123, press A, type 00123 and press the RETURN key. Be extremely careful not to set the program mode access code to a valid user number or ANI code or subset thereof, if you do the Model 45B will prompt you with the message ANI conflict. While entering a variable, press the BACKSPACE key to back up and correct mistakes. After the RETURN key is pressed, you are prompted to enter the supervisor user number. Enter the new number and press RETURN or just press RETURN to leave the current setting unchanged and skip the next entry.

When displaying system programming, the scrolling of the menus may be stopped with Control S (^S). Enter Control Q (^Q) to restart the listing.

Press M to enter the Logon message. This message will appear before the top menu when you first access the system.

To exit the menu, simply type a ! to return to the top menu, or type a period to return to the previous menu (in this case the top menu) if you are currently at the top of the supervisor menu.

```
Select: V

SUPERVISOR MENU

A. Program mode ANI (chrs) = 00098
N. Supervisor user number = 0
S. Reset system programming = No
U. Reset user programming = No
I. Clear SMDR storage = No
M. Logon message =
L. List system programming = No

Please select:
```

FIGURE 4: Supervisor programming

PROGRAM MODE ANI--the code is used to gain access to DTMF programming from a mobile, or DTMF or modem programming from a telephone. The first three digits of the code cannot be in the range of 001 to 325.

SUPERVISOR USER NUMBER--specifies privileged supervisor user. The supervisor can answer any call (telephone-to-mobile or mobile-to-mobile) and disconnect any call in progress (telephone, mobile-to-mobile, or repeat) using the specified connect and disconnect codes.

RESET SYSTEM PROGRAMMING--if a "Y" is entered, the units system programming is reset to the factory defaults.

RESET USER PROGRAMMING--if a "Y" is entered, the unit's user programming is reset to the factory defaults. Caution: When the user programming is reset the accumulated call data is also cleared. The accumulated call data can also be cleared in the accounting menu, clear accumulated.

CLEAR SMDR STORAGE (option)--with the internal SMDR storage option, a "Y" will clear all SMDR call transaction entries. This command does not clear the accumulated storage.

LOGON MESSAGE--The message entered hear will appear in the logon message above the TOP MENU.

LIST SYSTEM PROGRAMMING--if a "Y" is entered, all of the system programming menus will be listed with their programmed values. A control S (^S) will stop the scrolling and a control Q (^Q) will start it again.

PROGRAMMING SYSTEM INFORMATION

Pressing "S" followed by RETURN from the top menu, display's the System Menu (Figure 5). From this menu, 13 system-related programming options are available, discussed below.

```
SYSTEM MENU

C. COR              A. ACCESS
H. DISPATCH         P. PAGING
I. STATION ID       D. AUTODIALS
V. TOLL RESTRICT    T. TELCO CONTROL
1. LINE 1           2. LINE 2
L. LOCAL PHONE      S. SIMPLEX
M. MISCELLANEOUS

Please select:
```

FIGURE 5: System Programming Menu

COR Programming

Pressing "C" followed by RETURN from the System Programming Menu will display seven variables which effect COR operation (Figure 6). Press the letter (H, Q, M, A, V, or B) of the variable to change, or press H to step through all settings. Enter the desired value noting the required units and press RETURN to implement the change. Each variable is described in detail below.

```
COR MENU

H. Hold time (*100ms) = 2
Q. Quiet time (*100ms) = 30
M. Mob Tx-to-Rx time (*100ms) = 2
A. Mob act time (*sec) = 30
V. COR validation active high = Yes
B. Channel busy active high = No

Please select:
```

FIGURE 6: COR programming information

HOLD TIME--the hold time determines how long the COR signal must be inactive before the Model 45B is sure that the mobile is not transmitting. This time eliminates "picket-fencing" with mobiles. Enter the value for COR hold time from 0 to 50. This value is then multiplied by 100 milliseconds to obtain the actual COR hold time.

QUIET TIME--the quiet time is the amount of time the radio channel must remain quiet (no COR) before the Model 45B issues ring-outs over the air on a phone to mobile call. Note that this time delay is not used on a mobile to mobile call.

MOBILE TX-TO-RX--this is the amount of time the mobile requires to change from transmit to receive mode. After this time expires the courtesy tones, if enabled, will be issued. Note that the mobiles audio is muted during this time. If the mobile is set up as full-duplex this timer has no effect, the phone to mobile audio is never muted. When operating in the simplex mode, this timer value must be less than the VOX hold time in the simplex menu.

MOBILE ACT TIME--the mobile activity time determines how long a land-line may transmit without mobile intervention. The FCC regulations set this time at 30 seconds for Part 90 operation. The transmitter is automatically dropped if this time expires. Warning beeps are issued at 12, 9, 6 and 3 seconds before the transmitter is dropped.

COR VALIDATION--the unit is provided with an auxiliary "sense" line input (SENSE1) to allow the connection of an external validation signal (e.g. the output of a CTCSS tone decoder). If "N" is entered, an active low level signal is required for the unit to validate the COR input. Alternately, if a "Y" is entered, an active high level is required to validate COR. Note that the COR validation input is always pulled high internal to the model 45B. So if COR Validation is not being used set it to active high and leave the input open. If needed JP13 puts a 1K-ohm pull-up to +5V on this line.

CHANNEL BUSY--the unit is also provided with an auxiliary channel busy input (SENSE 2) for use with a monitor receiver. If "N" is entered, the input must go high for the programmed quiet time (described above) before the unit will ring-out on the channel (active low channel busy). Alternatively, a "Y" indicates active high channel busy on the input. Note that the channel busy input is pulled high internal to the Model 45B. So if the channel busy input is not being used set it to active low and leave the input open. If needed JP14 puts a 1K-ohm pull-up to +5V on this line. Caution: if the COR LED is flashing, this input is active and access from a mobile will be impossible.

Access Programming

Pressing "A" followed by RETURN from the System Programming Menu will display eight access oriented variables (Figure 7), discussed below.

```
ACCESS MENU

S. Sign-on mode = 0
1. User 1 short sign-on = Yes
D. DTMF timeout (*100ms) = 50
R. Min. regenerated digits = 7
U. Phone-to-mobile use ANI = No
M. Mobile-to-mobile use ANI = No
P. #+ANI to disconnect = Yes
A. Direct page ANI (chars) = *2
C. Dial click decode mode = 0
W. Enable wild ANI = No

Please select:
```

FIGURE 7: Access programming information

SIGN-ON MODE--selects Zetron (0), RCC style (1), or RCC style 2 (2) sign-on modes, with steering digits and formats as follows:

Zetron (0):	"*" + Access Code = default phone line access
	"0" + Access Code = repeater access
	"1" + Access Code = mobile-to-mobile access
	"2" + Access Code = alternate phone line access
RCC 1 (1):	Access Code + "9" = default phone line access
	Access Code + "5" = repeater access
	Access Code + "7" = mobile-to-mobile access
	Access Code + "8" = alternate phone line access
RCC 2 (2):	"*" + Access Code + "9" = default phone line access
	"*" + Access Code + "5" = repeater access
	"*" + Access Code + "7" = mobile-to-mobile access
	"*" + Access Code + "8" = alternate phone line access

USER 1 SHORT SIGN-ON--if "yes", allows mobiles to sign-on as user 1 using a long (0.8 sec.) single digit. The Zetron style sign-on steering digits ("*", "0", "1", "2") are used regardless of the sign-on mode selected.

DTMF TIMEOUT--this is the maximum amount of time the Z-Patch waits between DTMF digits from the mobile, when dialing a phone number, before dropping out of digit regeneration. A DTMF "*" from the mobile will also cause the unit to drop out of regeneration, see also minimum regenerated digits. This timer does not affect sign-on, it is a fixed 2 seconds between digits.

MINIMUM REGENERATED DIGITS--this is the minimum number of digits the Model 45B accepts from a dialing half-duplex mobile before deciding that dial-in is complete. The minimum number of regenerated digits is not used as a toll restrict, but is an indication that regeneration should be terminated and the mobile's audio should be passed to the phone line. Regeneration will, however, not cease until the mobile unkeys, the DTMF time-out occurs or the mobile keys a DTMF "*". Note that a full-duplex mobile has to key the DTMF "*" or time-out, since he does not normally unkey.

PHONE-TO-MOBILE USE ANI--if 'yes', a landline caller must enter the called mobile's ANI code rather than user number before ring-outs are issued.

MOB-MOB USE ANI--if 'yes', a mobile caller must enter the called mobile's ANI code rather than the user number before ring-outs.

#+ANI to DISCONNECT--This question only applies when a user is not allowed to disconnect a call with just a "#" (# to disconnect = No, in user programming). If "#" to disconnect is set to no for the user and #+ANI to Disconnect is set to yes, the mobile is required to enter "#" + ANI code to disconnect a call. If #+ANI to disconnect is set to no the user must enter ANI code to disconnect. If the user is set up with # to disconnect, user programming, this question does not affect sign-off. See user programming for more disconnecting information.

DIRECT PAGE ANI (option)--enter an up to 8-digit code. If this code is entered by a calling telco party, they may then enter a GMARC page code. See GMARC discussion in the Options Section. Caution: for this option to work properly user 1 must be programmed as a two-way mobile with the GMARC paging format. The first three digits of this code cannot be in the range of 001 to 325.

DIAL CLICK DECODE MODE (option)--Dial click may be enabled be setting this question to a 1 or 2. If dial click is not being used, set this question to '0'. In mode one the Model 45B decodes clicks from the phone line using timing from a standard phone, or the value of the timing in nonvolatile memory. See the installation section. If this does not work, mode 2 will require a leading '0' to calibrate the software. Mode 2 only requires the leading '0' from the dial pulse phones, the DTMF phones just enter the access code. Mode 3 is for use with an external dial click decoder. When mode 3 is used the normal dial click functions of the Model 45B will be disabled and the pause before disconnect or auto call is extended to 15 seconds. The external decoder is enabled with the output at J1 pin 21 after the beep or after dial tone drops. When mode '0' is selected the nonvolatile memory is initialized to the timing of a standard phone.

ENABLE WILD ANI--if 'yes', allows mobile to sign on with any DTMF digit where an "A" is programmed in the User Specific Menu under ANI code. If an ANI of 10AA is programmed for any user, then 1000 thru 1099 will sign on as that user. If an ANI of 4A is programmed for any user, then 40 thru 49 will sign on as that user, etc. This is used mainly to allow roaming between systems.

Dispatch Programming

Pressing "H" followed by RETURN from the System Programming Menu will display four dispatch oriented variables (Figure 8), discussed below.

```
DISPATCH MENU

H. Hold time (*100ms) = 30
T. Timeout (*min) = 3
A. ANI for dispatch = Yes
C. Courtesy tone = Yes
R. Repeat audio = No

Please select:
```

FIGURE 8: Dispatch programming information

HOLD TIME--the amount of time the unit will keep the transmitter keyed after the mobile unkeys. Note that on a mobile to mobile call the hold time is forced to 25 seconds.

TIMEOUT--the maximum amount of time the repeater may remain in transmit mode.

ANI FOR DISPATCH--if 'yes', a mobile must enter their ANI code with the proper steering digit to gain repeater access. If 'no', simply keying up will key up the repeater (dispatch mode).

COURTESY TONE--if 'yes', a courtesy tone is issued when a mobile unkeys if ANI for dispatch is 'no'. If ANI for dispatch is 'yes', the courtesy tone setting for the originating user is used.

REPEAT AUDIO--if 'yes', the Model 45 will repeat the audio during a mobile-to-mobile call and continue to repeat the audio for the duration of the call. This is used if the operator of the system wants to keep track of the time for all mobile-to-mobile calls. If Repeat Audio is set to 'no', the M45 will page the mobile being called and ring out until the called mobile answers. After the mobile answers, the M45 will drop out of the call allowing the repeater to repeat the audio. Mobile-to-phone and phone-to-mobile calls are not affected by this question.

Paging Programming
Pressing "P" followed by RETURN from the System Programming Menu will display five paging oriented variables (Figure 9). Each variable is discussed in detail below.

```
PAGING MENU

D. Keyup delay (*25ms) = 40
1. DTMF timing #1 (*25ms) = 3
2. DTMF timing #2 (*25ms) = 8
R. RTX enable = No
T. Talk time (*sec) = 5
G. Number of GMarc channels = 4

Please select:
```

FIGURE 9: Paging information programming

KEYUP DELAY--the delay the unit inserts between the time it keys up the transmitter and issues the paging tones. Note that the CTCSS tones come up at the same time the transmitter is keyed.

DTMF TIMING--two variables for setting the timing of DTMF digits for DTMF paging. One of these two variables is selected in a user's page format programming. This timing sets the digit on time and the inter-digit timing.

RTX ENABLE--if 'yes', the Model 45 will send a collect tone (DTMF D) for 2.5 seconds prior to sending the DTMF page. This collect tone is used by the RTX mobile decoders to lock onto the channel while scanning and wait for the page. This will also change the hangup tones sent by the Model 45 from the beeps to a DTMF A. This hangup tone is used to mute the RTX decoder board after a call has been completed. (This format is only used with the DTMF option.)

TALK TIME--the maximum amount of time allowed for voice messages during tone-and-voice paging. If the phone party is silent for twice the VOX hold time (in the simplex menu), the talk time is prematurely terminated and the call is ended.

NUMBER OF GMARC CHANNELS (option)--enter the number of channels being used in the GMarc system that the unit is installed with. This number determines the timing of the collect tone, first tone sent, in 2/4 tone paging. The collect tone equals the number of channels X 90ms + 90ms.

Station ID Programming
Pressing "I" followed by RETURN from the System Programming Menu will display three station ID oriented variables (Figure 10), discussed below. The station ID frequency is fixed at 1200Hz.

```
STATION ID MENU

M. Mode = 0
I. Interval (*min) = 15
S. Call sign (chrs) = 0

Please select:
```

FIGURE 10: Station ID information programming

MODE--determines how the Station ID will be broadcast.

0= Not broadcast.
1= Broadcast at end of call if ID interval has expired.
2= Broadcast at expiration of ID interval and quiet channel. If the interval expires during a call, the ID is broadcast at call's end.
3= Broadcast when channel is quiet, after ID interval and channel activity.
4= Broadcast at end of every call.

INTERVAL--the amount of time between broadcasts of the station ID.

CALL SIGN--the ID which is broadcast in Morse code. Up to 10 alphanumeric digits may be entered.

Auto-Dial Programming
Pressing "D" followed by RETURN from the System Programming Menu will display the nine auto-dial numbers (Figure 11).

```
AUTODIAL MENU

1.  (chrs) =
2.  (chrs) =
3.  (chrs) =
4.  (chrs) =
5.  (chrs) =
6.  (chrs) =
7.  (chrs) =
8.  (chrs) =
9.  (chrs) =

Please select:
```

FIGURE 11: Auto-dial information programming

AUTO-DIAL NUMBERS--nine numbers of up to 16 digits may be entered for each auto-dial. A "D" between two digits will cause a 5-second delay in dialing between those two digits unless the VOX is active for 2 seconds. Caution: the numbers cannot contain any spaces or characters other than D between digits.

Toll Restrict Programming
Pressing "V" followed by RETURN from the System Programming Menu will display six toll restrict oriented variables (Figure 12). Each variable is discussed in detail below.

```
TOLL RESTRICT MENU

1. Max toll digits 1 = 15
2. 1st digit restrict 1 (chrs) =
3. 2nd digit restrict 1 (chrs) =
4. Max toll digits 2 = 15
5. 1st digit restrict 2 (chrs) =
6. 2nd digit restrict 2 (chrs) =

Please select:
```

FIGURE 12: Toll Restrict information programming

MAX TOLL DIGITS--these variables contain the maximum number of digits a mobile may dial for a phone number. Two variables are provided for greater flexibility. Each user's programming selects no toll restricts or one of these sets, 1 or 2. Note that Max Toll Digits and 1st and 2nd digit restrict are selected together.

DIGIT RESTRICT--Two sets of digit restrictions are allowed; each set allows selection of up to four first digits to restrict and selection of up to four second digits to restrict. Entering a space will clear any previously entered digits. Each user's programming selects no toll restriction, restriction set 1, or restriction set 2. Note that when selecting digit restrict 1 or 2 that this also selects max. toll digits 1 or 2. The numbers 911, 1-800-nnn-nnnn, and the auto-dial numbers are never restricted, but the last number redial is toll restricted. Also, if Toll Mode 2 is selected in the user programming, the numbers 411 and 555 are restricted all the time. When entering the digits they must be entered without any spaces or other characters between them. If less than 4 digits are entered during dialing, the call will be restricted when the DTMF timeout expires.

Telco Control Programming

Pressing "T" followed by RETURN from the System Programming Menu displays eight telco control oriented variables (Figure 13), discussed below.

```
TELCO CONTROL MENU

1. Call limit timer-1 (*min) = 3
2. Call limit timer-2 (*min) = 15
3. Channel ring-outs-1 = 5
4. Channel ring-outs-2 = 5
O. Delay before dialout (*100ms) = 20
D. Disconnect on 2nd DialTone = Yes
M. Dialout mode = 0
V. Override dispatch = No
B. Broken ring for busy = No
P. Hookflash PTT count = 0
R. Regenerate DTMF after PTT hookflash = No

Please select:
```

FIGURE 13: Telco control information programming

CALL LIMIT TIMER--these two variables restrict the maximum length of a call. Each user's programming selects no time-out or one of these two limits. This timer affects phone to mobile and mobile to phone. This timer will also limit the time of a mobile to mobile call if the repeat audio is 'yes'. This timer will limit repeater time if the repeat audio option is 'yes' and ANI for dispatch is 'yes'.

CHANNEL RING-OUTS--these variables control how many AIR ring-outs are issued for an incoming landline call. Each user's programming selects one limit.

DELAY BEFORE DIAL-OUT--minimum time between phone line off-hook and start of dial, if the mobile does not unkey after entering the access code. This value must be greater than the amount of time it takes for the telephone company to issue dial tone after coming off-hook.

DISCONNECT ON 2ND DIAL TONE--if 'yes', the Z-Patch disconnects a call after 2 seconds of dial tone returned after the unit has dropped out of DTMF regeneration (2nd dial tone) or 5 busy signal cycles (after dialing phone no.). Note that this function is not intended to be used for toll restriction.

DIAL-OUT MODE--this variable determines how the Model 45B dials a mobile originated call's phone number during regeneration.

0= slow DTMF (5 digits/sec) 2= slow Pulse (10 pulses/sec)
1= fast DTMF (10 digits/sec) 3= fast Pulse (14 pulses/sec)

OVERRIDE DISPATCH--if 'yes', incoming calls from any phone line will issue a warning tone over the air if the channel is busy, then it will key the transmitter and call out to the user. This overrides the quiet timer. Note that you should disable the repeat audio in your repeater when the Model 45B keys the transmitter. If you have the repeat audio enabled in the Model 45B, the audio will be muted by the Model 45B.

BROKEN RING FOR BUSY--if 'no', the Model 45 will send a true busy signal to the phone party when a busy channel is detected after the phone party has overdialed the correct user number. If this question is 'yes' the Model 45 will send the usual broken ringing at this time.

HOOKFLASH PTT COUNT--this is the number of PTT's that must occur for the Model 45 to do a hookflash. A '0' entered here enables the DTMF hookflash mode. In DTMF mode, if the mobile enters a DTMF digit '1', the Model 45 will do a hookflash and go back to the regeneration mode. This allows the mobile to dial a number after the hookflash. If the mobile enters a DTMF digit '2', the Model 45 will do the hookflash and return to the conversation mode. This allows the mobile to answer a call-waiting call and begin talking after the hookflash. The minimum number of PTT's for a hookflash is 3 and the maximum number is 9. If you try to program a 1 or 2 here, the Model 45 will convert it to a 3. The timing for a PTT hookflash is critical. The PTT cannot be held for more than one second and cannot be released for more than one second to accomplish the hookflash.

REGENERATE DTMF AFTER PTT HOOKFLASH--if 'yes', the Model 45 will go back to the regeneration mode after the PTT hookflash. A 'no' here will return the mobile to the conversation mode after the hookflash. You will need to decide which mode is best suited for your application if you are using the PTT hookflash. This question is not used for a DTMF hookflash.

Line 1 and 2 Programming
Line 1 and 2 programming are identical except that line 2 has an override mode; only line 2 is discussed. Pressing "2" (1) followed by RETURN from the System Programming Menu will display five line 2 (four line 1) oriented variables (Figure 14), discussed below.

```
LINE 2 MENU

A. Rings until answer = 1
D. Channel busy rings = 6
M. Answer Mode = 0
U. Auto call user = 1
P. Priority override = No   (line 2 menu only)

Please select:
```

FIGURE 14: Line 2 (1) information programming

RINGS UNTIL ANSWER--this variable determines the number of rings the Model 45B must receive from a land-line before it determines that a call on that line needs to be processed. Caution: Rings until answer must be less than channel busy rings.

CHANNEL BUSY RINGS--this variable determines the number of rings that may occur before the Z-Patch disconnects when the channel is busy. The calling party hears broken rings. If the channel becomes free before channel busy rings occur then channel ring-outs will occur. On an idle channel if channel busy rings is greater than channel ring-outs then the phone will hear channel busy number of rings while the channel will still only get channel ring-outs. Caution: The caller will only hear channel busy rings, since this variable includes the rings until answer, if the channel is busy.

ANSWER MODE--this variable determines one of three Telco answer modes.

0= Answer/beep/Ring-out
Line is answered with a 400ms beep 750ms after Rings-Until-Answer, the Model 45B will then wait for the caller to enter a user number (or ANI), if the code is valid ring-outs will be sent out over the channel if the channel is clear. If the caller does not enter a number before the line times out, the Model 45B will disconnect if the auto call user number is '0', or the auto call user is disabled. If the auto call user number is not '0' then it will ring-out on the channel as above. If the channel is clear, the calling party will hear normal ringing. If the channel is in use, the calling party will hear broken ringing and the line will be disconnected after channel busy rings occur. If the channel is clear and if a mobile does not answer, the call is disconnected after channel ring-outs, if channel busy rings is less then channel ring-outs. If channel busy rings is greater than channel ring-outs the channel will receive channel ring-outs and the phone will receive channel busy rings. The minimum number of channel ring-outs and rings to the phone will be channel ring-outs if the channel is idle.

1= Answer/Dialtone/Ring-out
The line is answered after Rings-Until-Answer and a two-second dial tone is issued. During or within 5 seconds after the dial tone drops, the calling party may enter a valid user number (or ANI code if telco-use-ANI is required). When the access code is verified, the call proceeds as if in ANSWER/BEEP/RING-OUT mode above. If an invalid user number or code is entered, the call is disconnected. If a code or user number is not entered and the auto call user number is '0' then the call will be disconnected. If the auto call user number is not '0' then that user will be called if not disabled.

2= No-Answer/Ring-out
A call and ring-outs are issued over the channel after Rings-Until-Answer occur to the auto call user. The phone line is not taken off-hook until a mobile answers. If a mobile does not answer before channel busy rings, or channel ring-outs expire, the line is answered briefly to disconnect the call.

AUTO CALL USER--This parameter allows a valid user number to be assigned as the default recipient of an incoming call on this line. Exactly how this feature works depends on the Answer Mode to which the line is set.

If the line is set to Answer Mode 0 or 1, the line is answered and the prompt issued as usual. If the caller does not overdial anything, the Auto Call user is called after the dialing period times out. If the Auto Call user is set to '0' (or an invalid user number) the call will disconnect after the time out.

If the line is set to Answer Mode 2, the line is not answered, but the Auto Call user is signalled right away. The line is picked up when the Auto Call answers the call from the patch. If the Auto Call user is set to '0', the patch behaves as though the line were set to Answer Mode 0. It answers the phone line and issues a beep prompt. If the caller does not overdial a valid user number in the time allowed, it hangs up. Answer Mode 2 is really only useful when a valid user number has been assigned to the Auto Call user.

PRIORITY OVERRIDE--if 'yes', an incoming call on line 2 will issue a warning tone and cancel any operations currently in progress. This allows the new call on line 2 to be processed. This item only applies and is only displayed in the line 2 menu.

Local Phone Programming
Pressing "L" followed by RETURN from the System Programming Menu will display three local phone oriented variables. These variables are identical to the last three variables for line 1 programming. The only difference is that the local phone is limited to answer modes 0 and 1.

Simplex Programming
Pressing "S" followed by RETURN from the System Programming Menu will display eight simplex oriented variables (Figure 15). Each variable is discussed in detail below. Variables indicated with (*) are only used in simplex systems.

```
SIMPLEX MENU

X. Simplex operation = No
V. VOX hold time (*100ms) = 7
D. Dial tone sample rate (*100ms) = 10
S. Dial tone sample width (*100ms) = 1
I. Into sample time (*100ms) = 50
R. Sample rate (*100ms) = 20
W. Sample width (*10ms) = 2
T. Tx-To-Rx time (*10ms) = 3

Please select:
```

FIGURE 15: Simplex information programming

SIMPLEX OPERATION--this variable indicates whether the Z-Patch is operating on a simplex base or on a full-duplex base, or repeater. If answered yes the Z-Patch will operate in the simplex mode.

VOX HOLD TIME--the time between a gap in the telephone VOX signal and the Model 45B's determination that the phone party is no longer talking. This time should be longer than inter-syllable gaps but short enough to allow normal conversation turn-around. When calling a tone-and-voice pager, the talk time will be prematurely terminated if the phone party is silent for twice the hold time, simplex or full-duplex. If using a VOX delay board, be sure to set the VOX hold time greater than the VOX delay to avoid premature transmitter drop. When operating simplex, this value must be greater than the mobile tx-to-rx time in the COR menu.

DIAL TONE SAMPLE RATE (*)--this time is how long the Z-Patch samples or allows phone audio to go out the transmitter during DTMF regeneration. Dial tone sampling only occurs when the mobile is not keyed and the VOX is active (dial tone present).

DIAL TONE SAMPLE WIDTH (*)--this is the amount of time the Model 45B looks for mobile activity during a single sample. The amount of time the transmitter is dropped is equal to the sample width plus the tx-to-rx time. Once COR becomes valid the unit will not start sampling again until COR drops and VOX is active. Sampling only occurs when the mobile is not keyed and the VOX is active. Once DTMF regeneration is complete dial tone sampling is no longer used. If this value is

set to the maximum, dial tone will only be heard once for the dial tone sample rate time.

INTO SAMPLE TIME (*)--this is the amount of time the telephone VOX detector must be continuously active, no COR activity, before the Z-Patch will drop out of VOX simplex and begin simplex sampling. If this value is set to 255 the unit will never go into sampling. Once COR is seen or the VOX becomes idle the unit will drop back into VOX simplex operation.

SAMPLE RATE (*)--the sample rate is how often, after the Z-Patch has started simplex sampling, the Z-Patch samples the mobile channel for COR, this is how long the phone audio is allowed to go out the transmitter when the VOX is active. Note that once COR becomes valid and drops the Z-Patch will go back into simplex VOX. If the VOX becomes inactive the Z-Patch will also revert back into simplex VOX.

SAMPLE WIDTH (*)--this is the amount of time the transmitter is unkeyed and the channel is tested for COR activity. Simplex sampling only occurs if the VOX is continuously active for the into sample time and COR is not active. If the VOX goes idle or COR becomes active the Z-Patch reverts to VOX simplex.

TX-TO-RX TIME (*)--this is the time delay between the Z-Patch dropping the transmitter and the start of sampling (testing for a valid COR signal). This delay should be slightly longer than the time needed to change the transmitter from transmit to receive. The Z-Patch will not consider the COR signal to be valid until this time has expired after dropping the transmitter.

Miscellaneous Programming

Pressing "M" followed by RETURN from the System Programming Menu will display ten miscellaneous variables (Figure 16). Each variable is discussed in detail below.

```
MISCELLANEOUS MENU

D. Courtesy tone duration (*25ms) = 3
F. Courtesy tone frequency (*10Hz) = 54
R. ANI for system relays (chrs) = *1
1. User relay 1 mode = 0
2. User relay 2 mode = 0
B. Run modem at 300 baud = No
I. Invert digital = No
E. DID delay billing = No
V. ANI for voice prompts (chrs) = *3

Please select:
```

FIGURE 16: Miscellaneous information programming

COURTESY TONE DURATION--this is the duration of the courtesy tones and warning tones to the phone and mobile.

COURTESY TONE FREQUENCY--this is the frequency of the courtesy tones and warning tones to the phone and mobile. This value does not affect the Morse ID, it is fixed at 1200Hz.

ANI for SYSTEM RELAYS--this access code is entered from either a mobile or telephone to allow changes to be made to the system relays. Note that when accessing the system relays from a mobile a valid steering digit must also be entered before or after the access code, depending upon the sign-on mode; e.g., if Zetron-style sign-on is in effect, and the relay access code is "*1", a "**1" must be entered. The first three digits of this code can't be in the range of 001 to 325. ("System Relay 1" is Control 1 [J6 Pin 8, pulls to ground], and "System Relay 2" is Control 2 [J2 Pins 1&2]). After the prompt, enter a '0' to turn the relay off, a '1' to turn the relay on, or a '2' to not change the relay. Two digits must be entered. (See page 9-3 for pin outs.)

USER RELAY MODES--selects the corresponding user relays operation:

0 = ON at mobile originate, OFF at disconnect
1 = ON at mobile answer, OFF at disconnect
2 = ON at telco access, OFF at mobile answer
3 = ON at telco access, OFF at disconnect
4 = ON at telco access or mobile originate, OFF at disconnect
("User Relay 1" is Control Relay 3, and "User Relay 2" is Control Relay 4. See page 9-3 for pin outs.)

RUN MODEM at 300 BAUD--this menu item will only appear if the 300/1200-baud modem option is installed. If set to yes the modem will operate at 300 baud, if set to no the modem will operate at 1200 baud.

INVERT DIGITAL--If set to 'yes' the digital encode output will be inverted. See the appendix, Digital Squelch codes, for more information.

DID DELAY BILLING--this is only programmed when using a DID converter with the M45B. If set to 'yes', the accompanying DID converter will reverse battery voltage when the called mobile answers the call through the DID unit. This action will let the phone company know that the mobile has answered the call and to start billing if it is a long-distance call. The question in the DID converter to allow delayed billing must also be set to "on" (23# 2#). If the Delay Billing questions are no, then the DID Converter will reverse battery voltage immediately when the M45 answers the call.

ANI FOR VOICE PROMPTS--this access code is entered from a telephone to program the voice prompts, if installed. This can be up to eight digits long but cannot be 001 thru 325 because of ANI conflicts. The factory default is *3.

PROGRAMMING USER INFORMATION

Pressing "U" followed by RETURN from the Top Menu will display the User Programming Menu (Figure 17). This menu provides two methods for programming user information. The access and operation menus or common menus allow a group of user's access, telco and equipment variables to be entered and changed. The specific menu works with one user at a time to program information unique to each user. The individual user programming options are discussed below.

When entering user information, typing a comma increments the current user number by 1.

```
USERS MENU

A. ACCESS       O. OPERATION
S. SPECIFIC     L. LIST

Please select:
```

FIGURE 17: User programming menu

Access User Programming

Pressing "A" followed by RETURN from the User Programming Menu will display the User Access Menu (Figure 18). In the Access and Operation menus, the user range or user to be affected is displayed in parentheses just after the menu name. If a range is selected then the parameters of the user being displayed will be on the right side of the colon ":", (range:user). If the user number being displayed is not within the range then its parameters will not be changed. When a parameter is changed, it only affects the users in the range.

```
USER ACCESS MENU(1)

U. User range = 1
E. User enabled = Yes
M. Mobile-to-phone = Yes
P. Phone-to-mobile = Yes
B. Mobile-to-mobile = Yes
T. Dispatch = Yes
C. COR to answer = No
S. * to answer = Yes
D. # to disconnect = No
F. Fast ANI required = No
L. Line select = No
2. Line 2 default = No
A. Autodial mode = 0

Please select:
```

FIGURE 18: User access menu

USER RANGE--this variable defines a single user or range of users to be affected by changes in the user common menus (access and operation). Enter a single user by typing U followed by the number of the user to select followed by RETURN. Enter a range of users by pressing U followed by the beginning user number, followed by a hyphen, followed by the ending user number and terminated with RETURN. For example, to enter a range of users one to 99, press U, enter 1-99 and press RETURN. When a range of users is selected, the range is displayed as f-l:c, where f= first user number, l= last user number and c= current user number, whose variables are displayed. The current user number may be outside the range, in which case, any changes made would not be reflected in the viewed data. Note that typing a comma will increment the current user number (c).

USER ENABLED--if 'yes', this user may access the Model 45B or receive calls through the Model 45B as allowed below.

MOBILE-TO-PHONE--if 'yes', this user may make mobile originated phone calls.

PHONE-TO-MOBILE--if 'yes', this user may receive calls from the landline.

MOBILE-TO-MOBILE--if 'yes', this user may place a call from his mobile to another mobile.

DISPATCH (option)--if 'yes', this user may access the repeater when ANI for dispatch is required (system programming).

COR-to-ANSWER--if 'yes', an incoming call to this user will be answered by a mobile keying up, any valid COR signal, this answer mode overrides "*" to Answer.

-to-ANSWER--if 'yes', the user may answer incoming calls by simply pressing a long DTMF "". Note that if COR to answer is set to yes this question has no affect on the way the mobile answers. If 'no' the user must answer with their ANI code. When using Zetron sign-on the user enters *+ANI to answer, with RCC mode 1 the user enters their ANI+*, and with RCC mode 2 the user must enter *+ANI+*. Note that the trailing '*' can be any digit.

#-to-DISCONNECT--if 'yes', the user may disconnect a call by simply pressing a 125ms DTMF "#". If 'no', the user must enter their ANI code to disconnect. If #+ANI to disconnect is enabled, in system programming, and # to disconnect is set to no, then the user disconnects with a "#" followed by their ANI code. (see #+ANI to disconnect in System access programming).

FAST ANI REQUIRED--if 'yes', the mobile must enter their ANI code to access, answer or disconnect at a minimum rate of 5 digits per second. This item does not affect access from the telephone.

LINE SELECT--if 'yes', user may determine which phone line to use for outgoing calls. If 'no', all outgoing calls are made on user's default line (see below). Line selection is controlled by sign-on mode.

LINE 2 DEFAULT--if 'yes', the user's default line is switched to line 2 rather than line 1. (e.g. a "*" ZETRON sign-on places the call on line 2 and a "2" places a call on line 1). Note that the connect button will connect to the default line for user 1.

AUTO-DIAL MODE--this variable selects the user's access to the nine auto-dial numbers, normal dialing and last number redial. The four auto-dial modes are shown below. With mode '0' the user can only dial numbers manually. With modes '1-9', when the user access's the system the number they are assigned to is automatically dialed. With mode '14' the user can access all of the auto-dial numbers, can do manual dialing and can do a last number redial. With mode '14' the auto dials are accessed by entering a '*' then a digit from 1 to 9, for the number they want auto-dialed, or a 0 for last number redial, after they receive dial tone. With mode '15' the user can only access the auto-dial numbers, they cannot do any manual dialing. Access is done by just entering the auto-dial number after they receive dial tone.

Caution: the auto-dial numbers are not toll restricted, but last number redial is.

0 = Autodial access and last number redial is not allowed.
1-9= Forced automatic dialing of the indicated auto-dial number upon mobile access.
14= Access to all auto-dial numbers, normal dialing and last number redial.
15= Access to all auto-dial numbers only (normal dialing not allowed).

User Operation Programming

Pressing "0" followed by RETURN from the User Programming Menu will display the User Operation Menu (Figure 19). The user range and user enabled items in this menu are identical to that of the User Access Menu and are not discussed in detail here. All other User Operation Menu items are discussed in detail below.

```
USER OPERATION MENU(1)

U. User range = 1
E. User enabled = Yes
Q. Equipment type = 0
N. Number of ring-outs mode = 1
S. Ring-out style = 0
O. Courtesy tone = Yes
X. Full-duplex mobile = No
P. Privacy = No
M. Call timer mode = 1
T. Toll mode = 0
D. DTMF thru = No
F. Page format = 0
C. CTCSS/Digital drop mode = 0
1. Enable relay 1 = No
2. Enable relay 2 = No
H. Enable hookflash = No

Please select:
```

FIGURE 19: User operation menu

EQUIPMENT TYPE--this variable determines the type of equipment this user will be using to receive calls. The choices of equipment type are described below.

0 = Mobile.
1 = Talk-back pager.
2 = Tone+Voice pager.
3 = Tone-only pager.
4 = Direct channel access.

Equipment type 4 will dump the caller on air, if the channel is idle, after issuing a beep.

Note that if any equipment type other than mobile is selected, the mobile-to-phone privilege is automatically set to "no". If desired, it must be re-enabled. This item only affects how the unit is called from a mobile or the phone line.

NUMBER of RING-OUTS MODE--this variable determines which of the two system variables, channel ring-outs-1 or channel ring-outs-2, will be assigned to a user. The channel ring-outs determine the number of ring-outs that will occur on the channel before the transmitter is dropped.

RING-OUT STYLE--this variable provides one of seven different and distinctive ring-out styles for a mobile. Each style is described below.

0 = Normal ring.
1 = Double ring.
2 = Triple ring.
3 = Ding-Dong type ring.
4 = Singer type ring.
5 = Warbler type ring.
6 = Normal ringing.
7 = Repeat pager tones.

Note that if the user is not setup with a paging format and code that normal rings will occur if repeat pager tones is selected.

COURTESY TONE--if 'yes', a tone will be issued to the phone line when the mobile unkeys. If ANI for dispatch (option) is required, a courtesy tone will also be issued out the transmitter when a mobile unkeys. The courtesy tone is sent after the COR hold time plus the tx-to-rx time. (see dispatch menu in system programming).

FULL-DUPLEX MOBILE--if 'yes', this user operates as a full-duplex mobile. The COR signal is not used to mute the TX audio. Privacy tones and the mobile tx-to-rx timer will not apply. Note that on a half-duplex mobile the TX audio is muted when COR is active and during the COR hold time plus the mobile tx-to-rx time.

PRIVACY--if 'yes', a fast busy signal is sent out the transmitter when the mobile is keyed-up. Privacy is only used on half-duplex mobiles, if the mobile is setup for full-duplex, above, the privacy tone is disabled.

CALL TIMER MODE--this variable selects one of the two call timers for the user. A zero applies no time restriction to the user, a one selects call timer 1 and a two selects call timer 2.

TOLL MODE--this variable assigns one of the two toll restrict digit and number length sets to a user. A zero applies no toll restricts, a one selects toll restrict digit/length set 1 and a two uses set 2.

DTMF THRU--if 'yes', the mobile may DTMF dial directly to the phone line after the Model 45B stops regenerating DTMF. If 'no', extra DTMF digits are inserted after any mobile DTMF digits are entered preventing useful number dialing. Caution: if DTMF thru is allowed a mobile can dial a toll restricted number if dial tone is returned after the called party disconnects the call.

PAGE FORMAT (option)--the user's paging format, chosen from the list below. The given paging option must also be installed.

0 = No paging for this user.
1 = DTMF paging timing 1.
2 = DTMF paging timing 2.
3 = 2805 paging.
4 = Two-tone paging.
5 = Five/six-tone paging.
6 = GMarc paging.

CTCSS/DIGITAL DROP MODE (option)--if set to '0' the subaudible tone (CTCSS) or digital code will be transmitted for the duration of the call. If mode '1' is selected the tone/code is dropped after the paging tones are sent, or after the first ring-out if the user is not set up with paging tones, in mobile ring-out. If set to mode '2' the tone/code is dropped after the mobile answers the call. If mode '1' or mode '2' are selected the tone/code will not be sent out when the mobile signs on to the system.

ENABLE RELAY 1/2--controls whether the two user relays, 1 or 2, are enabled for use as setup in system programming. If yes the relay(s) will operate per the mode selected, if no the relay(s) will not operate. See system programming for operation modes. User relay 1 is K2 and the contacts come out on J2 pins 3 & 4, user relay 2 is K1 and the contacts come out on J2 pins 5 & 6.

ENABLE HOOKFLASH-- if 'yes', this user may do a hookflash as described in the System Telco Menu.

User Specific Programming

Pressing "S" from the User Programming Menu will display the User Specific Menu (Figure 20). The current user is displayed in parentheses after the menu name, this is the user that is being programmed. The current users parameters are displayed and are changed when an item in this menu is changed. This is the same user number as the current user in the user common (access and operation) menus.

Note that items changed on the user specific menu only affect one user, not a block of users as in the common menus.

If a comma is entered while in the user specific menu, the current user number is incremented by one. If a comma is entered after data, the data is entered and the current user number is incremented while staying on the same menu item.

```
USER SPECIFIC MENU(1)

U. Current user = 1
E. User enabled = Yes
A. ANI code (chrs) = D
F. Page format = 0
P. Page code (chrs) =
C. Tx tone/code = 0

Please Select:
```

FIGURE 20: User specific menu

CURRENT USER--this variable selects the user that is affected by changes made by specific user programming. The current user is displayed in parentheses just after the menu name and is the same current user as in the common menus.

USER ENABLED--if 'yes', this user may access the Model 45B (duplicated in the other user menus).

ANI--the ANI code for the user, from one to eight characters. When entering ANI codes if the Model 45B detects another ANI that is the same or a subset it will display "ANI conflict" and a new ANI will have to be entered. If you continue to have problems check all ANI codes with the user list command and list system. To clear the ANI and reset it back to 'D', press the space bar and then ENTER.

PAGE FORMAT (option)--same as page format in the user operation menu. CAUTION: When a different page format is entered, the page code is automatically cleared (below).

PAGE CODE (option)--the page code, if applicable, defines the DTMF or tone code that is sent over the air. Each code depends on the page format, as shown in the Options section.

TX TONE/CODE (option)--this variable specifies the subaudible (CTCSS) tone or the digital code for the user. The CTCSS tone is selected from 1 to 38, or zero for none. The digital code is selected from 1 to 104. To enter a digital code a 'D' must preset the number. See the Appendix Section for tone frequencies vs. tone numbers and the digital codes vs. numbers.

User Lists

Pressing "L" from the User Programming Menu will display user lists. First, press U and enter the range of users to list (i.e.1-20) and press RETURN. Finally, enter "Y" and RETURN to list the user's programming. First the user number will be displayed on the left, to the right will be the user programming, A - X, followed by the ANI for the user, the CTCSS tone, the paging format and finally the page code. A typical user list is shown in Figure 21. To save space, the user programming information is displayed in a compact format of 24 characters. The programming associated with each character (labeled from A to X from the left) is given below. The user list may be paused is needed by entering a control S (^S). Once paused it may be started again by entering a control Q (^Q). If you wish to abort the display enter a control C (^C).

```
Model 45B (Station ID) 09/23/87 08:00:24
Usr       Programming          ANI     Tone  Type     Page
--- ABCDEFGHIJKLMNOPQRSTUVWXY ------- ---- ------ --------
  1 nnYnn1Onnn1nnnnYYYYYOO>nn 001         0  *NONE*
** End of list **
```

Figure 21: User List

Definition of programming characters:

A. Privacy	B. Enable user
C. * to answer	D. # to disconnect
E. DTMF thru	F. Number of ring-outs mode
G. Ring-out style	H. CTCSS drop mode
I. Fast ANI required	J. Full-duplex mobile
K. Call timer mode	L. Line 2 default
M. Enable relay 1	N. Enable relay 2
O. COR to answer	P. Mobile-to-phone
Q. Phone-to-mobile	R. Mobile-to-mobile
S. Dispatch	T. Courtesy tone
U. Toll mode	V. Equipment type
W. Auto-dial mode	X. Line select
Y. Hookflash enable	

If a programming variable is enabled or allowed, a "Y" is printed, otherwise an "n" is printed. Variables with a range have a number printed. The auto-dial mode variables are displayed as follows: 0 is no access to auto-dials or last number redial; 1-9 is access only to the auto-dial specified, 1-9; ? is access only to the auto-dials 1-9; > is access to normal dial-out and all of the auto-dials. While the list is output, the following keyboard commands are available:

cntrl C - aborts list
cntrl S - pauses list
cntrl Q - restarts a paused list

PROGRAMMING ACCOUNTING INFORMATION

Pressing "A" from the top menu will display nine SMDR variables and the number of SMDR records stored in the unit will be displayed in parentheses (Figure 22). This menu lets you control the storage and printing of airtime billing records as well as set the date and time of the Model 45B's internal clock/calendar. If the internal buffer overflows then the message 'lost records', with the number of lost records will be displayed. If the number of records stored is less then 999 then you may have a memory problem and you should perform a memory test. See the test menu.

```
ACCOUNTING MENU (0 recs)

P.  SMDR print mode = 0
I.  Internal SMDR storage = Yes
M.  Minimum call time (*sec) = 0
C.  Set clock (mm/dd/yy hh:mm:ss) = 07/04/87 13:13:13
O.  List SMDR storage = No
S.  Clear SMDR storage = No
R.  User range = 1
2.  List accumulated = No
1.  Clear accumulated = No

Please select:
```

FIGURE 22: Accounting menu

SMDR PRINT MODE (option)--this menu item determines whether the SMDR information is sent out the serial port at the end of each transaction, and the format of the output. Enter '1' to send the SMDR data to the serial port to be printer at the end of each call in the pretty print format, a '2' for the FP-10 format or '0' to suppress printing. This mode selection also affects the SMDR list below. See the options section for more information on the format.

INTERNAL SMDR STORAGE (option)--this menu item determines whether the SMDR information is internally stored at the end of each transaction. This is the same data that goes out the serial port. Enter 'Y' to store data at end of each call or 'N' to suppress internal storage.

MINIMUM CALL TIME--this is the minimum duration a call must reach before the call is printed or stored. When a call is printed or stored, the record shows the entire call time used.

SET CLOCK--use this function to set the Model 45B's internal clock and calendar. Enter the date and time as mm/dd/yy hh:mm:ss, including the slashes, spaces and colons. Use 24 hour time when entering the hours.

LIST SMDR STORAGE--enter 'Y' to print all internally stored detailed (SMDR) billing records. While the list is output, the following keyboard commands are available:

cntrl C - aborts list
cntrl S - pauses list
cntrl Q - restarts a paused list

The output format is determined by the SMDR print mode. See options section for more information on the format.

CLEAR SMDR STORAGE--enter 'Y' to clear the internally stored detailed (SMDR) billing records (does not clear accumulated).

USER RANGE--enter the range of users (low-high) to be included in the listing or clearing of accumulated billing information.

LIST ACCUMULATED--enter a 'Y' to list the accumulated billing information for the users specified with the USER RANGE command. The maximum time is 18 hours and the maximum hit count is 999 per user.

CLEAR ACCUMULATED--enter a 'Y' to clear the accumulated billing information for the users specified with the USER RANGE command above (does not clear detailed).

LISTING OPTIONS

Press O from the Top Menu to list the options installed in your Model 45B.

PROGRAMMING TEST MODES

Pressing "T" followed by RETURN from the Top Menu will display the Test Menu (Figure 23). Ten tests are displayed.

```
TEST MENU

A. Tone 1 frequency (*10 Hz) = 54
B. Tone 2 frequency (*10 Hz) = 10
1. Single tone (=Telco:1, Tx:2) = 0
2. Dual tone (=Telco:1, Tx:2) = 0
3. CTCSS/Digital encode = 0
4. Emphasis (=Telco:1, Tx:2) = 0
H. Hybrid adjust (=Off, On) = 0
D. DTMF/Click detect (=Telco:1, RX:2) = 0
C. COR detect = No
K. Click calibrate = No
S. Sense line states = No
M. Memory = No

Please select:
```

FIGURE 23: Test menu

TONE FREQUENCIES--select A or B to enter the tones used for the single and dual tone tests. Tone 1 is used for the single tone test. Tones 1 and 2 are used for the dual tone test. A range of 200 to 2500 Hz may be entered for the test tones.

SINGLE AND DUAL TONE TESTS--select 1 or 2 for single or dual tone tests. Next, enter 1 to send the tones to the telephone or 2 to send the tones out the transmitter. Press any key to end the test. Telephone line test are not allowed when programming via modem.

CTCSS/DIGITAL ENCODE TEST--select 3 for the CTCSS (subaudible) tone or digital encode test. Enter the tone number 1-38, or Digital number D1-D104 to start the test. The CTCSS tone/Digital code is sent out the CTCSS output line (J1-1). If CTCSS add-in is set to yes (system misc. menu) the tone is also sent out the transmit audio output, pins 18 and 19 of J1. The tone/code is generated for 10 seconds, after which the test ends. Caution: You cannot use CTCSS add-in when encoding a digital code.

EMPHASIS TESTS--select 4 for the EMPHASIS test. This test outputs a sequence of three tones of increasing frequency. The frequencies are 312, 624 and 1246 Hz each lasting 1.1 seconds. The sequence is followed by 3 seconds of quiet, after which the sequence is repeated. Enter a 1 for telephone output, or a 2 for transmitter output. Press any key to stop test. Telephone line tests are not allowed when access is via modem.

HYBRID ADJUST--select H for the hybrid adjust test. This test offers a simple way of balancing the telephone hybrid circuit. This test issues a single tone (test frequency 1) out a telephone line and feeds received telephone audio to the transmitter. Press 1 to start the test. When the test begins, the ringing phone line is answered--if no lines are ringing, line 1 is answered. Have a friend call the patch and remain quiet. Start the test. Adjust the phone balance potentiometers, R and C, for minimum deviation on the channel. Press any key to end the test. This test is not allowed when access is via modem.

DTMF/CLICK DETECT TEST--select D for DTMF tests. This test displays decoded DTMF from a mobile or phone and displays converted dial click digits from the phone. Enter a 1 to start the test from telco, 2 from the receiver. Note that clicks are only decoded from the telco. Press any key to end the test. If from telco, the test automatically answers the ringing phone line, or answers line 1 if neither of the lines are ringing. This test is not allowed when access is via modem. See the installation section for more information.

COR DETECT TEST--select C for the COR test. This test displays the COR state (OFF, HLD [hold], or ON). When COR is detected, the displayed state is ON. When COR goes away after being ON, the HLD state is displayed for the COR hold time. After the COR hold time, OFF is displayed. Press Y to start the test, press any key to end the test.

CLICK CALIBRATE--select K for the dial click calibrate test. This displays the state of the dial click detection circuit. This test automatically answers the ringing phone line, or line 1 if neither line is ringing. Press Y to start the test, press any key to end the test. Have a friend call the patch. Start the test. Have the friend dial a sequence of 0's. Adjust the click sensitivity potentiometer R6 on the Dial Click Decoder Board so the state is ON for the duration of the 0 and does not flicker off (about mid-range). This test is not allowed when access is via modem. See the installation section for more information on setting up the click adjustments.

SENSE LINE STATES--Select S to display the current state of the sense line inputs. Entering a Y will display the state (HI for high, LO for low) of the four sense lines 1-4. Once the states are displayed the test is ended.

MEMORY TEST--Select "M" to do a memory test. When the test is complete, a message is displayed depending on the results of the test and the options installed. "OK" is displayed if all memory is good. "FAIL is displayed if the system RAM (U58) is bad. If the SMDR internal storage option is installed "BAD:0", BAD:1", "BAD:2", or "BAD:3" is displayed if one of four the SMDR memory banks is bad. "BAD:SMDR" is displayed if the entire SMDR memory board is bad or not installed. The Model 45B may still operate if defective memory is detected but the memory should be replaced as soon as possible or unpredictable operation may occur. This test may also be done via modem.

SAVING THE DATABASE

Now that you have finished programming the system and user database you can now download the database to your computer if you have purchased the ZCOM software from Zetron. This function allows you to save what you have done and upload it to another terminal or upload it to the same device, if the database gets altered by a lightning storm or by a sever power disruption. The database in the Model 45B is backed up by an internal battery and will hold the programming through normal power outages. Caution: The accumulated air time is part of the user database, so when downloaded and re-uploaded the accumulated time will also be uploaded.

5. PROGRAMMING VIA DTMF

INTRODUCTION

Although it is not suggested that major system or user programming be accomplished via DTMF, it is often useful to have such a feature. DTMF programming is adequate for fine tuning system parameters, enabling or disabling users or changing user parameters. DTMF programming may be done over-the-air from a mobile or from a DTMF telephone from line 1, line 2 or the local phone. Note: the baud rate may only be changed via DTMF.

Almost all programming functions available through menu programming are also available with DTMF programming. One exception is that only one user may be programmed at a time, rather than a range of users (current user).

DTMF PROGRAMMING ACCESS OVER-THE-AIR

Since DTMF programming from a mobile uses the mobile channel, a method is incorporated to enter the programming mode, rather than to make a phone or mobile-to-mobile call. To enter the DTMF programming mode from a mobile, enter the programming access code rather than a user access code. An eight-note tone is sounded to verify the DTMF programming mode has been entered. The exact method to enter into the programming mode depends on the sign-on mode. With Zetron sign-on it is *+the access code, RCC mode 1 it is the access code+*, and with RCC mode 2 it is *+the access code+*. Note that the trailing "*" can be any digit.

DTMF PROGRAMMING OVER A TELEPHONE LINE

As with entering the DTMF programming mode from a mobile, a method is required to enter the programming mode from a phone line. Enter the DTMF programming mode from a phone line by dialing the Model 45B phone number. When the Z-Patch answers the phone, enter the programming access code. An eight-note tone is sounded to verify the DTMF programming mode has been entered. If the unit has the modem option installed, 10 seconds of modem carrier will be issued first.

ENTERING DTMF PROGRAMMING COMMANDS

All DTMF programming is accomplished by entering a programming function code, which selects one of the programming variables. All programming functions with corresponding DTMF function codes, menu paths, argument ranges and values are summarized on the programming reference sheet.

Once in DTMF programming mode, a function code is selected by entering the function code on the DTMF keypad followed by a DTMF "*". Entry of a valid function code is acknowledged with two quick beep tones. Entry of an invalid function code is signaled by two bee-doos.

After a valid function code is selected, enter the function argument (value) followed by a DTMF "#". Entry of a valid function argument is acknowledged with three quick beep tones. Entry of an invalid function argument is signaled by two bee-doos.

Functions that program digit sequences (e.g. access codes) are entered in a somewhat different manner. Enter the function code as normal. Next enter the LENGTH of the sequence to enter followed by a DTMF "#" -- three beeps are heard. Finally enter the string -- three beeps are heard after the correct number of digits have been entered.

EXITING DTMF PROGRAMMING MODE

DTMF function code zero provides a method of exiting the programming mode. Exit DTMF programming by selecting function code 0 (enter 0*). Select function argument zero - exit programming mode (enter 0#). A successful programming mode exit is acknowledged by sounding a series of two beep tones of three quick tones each. If the station ID mode is one or two, the station ID is sent after exiting the program mode.

DTMF PROGRAMMING ERRORS

If a "bee-doo" is heard when a "*" or "#" is entered at the end of a command string, then the command contained invalid data and no changes will have been made to the function parameter. A valid parameter is changed as soon as the "#" is entered NOT when the program mode is exited.

If an undesired function code is entered, pressing the "*" twice will abort the command and allow a new function code to be selected. If an undesired parameter is entered, pressing "*" instead of "#" will abort the command. If undesired but valid data are entered, the function must be reprogrammed with the desired data.

DTMF PROGRAMMING EXAMPLES

These examples assume the Model 45B's phone number has been dialed and the Z-Patch has answered the phone line and is issuing dial tone. Refer to the programming reference sheet at the rear of the manual for the DTMF commands used below.

1) Access DTMF programming:
   (Assuming the factory default)

   Enter "00098", Program mode access code
   (hear 8-tone signal, may have to wait for modem to drop).

2) Setting the Courtesy tone Frequency to 800 Hz:

   Enter "15*", Courtesy tone frequency function code.
   (hear two beeps)

   Enter "80#", Courtesy tone frequency function argument.
   (hear three higher-pitched beeps)

3) Setting auto-dial number one to 6441300:

   Enter "153*", Auto-dial number on function code.
   (hear two beeps)

   Enter "7#", Auto-dial number length.
   (the length -- hear three beeps)

   Enter "6441300", the number.
   (hear three beeps)

4) Enabling user number 99:

   Enter "30*", User number function code.
   (hear two beeps)

   Enter "99#", User number function argument.
   (select user 99 -- hear three beeps)

   Enter "82*, User enabled function code.
   (hear two beeps)

   Enter "1#", User enabled function argument.
   (enable user 99 -- hear three beeps)

5) Exiting DTMF programming:

   Enter "0*", System function code.
   (hear two beeps)

   Enter "0#", Exit programming function argument.
   (hear two-five beep sequences)

TESTS FROM DTMF PROGRAMMING

Tests are started by entering an argument of 1 or 2 (depends on test and desired output). The following tests are not available from DTMF: DTMF, COR, DIAL CLICK, and Sense line states.

6. OPTIONS

INTRODUCTION

This section covers the options that may be installed in the Model 45B. The available options are: paging tones, subaudible encode, repeat audio, extended users and billing. The options currently installed in a Model 45B are displayed by pressing 'O' from the Top Menu in CRT programming. Installation of one or more of these options affect Model 45B operation and programming. Specifics of each option is discussed in detail below.

PAGING OPTION

The Model 45B is capable of generating a variety of paging tones including two-tone, five/six-tone, GE GMarc, 2805, and DTMF. Installing any paging option will enable programming of paging variables such as page format and page code for each user. The use of each paging option is discussed below.

Two-Tone Paging Option

The Z-Patch contains a table of all commonly encountered tones used in two-tone sequential paging. The call code which the Z-Patch requires for paging a given user is derived from the tables which are found in Appendix A4. A page code is created as a 5-digit number which is entered as the page code for each two-tone pager. A page code has the format:

PAGE-CODE: T G1 G2 T1 T2

The first digit of the page code is selected from the timing table in Appendix A4.1 and depends only on the actual type of two-tone encoding desired. This number is referred to as T.

The second through fifth digits must be selected from the tone-group table in Appendix A4.2 and are in the form: G1-G2-T1-T2, where G1 and T1 are numbers for Group-1 and Tone-1 respectively. Look up the specific frequencies that the pager requires in the table. Write down the column number in which the first frequency appears. This is G1. Look across at the row number on the left side of the row where your first frequency appears. This is T1. Now repeat the process for your second frequency. This second procedure yields G2 and T2. Write down the five-digit number in the order T, G1, G2, T1, T2.

> EXAMPLE--given a Motorola tone-only pager, which requires 855.5 Hz as the first tone, and 313.0 as the second tone. The timing table of A4.1 gives a value of 2 for "Motorola Tone only" timing, therefore, T=2.

Looking up 855.5 Hz in the tone-group table of A4.2, we find it is listed in column 5, thus G1 is 5. 855.5 Hz is also in the row marked 8, therefore, T1 is 8.

Using a similar process with 313.0 Hz, we find that G2 (Mot 3) should be 3, and T2 is 4.

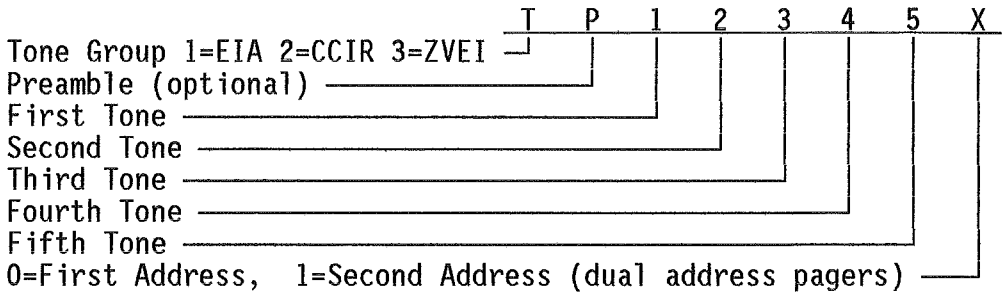
Now we have all the digits: T=2, G1=5, T1=8, G2=3, T2=4

Finally, write them down in the order: T G1 G2 T1 T2. For this example the pager code is 25384.

As a final double check, the last two digits of the actual cap-code on the pager should match the last two digits of the page code as entered into the Z-Patch (doesn't have to match user number).

> NOTE ON "TONE NUMBER A" IN THE FIRST TONE-GROUP TABLE--this is the diagonal tone for the tone group. If the decoders/pagers don't have group call and the decoder's capcode ends in the same two digits, then the diagonal tone is entered for one of the two tones. For most pagers the diagonal tone is entered for the first tone sent (tone A).
>
> NOTE ON GROUP CALL--for decoders/pagers with group call, a tone is sent for the group call time ("Grp" in timing table) to activate the decoders/pagers in the group. To activate group call in the Z-Patch, enter the first tone and group for both tones and groups in the page code. (Example: T G1 G2 T1 T2 if G1=G2 and T1=T2).

Five/Six-Tone Paging Option
Seven- or eight-digit pager codes for five-tone paging are entered as follows: (seven digits=no preamble, eight digits=preamble)



EXAMPLE--pager capcode 8-84325, EIA tones:

1st address ... Page code = 18843250

EXAMPLE--pager capcode 53421, ZVEI tones:

2nd address ... Page code = 3534211

DTMF Paging Option
DTMF paging is accomplished by sending a string of one to seven DTMF digits. The digits may be sent using one of two timers which may be from 50 msec to 2 sec. DTMF timer 1 and 2 are set in the paging menu and the actual timer is selected in user programming.

SUBAUDIBLE (CTCSS) ENCODE OPTION

The subaudible (CTCSS) encode option allows units to be programmed to encode a CTCSS tone (1 of 38) when transmitting. If this option is not installed, no menu selections dealing with this option are displayed. See Appendix 6 for tone numbers.

GMARC PAGING OPTION

The Zetron Model 45B Z-Patch with the GMarc paging option can be added to a GMarc V repeater to allow interconnect between a mobile and a phone line. The Model 45B is connected to one channel of the system, preferably the last channel to be used for repeat audio. Calls to and from GMarc VE mobiles via the GMarc V repeater are also possible, with the addition of an SRM board to the repeater to handle the handshake with the mobile when it initiates a call.

The unit can also be used to provide mobiles with the capability to alert other mobiles with different GMarc codes using the Model 45B's mobile-to-mobile features.

It is possible to add Model 45Bs on more than one channel, preferably having all of the units on the same listed directory number with the phone company CO automatically searching for the next free Model 45B. The problem that arises is that if a mobile is already busy on another patch, or with a dispatch call, the Model 45B will still attempt to alert the unit.

If the GMarc paging option is installed, the user 2 relay will be used exclusively for the GMarc page. This relay will key when the 2nd, 3rd, and 4th tone of a 4-tone page is being sent out. This is used to disable the busy tone so as not to false 2-tone mobiles on the same system. The relay contacts should be used to disable the busy tone when they are energized. This relay will ignore normal programming if you have GMarc paging installed in your Model 45. The user 1 relay will act as normal.

The user's page code is entered as a four- or eight-digit code, with each pair of digits corresponding to one of the following GMarc tones:

Tone	Code	Tone	Code	Tone	Code
604.2	01	1041.2	13	1795.6	25
631.5	02	1089.0	14	1877.5	26
662.3	03	1140.2	15	2051.6	27
693.0	04	1191.4	16	2143.8	28
727.1	05	1246.0	17	2239.4	29
761.3	06	1304.0	18	2341.8	30
795.4	07	1362.1	19	2447.6	31
832.9	08	1423.5	20	2556.9	32
870.5	09	1488.4	21	2672.9	33
911.5	10	1556.7	22	2792.4	34
952.4	11	1628.3	23	2918.7	35
996.8	12	1717.1	24		

The first tone of a page is issued for 90ms + 90ms x number of channels (see paging menu). If only two tones have been specified, the second tone is issued for 450 ms. If four tones have been specified, the 2nd, 3rd, and 4th tones are issued for 180 ms each.

An additional system ANI (Direct Page ANI under the System-Access menu) has been added to provide capability for direct pages to specific mobiles that are not entered into the user database. Operation is as follows:

1) Enter the Direct Page ANI from the phone.
2) Wait for the prompt beeps.
3) Enter either a four- or eight-digit sequence corresponding to the desired page frequencies, as above. If an eight-digit sequence is entered, operation will immediately continue. If a four-digit sequence is entered, the unit will wait the programmed DTMF time-out before continuing (alternatively, a DTMF "#" may be entered to avoid waiting the time-out. From a dial-pulse phone, the time-out will have to be used.

Note that for the above to work correctly, the default user for the phone line (factory default to user 1) used must be set up as a mobile with GMarc page format, and must be enabled.

EXTENDED USER OPTION

The extended user option incorporates a larger internal memory for user database storage. User numbers are from 001 to 325.

SMDR PRINT OPTION

The SMDR print option provides the unit with a clock and the ability to output a detailed record of each transaction out the J3 Serial I/O connector, at the completion of the call (see the Installation Section for baud rate selection). The data is sent to a line printer or data recorder (customer supplied). The output contains information formatted in one of two ways, depending upon the SMDR print mode selection. In mode 1 the

output will be formatted for a line printer (pretty print) with headings for each data field (see the example below). In mode 2, the output is formatted for SMDR (Station Message Detail Record), (see below). This format can be interpreted by customer supplied equipment to sort and total each user's access. SMDR format is commonly used by PABX equipment in hotels to tally up room charges. The SMDR output emulates the Dimension FP-10 format. In mode 1 the output will display a maximum time of 18 hours while in mode 2 the output will only display a maximum of 9 hours.

FP-10 Format
When the SMDR print mode 2 is selected the output to the printer and the output to the screen, when doing an SMDR list, will be in the FP-10 format. The format output is shown below.

The following is a list of the line codes, column 18, which will be displayed depending on the access to the system:

A = Mobile to Phone on line 1.
B = Mobile to Phone on line 2.
0 = Phone to Mobile on local phone. (DID if installed).
1 = Phone to Mobile on line 1.
2 = Phone to Mobile on line 2.
R = Repeater access.
M = Mobile to Mobile.
C = Manual Connect.

The following is a list of the condition codes, column 16, which will be displayed depending on what happens to the call:

A = Call completed successfully.
B = Called mobile did not answer.
C = Call disconnected by line 2 override.
D = Illegal access.
Z = Internal SMDR overflow, detailed billing record only.

SMDR Format (Station Message Detail Record) ("Dimension" FP-4, 7, 10)
Each standard SMDR record is 63 characters long. The Month/Day output is printed on a line by itself. It is the ONLY record which begins in column 0. The month/day is only printed once per day. See SMDR pretty print for detailed explanation of each call. The Month/Day detail is shown below:

Column #	Width	Description
0	2	Month (1-12)
2	1	space
3	2	Day (1-31)
5	53	spaces
58	1	Carriage Return
59	1	Line Feed
60	3	Nulls (0's)

The time the call was placed is the start of the normal SMDR record.
Normal SMDR record detail is shown below, FP-10 (print mode 2):

Column #	Width	Description
0	3	spaces
3	2	Hour (00-23)
5	1	:
6	2	Minute (00-59)
8	1	space
9	1	Duration Hours (0-9)
10	1	:
11	2	Duration Minutes (00-59)
13	1	.
14	1	Duration Tenths-of-Min (0-9)
15	1	space
16	1	Condition Code
17	1	space
18	3	Line Code
21	1	space
22	3	Route Advance (unused)
25	1	space
26	18	Phone Number Dialed
44	3	spaces
47	4	Calling Number
51	2	spaces
53	5	Account Code (unused)
58	1	Carriage-Return
59	1	Line-Feed
60	3	Nulls (0's)

Printout Examples
See the Pretty print section for details on each call.

SMDR Output, with FP-10 format =

```
15 Record(s)
10 09
   11:38 0:00.1 D 1                              0011
   11:39 0:00.7 B 1                              0001
   14:20 0:00.1 A C                              0001
   14:24 0:00.1 D 1                              0004
   14:40 0:00.7 A 1                              0001
   14:41 0:00.7 A A                    6441300   0001
   14:43 0:00.6 B M                        002   0001
   14:44 0:00.9 A M                        002   0001
   14:45 0:06.3 A 1                              0001
   14:52 0:00.4 A 1                              0001
   14:53 0:00.2 B 1                              0001
```

Pretty Print

The pretty print is obtained by selecting SMDR print mode 1. Below are some examples of the printout. This is the form the unit will display, if the internal SMDR storage option is installed, when an output is requested or what will be displayed on the printer. The header line is printed every 62 lines and, with added spaces, the header should be printed once per page. The date and time are set in the internal clock of the Model 45B. "USR" is the user that originated the call or received the call. "AIR-TIME" is the amount of time the transmitter was keyed, including the ring-out. "CALLED" is the column that contains information about the call; 'No Answ' is displayed if the call was not answered; if blank, the call was answered; 'User' (number) is the number of the user called on a mobile to mobile call. If the mobile did not answer, 'No Answ' will follow to the right. If 'Err' is displayed the number the mobile tried to dial was toll restricted or the user being called was invalid or restricted. The list of calls below is the same as the calls listed in the FP-10 printout. Under "TYPE", the first letter is who originated the call, the second letter or number is the line that was used or in the case of a mobile to mobile call it will be "MM".

The following is a list of codes displayed under TYPE:
P = Phone, 0 = Local Phone Line, 1 = Phone Line 1, 2 = Phone Line 2,
M = Mobile, C = Manual Connect.

Pretty Print =

Model 45B (Station ID) 10/09/87 14:54:36

DATE	TIME	USR	AIR-TIME	TYPE	CALLED
10/09/87	11:38:00	011	00:00:09	P1	Err
10/09/87	11:39:00	001	00:00:46	P1	No Answ
10/09/87	14:20:00	001	00:00:11	C	
10/09/87	14:24:00	004	00:00:09	P1	Err
10/09/87	14:40:00	001	00:00:42	P1	
10/09/87	14:41:00	001	00:00:42	M1	6441300
10/09/87	14:43:00	001	00:00:37	MM	User 002 No Answ
10/09/87	14:44:00	001	00:00:59	MM	User 002
10/09/87	14:45:00	001	00:06:18	P1	
10/09/87	14:52:00	001	00:00:24	P1	
10/09/87	14:53:00	001	00:00:16	P1	No Answ

1. Phone line 1 to user 011, user disabled.
2. Phone line 1 to user 001, mobile did not answer.
3. The connect button was depressed.
4. Phone line 1 to user 004, user disabled.
5. Phone line 1 to user 001, mobile answered.
6. Mobile user 001 to phone line 1, dialed number.
7. Mobile user 001 to mobile user 002, mobile did not answer.
8. Mobile user 001 to mobile user 002, mobile answered.
9. Phone line 1 to user 001, call limit time-out.
10. Phone line 1 to user 001, dial tone disconnect after answer.
11. Phone line 1 to user 001, dial tone disconnect before answer.

SMDR INTERNAL STORAGE OPTION

This option provides the unit with the capability to store up to 999 transactions. The call information is stored in battery-backed memory insuring preservation of data even if power is lost. The detailed records may be viewed via programming menus. The Model 45B is accessed by the CAS either directly or over a phone line using the Model 45B's internal modem. The internal billing records stored in the Model 45B are downloaded by the CAS and stored on disk.

The Model 45B's system and user programming data may be downloaded and stored on disk. In the event of Model 45B failure (such as lightning strike) the system and user programming is reloaded into the Model 45B and the system is back on-line without having to manually reprogram.

Model 45Bs without internal storage don't store detailed call records, but they do store accumulated call records (one per user). For each user, a record of accumulated call time and number of calls is recorded. This information can be downloaded and used for billing. However, no time of day rate variations are used, nor can toll calls be tracked. The CAS will download and upload system and user program data for a Model 45B of any configuration.

300/1200-BAUD MODEM OPTION

The 300/1200 baud modem for the Model 45B allows modem communication at 300 or 1200 baud. This option is strongly recommended for remote systems. With a CRT, program the "run modem" at 300 baud question in the system misc. menu, for the baud rate desired. This baud rate does not affect the normal operation of the serial, RS-232, port. With the modem you may also remotely do tests of the system.

VOICE PROMPT OPTION

The following is a list of the voice prompts and how they work. Message numbers one and two have a maximum length of 7.5 seconds. All other messages have a maximum length of 3.7 seconds.

1. **Message One** is the **"Welcome"** message. This message comes on after the phone line is answered and before the beep or dial tone prompt is sent. DTMF can be entered during the voice message. This is for experienced users who don't want to listen to the whole message. When the first DTMF digit is received, the voice message will stop. Dial click detection is not enabled until after the voice message so anyone using a rotary telephone will need to wait until after the voice message to begin dialing. If the message is not recorded the beep or dial tone prompt will be sent immediately.

2. **Message Two** is the **"Your call cannot be completed at this time"** message. This message comes on if the mobile does not answer the call or the channel is busy and the channel busy ring occurs. The line is disconnected after this message is sent out to the calling party. If this message is not recorded a reorder tone (fast busy) will be sent to the calling party.

3. **Message Three** is the **"Thank You"** message. This message comes on after a valid ANI or user number has been entered by the calling party. If this message is not recorded the M45 will go directly to ringing.

4. **Message Four** is the **"This user is no longer in service"** message. This message comes on if the ANI or user number dialed in is correct but the user has been disabled in the User Programming section of the M45. If this message is not recorded the M45 will issue reorder tone (fast busy), then disconnect the call.

5. **Message Five** is the **"The number you dialed is invalid"** message. This message comes on if the number dialed is not a valid ANI or User number (one that has not been programmed into the unit). If this message is not recorded the M45 will issue reorder tone (fast busy), then disconnect the call.

6. **Message Six** is the **"At the prompt, please speak your voice message"** message and is used for Tone & Voice or Talkback paging. This message is sent before the caller is put on the air to leave a voice message. If this message is not recorded a beep will be sent to indicate when the calling party should begin speaking.

The Voice Prompt Access Code is defaulted to *3 when the M45 System Programming is reset to factory defaults. This access code can be programmed in the System Miscellaneous Menu in version 6.2 software or later. It can also be programmed using the DTMF command 171. The access code can be one to eight digits long. To program a code of *235 via DTMF first enter the DTMF Programming Access Code (00098). If a modem is installed in the M45 wait for the modem carrier tone to stop and the DTMF programming prompt to be sent. Enter 171* 4# *235. The 171* is the DTMF command, 4# is the total number of digits in the Access Code and *235 is the new Access Code. For an access code of 987654, enter 171* 6# 987654 etc.

Voice Prompt Commands

The following commands are used to program the voice prompts:

0 for Erase
2 for Play
9 for Record
* for Stop recording message
for Hang up phone line

The following prompts are heard during the recording:

Two Ding-Dongs: This prompt is sent when you first enter the programming mode.

Fast Busy Tone: This prompt is sent if you wait to long between recording. The M45 hangs up the line after this prompt.

Three Ding-Dongs: This prompt is sent after an invalid command or message number.

Six Beeps: This prompt is sent at the beginning of recording a message.

Eight Beeps: This prompt is sent to indicate a message is being erased.

One Ding-Dong: This prompt is sent after a message has been erased or the maximum length of the message has been recorded.

Programming a Voice Message

The Voice Prompt Messages can be recorded by using the Local Phone Line or by calling the unit on one of it's end to end lines (Line 1 or 2) hooked to a regular phone line. To use the Local line, connect a DTMF phone into the Jack marked Local and pick up the handset. When you hear the prompt, enter the Voice Prompt Access Code (*3). To use the end to end lines, dial the number that the M45 is hooked to as if placing an overdial call or programming the unit. When you hear the prompt enter the Voice Prompt Access Code as before (*3). After entering the Access Code you will hear the go ahead prompt (Two Ding-dongs). To record a message enter "9" followed by the message number you want to record (1 for the first message, 2 for the second etc.). After the Six Beeps, speak the message into the phone handset. If the message is shorter than 7.5 seconds for the first two messages or 3.7 seconds for messages 3 thru 6, enter a DTMF * to stop the recording. To listen to the message you just recorded enter 2 plus the message number you just recorded. 21 for the first message, 22 for the second message etc. All the other messages can then be recorded by entering the message number after the record command. Message 2 would be 92, message 3 would be 93 etc. To erase a message, enter 0 plus the message number to be erased. 01 for message 1, 02 for message 2 etc. You will hear eight beeps to indicate the message is being erased.

Example: Recording Message One with a Welcome Message
Plug telephone into Local Jack. Pick up handset and listen for dial tone. Enter *3 and listen for Two Ding-Dongs. Enter 91 and listen for Six Beeps. Speak message into the phone in a normal speaking voice. Enter a DTMF * right after the message to stop the recording process. Enter 21 to listen to the message you just recorded. If you don't like the message enter 91 to record over it and then enter 21 to play it again. Repeat this procedure for all the messages. If you'd like to erase message 1 so the beep prompt or dial tone prompt is sent immediately after the M45 answers, enter 01.

7. INSTALLATION

INSTALLATION WARNING

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, this device may cause interference to radio communications.

Installation of the Z-Patch should be accomplished by experienced radio and paging system personnel. Specialized knowledge in telephone systems is also important to ensure a smooth interface when connecting with the Telco network.

Over the last several years, some of our customers have had severe lightning strikes at their radio sites and have sent their Zetron equipment in for repair. It is Zetron's goal to repair your Zetron product promptly so that it may be quickly returned to service. Most lightning damage can be repaired quickly and your radio system can be operating again within a matter of days. In some cases, however, a direct lightning strike to the radio tower, power lines or telephone lines will irreparably damage your Zetron product. When considering the cost of lightning protection devices and radio site grounding, give some thought to the cost of lost revenue, angry customers, and damaged equipment. In most cases, proper radio site protection represents a very small fraction of site costs.

Zetron equipment incorporates protection against transients using MOV's, advanced grounding techniques, and fusible resistors. These protection methods reduce the possibility of damage resulting from nearby lightning strikes. If your installation is in an area where lightning strikes are commonplace events, you can add to your site protection arsenal with a few precautions. By following approved grounding methods, good radio installation practices, and installing protection devices on all conductive lines which enter the radio site, you can minimize the damage to your expensive communications equipment.

The topic of lightning protection involves a thorough review of each of your radio sites and the installation of appropriate grounding systems and protection devices. While the basic rules for good radio site protection are fairly simple, we recommend that each site be evaluated and specific areas identified where improvement is possible. Before beginning the site evaluation process we recommend that our customers purchase a book published by Polyphaser Corporation titled; The "Grounds" for Lightning Protection. This text covers all aspects of radio site lightning protection and is available from Polyphaser. If you would like additional information on lightning protection, please refer to these past issues of Mobile Radio Technology.

FAA Tests Lightning Protection Equipment: May 1990, Vol. 8, Issue 5

Lightning Protection Devices: How Do They Compare? : Oct. 1988

Lightning Sparks Debate: Prevention or Protection? : Jan. 1989

Zetron offers its "DeadBolt" Lightning Surge Protector device for use with the Model 45B Z-Patch, and other products using phone line inputs. The part number for the DeadBolt is 901-9325. Please contact Zetron for further information.

GENERAL

Connections to the transmitter and receiver are grouped on a detachable 15 pin connector on the rear of the Z-Patch for ease of installation. The Model 45B includes installation test modes accessible with a Touch-Tone phone plugged into the local phone jack to aid in installation. **CAUTION:** If the M45B is set up for a DID Convertor, R27 may have been changed disabling the local phone jack. R27 should be changed to a 15-ohm for testing, and then changed back to 2.2K for proper operation of the M50 DID or removed for the DAPT 1000 DID.

REQUIRED TEST EQUIPMENT

1. Radio transceiver w/DTMF encode capability
2. CRT or display terminal
3. VOM (Volt/Ohm meter)
4. Service monitor
5. Oscilloscope
6. Local DTMF (Touch - Tone) Phone

Figure 24 provides a graphic presentation of a typical Model 45B-to-transmitter/receiver connection.

TYPICAL CONNECTIONS

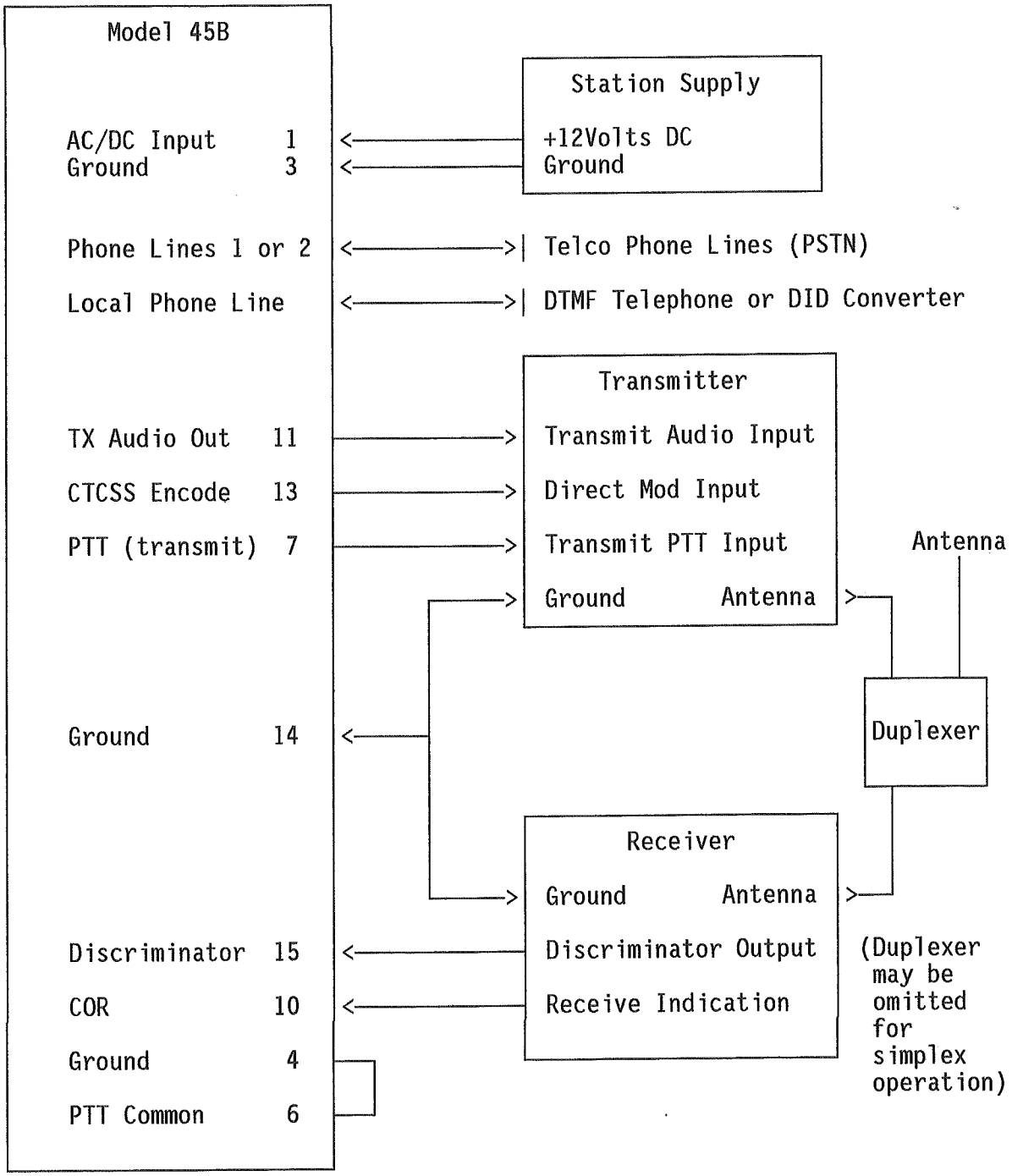


FIGURE 24: Typical Model 45B Installation

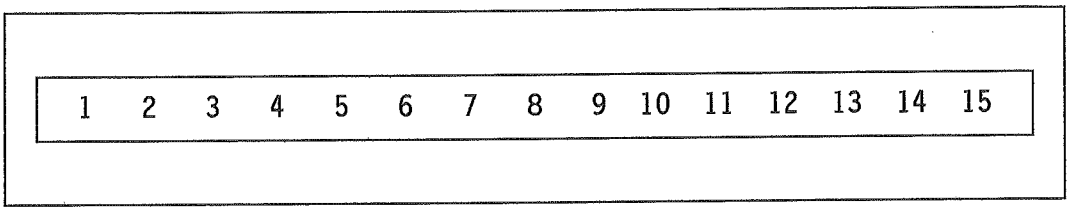


FIGURE 25: MODEL 45B Cable Connector Pin Numbers and Descriptions

1. 9-12 VAC or +12VDC
2. 9-12 VAC
3. Power Ground
4. Ground
5. PTT N.C.
6. PTT Common
7. PTT N.O.
8. Control Line 1
9. Sense Line 1
10. COR Input
11. Transmit Audio
12. Ground
13. CTCSS/DPL Output
14. Ground
15. Receive Audio

INSTALLATION PROCEDURE

1. Locate the 15-Pin connector from the accessory bag included with the M45B.

2. GROUND CONNECTION: Connect a chassis ground wire from pin 14 to the chassis ground of the transceiver.

3. TRANSMITTER PTT: For most transmitters, a contact closure to ground will cause the transmitter to key up. For this configuration, connect a wire from pin 7 (Tx PTT N.O.) to the PTT input of the transmitter. Next install a wire jumper between pins 6 and 4 (PTT Common and Gnd). In some cases, the transmitter needs to see a voltage to key up. If this is the case, put the voltage needed to pin 6 instead of a ground.

4. TRANSMITTER AUDIO OUTPUT: Connect pin 11 (TX Audio Out) to the mic or line input of the transmitter. Shielded cable must be used for this connection. Connect the braid to pin 12 (Ground). Jumper JP6 determines the level of the TX Output. (A=High and B=Low)

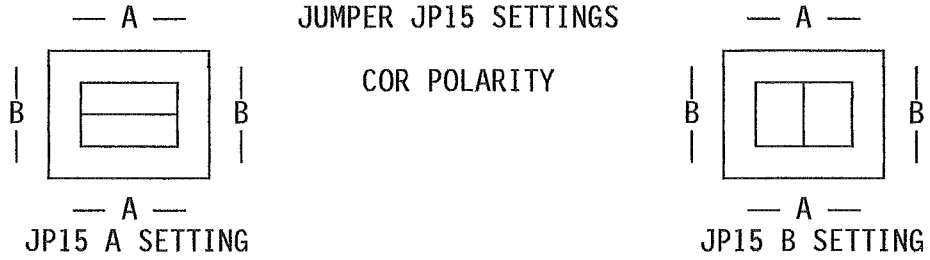
5. CTCSS OPTION: If the M45B has the CTCSS Encode Option installed, connect Pin 13 (CTCSS OUTPUT) to the direct modulation input of the transmitter. This wire should be shielded with the braid tied to pin 12.

6. DISCRIMINATOR INPUT: Connect pin 15 (RX Audio In) to the receiver discriminator output. Speaker audio may be used for this input, but disc. audio is recommended. Shielded cable is required for disc. audio but not for speaker audio. The shield braid should be connected to pin 14 (Ground). Install jumper JP9 in position B for signals less than 500mV P-P or in position A for signals greater than 500mV P-P. JP 17 should be in the B position for discriminator and in the A position for speaker.

7. COR INPUT: The M45B Z-Patch requires a signal from the receiver to indicate when a mobile is transmitting. This signal is derived from the receiver squelch circuit, and is sometimes called Carrier-Operated-Relay (COR) or similar names such as RUS, CAS, or COS.

   External COR input from the receiver: The Z-Patch needs a relay-contact closure between Pin 10 and ground, or a voltage applied to Pin 10 that changes at least one volt between carrier (unsquelched), and no-carrier (squelched) conditions. When the External COR wire is connected, jumper JP14 must be in position "B", and jumper JP15 will select the COR polarity; position "A" is for positive (hi=carrier), position "B" is for negative (lo=carrier) COR. Verify proper operation by supplying, then removing a signal on the receiver RF frequency. The CARRIER LED should light when a signal is being received. If the LED operation is backwards (off during receive, and on with no signal), change the COR polarity with JP15. If the LED doesn't change, adjust COR Threshold Pot AR12 until a change takes place.
   Summary: JP14 = COR source, "B" = external COR
   JP15 = COR polarity, "A" = positive COR, "B" = negative COR
   AR12 = COR threshold adjustment

   Internal COR: The M45B has an internal Dual-Time Constant noise detector circuit for COR indication. This circuit can be used if a good COR signal cannot be found in the radio. To use the internal COR, JP14 should be in the "A" position, JP15 should be in the "B" position, and AR12 should be set midpoint. AR4 is the squelch control for the internal COR circuit and must be adjusted for proper COR indication. With no signal applied to the receiver, adjust AR4 counter-clockwise until the CARRIER LED comes on. Then adjust clockwise until the LED just goes off. This adjustment is just like the squelch control on a mobile radio. Adjusting the RX Audio Pot AR3 affects this adjustment, so AR4 will need to be readjusted after doing the complete installation. See Tests and Adjustments number 6.
   Summary: JP14 = COR source, "A" = Internal COR
   JP15 = COR polarity, "B" = negative for internal COR
   AR12 = COR threshold adjustment, set midpoint
   AR4 = Squelch control, adjust for critical squelch



8. POWER SUPPLY: Locate the 12V DC supply for the repeater/transmitter. with a VOM measure the DC voltage. It must be between 10.5 and 15 volts, and capable of at least 700 milliamps of current. When using a DC supply the positive (+) connection must be to J6 terminal 1 and the negative (-) to J6 terminal 3. If proper DC voltage is not available, the 12V AC wall transformer supplied with the Z-Patch should be used. When using the wall transformer, connections should be made to J6 terminals 1 and 2. The M45B is internally fused with a 1-ampere slow-blow fuse. Verify that the Power LED lights when power is applied.

RESETTING TO FACTORY DEFAULTS

The M45B's system database may be reset to the factory defaults by using the following procedure:

1) Turn off the system power
2) Install JP 19
3) Turn on system power
4) When all the LEDs come on except Transmit, DTMF, and Local, remove JP 19.

The front panel POWER indicator should be on and the PAGE indicator should blink every 5 seconds. This only resets the System programming and does not reset the User programming or the SMDR storage. The System and User programming can be reset using the Supervisor Menu described in the Programming with a CRT or Computer Section of this manual.

LOCAL TELEPHONE

Connect a DTMF (Touch-Tone) telephone to the jack marked LOCAL. Pick up the handset and verify that dial tone is present for about 2 seconds. If no dial tone is heard, check to see if R27 has been removed. If so, replace R27 until all the test procedures are finished. R27 is a 15 Ohm 1/2 W resistor. If R27 has been changed to a 2.2k ohm for Model 50 DID operation, it will need to be changed back to a 15 ohm before you can continue. After hearing dial tone, dial "00098". If the modem option is installed, a high pitched tone will be heard for about 20 seconds followed by the programming mode greeting tone sequence. The programming sequence tones will be heard immediately if the modem option is not installed. This sequence indicates proper access to the DTMF program mode. Simply hang up the phone to exit the programming mode. This phone will be used for various test procedures during the alignment of the M45B. After the testing has been completed, R27 should be put back to it's former state.

DID OPTION: The local telephone line is also used for the DID Converter Option. Hookup for the DID is explained in the DID Converter Manual. If the DID option is a Model 50, R27 will be a 2.2k resistor. If the DID option is a DAPT-1000, R27 will be removed.

TESTS AND ADJUSTMENTS

1. PTT: Verify proper PTT operation by pressing the CONNECT/DISCONNECT button on the front panel. The transmitter should key up at this time. If not, check the wiring between the M45B and the transmitter. Press the CONNECT/DISCONNECT again button to unkey the transmitter.

2. TRANSMIT AUDIO: The transmitter deviation must be set for proper operation of the system. First, using an external mike on the transmitter, set the deviation for a maximum of 5 kHz using the Deviation Pot in the radio as described in the radio's manual. Next, using the phone plugged into the local phone jack, enter the DTMF programming mode as explained earlier. Take the phone off hook and dial "00098". Select a test tone frequency (usually 1 kHz) by entering the function code "102*" then the frequency divided by 10 followed by a "#" (100# = 1 kHz). Send the tone out the transmitter by entering the function code "98*", followed by "2#" for TxToneOn. This will cause the transmitter to key up and generate the desired frequency. Adjust AR1 for 3 kHz deviation. To end the test, simply press the "#" key. JP 6 can be used to increase or decrease the output if needed. JP 6 in the A position increases the output and decreases it in B.

3. CTCSS ENCODE OPTION: To set the CTCSS modulation level, access the programming mode as above, then enter "115* 18#". This will cause the transmitter to key up with the CTCSS tone 123.0 Hz encoded. Adjust AR11 for 750Hz deviation on the channel. To unkey the transmitter press the "#" key. Check the lower and upper tones for proper deviation by pressing "115* 1#" for 67.0 Hz and "115* 38#" for 250.3 Hz. This should also adjust the digital encode output for the correct deviation provided your transmitter is set up to handle DCS. You can check this by pressing "115*" and "D1# thru D104#" to encode the 104 digital codes described in the code table in the Appendix. "115* D1#" = Digital Code 025, "115* D104#" = Code 754 etc.

4. DISCRIMINATOR INPUT: Adjust the receiver audio level by supplying a full quieting signal to the receiver. This signal should have a 1kHz tone at 3kHz deviation. Adjust AR3 for 750 mV P-P on test point 1 (TP1) measured with an oscilloscope. Verify DTMF decoding with a handheld or service monitor with DTMF encoding capability. The Data LED should light with each digit.

5. REPEAT AUDIO ADJUSTMENT: If the Model 45B is used with a repeater or full-duplex base station, AR3 can be fine tuned using the Repeat Audio function of the Model 45B. First, enable the Repeat Audio in the System Dispatch Menu. Then go to the System Dispatch Menu and set the ANI for Dispatch to 'no'. This can also be accomplished by entering the DTMF Programming Mode (00098), then entering 142* 1# (which enables repeat audio), followed by 56* 0# (which disables ANI for dispatch), and then 0* 0# to hang up. The Model 45B is now a carrier operated repeater and will key up the transmitter and repeat audio every time COR is indicated. AR3 should now be used to adjust the repeat audio for unity gain through the Model 45B. Do not adjust AR1 during this proceedure because it was already set up earlier for 3 kHz deviation of the paging tones, as it should be. First, generate a signal into the receiver hooked to the Model 45B with a 1 kHz tone at 3 kHz deviation. This can be done with a service monitor or a handheld using Touch-Tone instead of a 1 kHz tone. If you are using a handheld, make sure the Touch-Tone is at 3 kHz deviation before continuing. Measure the transmitter audio with a service monitor and adjust AR3 for the same deviation you are sending into the receiver (3 kHz). 3 kHz in = 3 kHz out. This completes the adjustment of AR3.

   To disable carrier repeat operation, enter 56* 1#. To turn off repeat audio (i.e., disable repeater operation), enter 142* 0#.

   CAUTION: This adjustment cannot be made if the Model 45B is installed on a simplex base station. AR3 should be adjusted properly with the adjustment made in step 4 but can be fine tuned by making a call and adjusting it slightly while talking to the person on the phone.

6. TELEPHONE ADJUSTMENTS: The Model 45B Telco output level (AR9) is factory set for proper DTMF regeneration levels into the phone line and cannot be adjusted. The Telco input level (AR8) is also set at the factory. The new AGC circuit used by the Model 45B for phone input will compensate for any low levels experienced on the phone lines. If you have any problems with modem operation or full-duplex operation please refer to the troubleshooting section of this manual.

7. DIAL TONE DETECTOR ADJUST: The dial tone detector is factory preset to 440 Hz and in most systems should not need to be adjusted. AR10 is used to adjust the frequency of the detect circuit. The Dial Tone Detect LED DS1 will light upon detection of any dial tone and can be used to adjust AR10 if needed.

8. VOX DETECTOR ADJUST: The VOX detector is factory set and cannot be adjusted.

9. DIAL CLICK ADJUSTMENTS: If you are using the dial click detector you will need to set up the hardware. First verify that the dial click board has been installed. You will need to have a CRT or computer directly connected to the serial port for the set up. The following steps should get you close. Minor variations in the adjustments will occur due to the fact that dial click detection is detecting noise clicks on the phone line. CAUTION: Before you can do any tests you must first set the Dial Click Decode Mode to 1 or 2. If not, the click calibrate message will always say "Clicks are OFF". The modes are described in the Programming with a CRT or Computer section of this manual.

    1. Go to the test menu and select the Click calibrate test. The M45B will take line 1 off hook or the line that is ringing.
    2. Dial pulse the digit '0'; the message " Clicks are ON" should be displayed for the duration of the digits. If not, adjust R6. Make sure that the message "Clicks are OFF" is displayed at the end of each digit.
    3. Next select the DTMF/Click detect test, from the telco. The unit will take line 1 or the line that is ringing off hook. The message will display DTMF: then the decoded digit. This test is good for decode testing dial clicks or DTMF.
    4. The letters "A" or "B" may be displayed and can be ignored. If Mode 1 is selected, dial digits from the dial pulse phone. If the unit does not decode properly, adjust R6 as needed. If that does not work select Mode 2 and start this test over and continue from this point. Dial a "0" from your pulse phone. The first "0" will calibrate the software to the phone you are dialing on. This feature allows phones with different dialing characteristics to have a chance of working. Dial another "0". The proper digit should be displayed on the CRT. Then dial other digits and verify that they are decoded properly. Also try this test from several different phones and number prefixes. Make final adjustments as needed for all the phones to work. If an "A" or "B" is displayed along with the proper digit the adjustment should be okay. The "A" and "B" is just an indication that an invalid pulse was detected and will not affect the normal operation of the dial click decode.

FINAL CHECKS BEFORE LEAVING THE SITE

1. Have a helper call the Model 45B from a remote DTMF phone and verify proper access to the program mode. This tests the telco DTMF decode.
2. If the M45B has the modem option, have someone call the unit and access the modem programming. Verify errors are not present during modem communication.
3. Verify that the program mode can be accessed over the radio channel, or better yet, place a call through the Model 45B.

OPTIONAL CONNECTIONS

1. COR VALIDATION: J6 pin 8 (sense 1) allows connection to a logic signal or contact closure from a tone decoder to validate the COR input signal. This option allows only the users with the correct tone to use the system. See the Operation and Programming Section for more information.

2. TRANSMITTER INHIBIT VIA MONITOR RECEIVER: J2 pin 8 (sense 2) allows connection to a logic signal or contact closure from a repeater output frequency monitor receiver to prevent key-up or ring-out during co-channel usage. The Model 45B will indicate co-channel transmitter inhibit by flashing the COR LED. See the Operation and Programming sections for more information.

3. SENSE LINES 3 AND 4: J2 pins 10 and 12 are the sense lines 3 and 4 inputs. These input are used to page users 1 and 2 when a grounded. See the Operation and Programming sections for more information.

4. CONTROL RELAYS: Four relays are available for site control. Control 1 (J6 pin 8) and control 2 (J2 pins 1 and 2) are system relays. For control relay 1, JP16 controls the contacts. In the A position the relay is grounded when off and open when on. In the B position relay 1 is open when off and grounded when on. Control relay 2 uses JP 22 to determine whether it is normally open between pins 1 and 2 or normally closed. A= N.C. B= N.O. Control Relays 3 and 4 are user relays and use JP 21 and JP20 the same way relay 2 does. Relay 3 is on J2 pins 3 and 4 and relay 4 is on J2 pins 5 and 6. See the Operation and Programming section for more information.

RELAY	OPERATION	PIN NUMBERS	JUMPER
1	SYSTEM	J6 PIN 8	JP 16
2	SYSTEM	J2 PINS 1,2	JP 22
3	USER	J2 PINS 3,4	JP 21
4	USER	J2 PINS 5,6	JP 20

5. VOX DELAY BOARD (for simplex operation): The VOX Delay Board is factory installed and should not need adjusting. If the option is ordered after the Model 45B an installation instruction sheet will accompany the board. The delay board plugs into J10 in the Model 45B and is held in place by two screws included with the board. Jumper JP18 should be removed with the VOX Delay Board installed.
R11 on the delay board adjusts the delay of the voice from the telco to the transmitter and should be adjusted to the minimum value needed to guarantee that none of the telephone audio is lost due to transmitter key-up delays.

COMPUTER OR CRT CONNECTIONS

The computer/CRT port on the Model 45B is compatible with RS-232C signals and uses an asynchronous ASCII serial communications protocol. The unit sends and expects to receive data with 8 data bits, no parity, and 1 stop bit. Typically, only three wires need to be connected from your computer or CRT to the Serial I/O connector (J1) on the Repeater Manager: Pin-3 (Txdata), Pin-4 (Rxdata), and Pin-5 (GND) (Figure 26). If your hardware requires signals on the DSR, DTR or CARRIER DETECT pins, they must be tied high or low, depending on the requirements of your hardware -- consult the manual for your specific hardware for more information.

The Model 45B follows the "XOFF/XON" protocol. This is a flow control sequence that prevents information from flowing too rapidly for the display device (printer/terminal) to receive. If the Z-Patch receives an "XOFF" code (Control S), the data output will pause until a "XON" code (Control Q) is received. When the Model 45B is powered on, a header message is sent out the serial port. This may help when installing or debugging serial communication. See Appendices 1-3 for more information on terminal emulation and serial connections between the Model 45B and the Radio Shack Model 100.

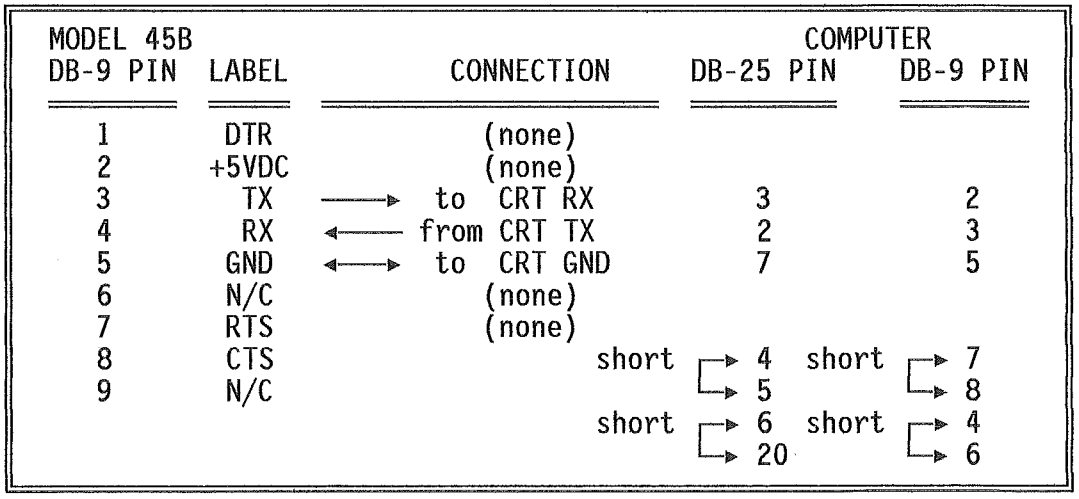


FIGURE 26: Typical Model 45B-to-computer serial connections.

CONNECT YOUR COMPUTER OR CRT to the serial connector J1 (DB9). The Model 45B serial port is preset for 4800 baud. Start your terminal emulation program and set it for 4800 baud, 8 data bits, 1 start bit and no parity. Press RETURN to "bring-up" the Model 45B sign-on message and "Top-menu". Appendix A-3 tells how to use a Radio Shack Model 100 computer for communications.

If required, the baud rate may be changed to 300, 600, 1200, 2400 or 4800 baud using DTMF programming via the local phone as follows:

a. Plug a standard DTMF telephone into the Model 45B's local phone jack.
b. Pick up the hand-set and enter "00098". The unit will issue its DTMF programming prompt tune (if the modem option is installed, 20 seconds of modem carrier will be issued first).
c. Enter "78*". The unit will issue 2 beeps.
d. Enter one of these:

0# for 300 baud
1# for 1200 baud
2# for 2400 baud
3# for 4800 baud
4# for 600 baud

after which the unit will issue 3 beeps.
e. Enter "0*0#" and hang up the hand-set.

INSTALLING NEW EPROMS

Most changes to the Model 45B are made only to the controlling software. Whenever a change is made to the Repeater Manager, new EPROM IC containing the operating software for the unit must be installed. ICs are delicate and sensitive to static. When handling them, be sure to remain grounded by maintaining contact with the chassis sheet metal. Only remove the ICs from the static protective shipping material when ready for installation. The following steps outline the EPROM installation procedure.

1. TURN OFF THE POWER, or remove power connector at rear.
2. Remove the top cover.
3. Remove the old EPROM(s) from the board.
4. Carefully note the orientation notch on the end of the old EPROM(s).
5. Install the new IC(s) in the designated sockets with the orientation notches aligned with the notches in the sockets.
6. Carefully examine all pins of each IC. Make sure pins are aligned in the sockets, fully inserted and not bent out or under.
7. Turn on power to the Repeater Manager and make sure that the front panel gives a normal display. If all LEDs are on, there is a problem.
8. Replace the top cover of the unit.
9. Return the old EPROM(s) to Zetron in the protective shipping material in which the new EPROMs were shipped.

UPGRADING TO THE SMDR PRINTOUT

When adding the SMDR printer option the EPROM(S) will need to be changed and a smart clock socket will have to be installed under the database RAM. You will have to remove the RAM from the battery socket in U6 and place it in the smart clock socket. Caution: this will destroy all of your system and user programming, you must first download the database and any call accumulation you want to keep. Plug the smart clock into U6 and the RAM, removed from the old socket, into the smart clock socket. The new socket contains the battery to retain all programming.

Power up the unit and reset the system programming as in RESET SYSTEM PROGRAMMING, using JP 19 in the Model 45B. Then upload the database.

UPGRADING TO THE SMDR INTERNAL STORAGE

When upgrading to the SMDR internal storage option you must first do the upgrade to the SMDR print option. Next install the SMDR memory in U5. Power up the unit and reset the system programming. Next go into the test menu and run the memory test. If the test does not come back with an O.K. then repair as necessary. Then upload the old database and continue. Note if the SMDR internal storage option is installed in the EPROM(s) but the memory is not installed or if there is a memory error, do not continue as erratic operation will occur. When upgrading to SMDR storage, and the print option is already installed, the database will not be destroyed.

UPGRADING 99-USER SYSTEMS TO 325-USER SYSTEMS

Upgrade to a 325-user system from a 99-user system by simply changing the PROMs as outlined above. The user programming for the first 99 users is still intact. Caution: the overdial from the phone will now be 3-digit, 001 to 325.

CONNECTION TO A GE MASTR II BASE/REPEATER

For: Zetron Model 45B
To: GE MASTR II base/repeater
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Station Supply +12VDC
12 Volts AC input	2	---	
DC ground	3	Black	Station Supply Ground
Ground	4	Drain	No Connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	J931 Pin 14, Local PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	J932 Pin 18, CAS
Tx audio	11	Blue	J933 Pin 6 OLD, Control board P2 Pin 4 NEW IDA
Ground	12	---	
CTCSS/DCS encode	13	Green	J933 Pin 3, CG Hi
Ground	14	Brown	J933 Pin 2, CG Lo
Discriminator in	15	White	J606 on IF/Audio/Sq board

MASTR II CONFIGURATION:

- Two versions of the GE Repeater Control Panel exist. The "Earlier" version is identified by multiple plug-in cards, the 10 volt regulator card being on the far right. The "Later" version is a single panel (no plug-in cards), and is identified by the local mic connector, speaker and volume knob on the front. All connections are the same except the for TX AUDIO. On "Late" models, the audio is connected to the "battery alarm audio" point.

- Remove the jumper between H16 and H17 (if installed) on the 10-volt regulator card.

- Remove any existing repeater tone panel (card-per-tone), and "Repeater Audio" and/or "Repeater Control" cards (if installed).

- If digital coded squelch encode is to be used, the exciter MUST be the newer style "FM" unit. If using the Audio Processor board number 19C321542G1, C105 must be 10uf, and C110 must be 22uf for proper digital encoding.

CONNECTION TO A GE CUSTOM MVP

For: Zetron Model 45B
To: GE Custom MVP
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Inside front panel, S701 (switched side)
12 Volts AC input	2	---	
DC ground	3	Black	Chassis Ground
Ground	4	Drain	No Connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	System Audio Squelch board, J911 (PTT)
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	System Audio Squelch board, J912 (CAS)
Tx audio	11	Blue	Exciter board, P902 Pin 4 (Mic Hi)
Ground	12	---	
CTCSS/DCS encode	13	Green	Exciter board, P902 Pin 9 (CG Hi)
Ground	14	Brown	Exciter board, P902 Pin 5 (Mic Lo)
Discriminator in	15	White	IF Detector board, junction of R606/R608/C622

GE MVP CONFIGURATION:

- Cut circuit trace on top of System Audio Squelch board which runs from U902 pin 6 toward R11. cut trace close to U902. This disables receiver mutting on PTT.

- Install a jumper between J904 pin 2 (rx osc control) and J904 pin 1 (10v reg) on the System Audio Squelch board. This provides a source of unswitched 10V to the receiver oscillator at all times.

CONNECTION TO AN E.F. JOHNSON CR1000 REPEATER

For: Zetron Model 45B
To: E.F. Johnson CR1000
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Pin 21, Level Adjust Card
12 Volts AC input	2	---	
DC ground	3	Black	Pin 24, Level Adjust Card
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Pin 19, Level Adjust Card
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Pin 12, Level Adjust Card
Tx audio	11	Blue	Pin 18, Level Adjust Card
Ground	12	---	
CTCSS/DCS encode	13	Green	Pin 22, Level Adjust Card
Ground	14	Brown	Ground
Discriminator in	15	White	Pin 11, Level Adjust Card

CR1000 CONFIGURATION:

- Move the wire in the receiver off of J211, connect to U201 pin 6. This provides unfiltered receive audio to the Model 38.
- Disconnect one side of C709 on the Level Card.
- Set the Repeat switches to: Access=tone, Repeat=off.

CONNECTION TO AN E.F. JOHNSON CR1000, WITH DCS MODS

For: Zetron Model 45B
To: E.F. Johnson CR1000, Digital Coded Squelch modification
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Pin 21, Level Adjust Card
12 Volts AC input	2	---	
DC ground	3	Black	Pin 24, Level Adjust Card
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Pin 19, Level Adjust Card
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Pin 12, Level Adjust Card
Tx audio	11	Blue	Pin 22, Level Adjust Card
Ground	12	--- .047uf 47K	
CTCSS/DCS encode	13	Green .047uf 470K	
Ground	14	Brown	Ground
Discriminator in	15	White	Pin 11, Level Adjust Card

CR1000 CONFIGURATION:

- Move the wire in the receiver off of J211, connect to U201 pin 6. This provides unfiltered receive audio to the Model 45.
- Disconnect one side of C709 on the Level Card.
- Set the Repeat switches to: Access=tone, Repeat=off.
- Modifications to exciter: remove C304, change R316 to 4.7K, short out C399, add a 0.47uf cap across C701 (TCXO), short U301 pin 5 to pin 10.

CONNECTION TO AN E.F. JOHNSON CR1010 REPEATER

For: Zetron Model 45B
To: E.F. Johnson CR1010
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END, LOGIC DRAWER CONNECTOR Connection / notes
12 Volts AC/DC in	1	Red	Logic Drawer Pin 15, +13.8V
12 Volts AC input	2	---	
DC ground	3	Black	Logic Drawer Pin 13, Gnd
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Logic Drawer Pin 23 $\overline{PTT}$
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Logic Drawer Pin 19, Fast squelch
Tx audio	11	Blue —/\/\/— 56K	Logic Drawer Pin 18, Tx tone CG
Ground	12	---	
CTCSS/DCS encode	13	Green —/\/\/— 15K	
Ground	14	Brown	Ground
Discriminator in	15	White	Logic Drawer Pin 5, CG Audio

CR1010 CONFIGURATION:

- Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).
- Add a 10K ohm resistor across R123 in the exciter.
- NOTE: This configuration does not use the deviation limiter in the exciter. It does provide a higher quality repeat audio quality than the alternate hookup on the next page.

CONNECTION TO AN E.F. JOHNSON CR1010, ALTERNATE HOOKUP

For: Zetron Model 45B
To: E.F. Johnson CR1010, Alternate hookup
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Logic Drawer Pin 15, +13.8V
12 Volts AC input	2	---	
DC ground	3	Black	Logic Drawer Pin 13, Gnd
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Logic Drawer Pin 23, $\overline{PTT}$
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Logic Drawer Pin 19, Fast squelch
Tx audio	11	Blue	Exciter Drawer Pin 1, Tx audio
Ground	12	---	
CTCSS/DCS encode	13	Green	Logic Drawer Pin 18, Tx tone CG
Ground	14	Brown	Ground
Discriminator in	15	White	Logic Drawer Pin 5, CG Audio

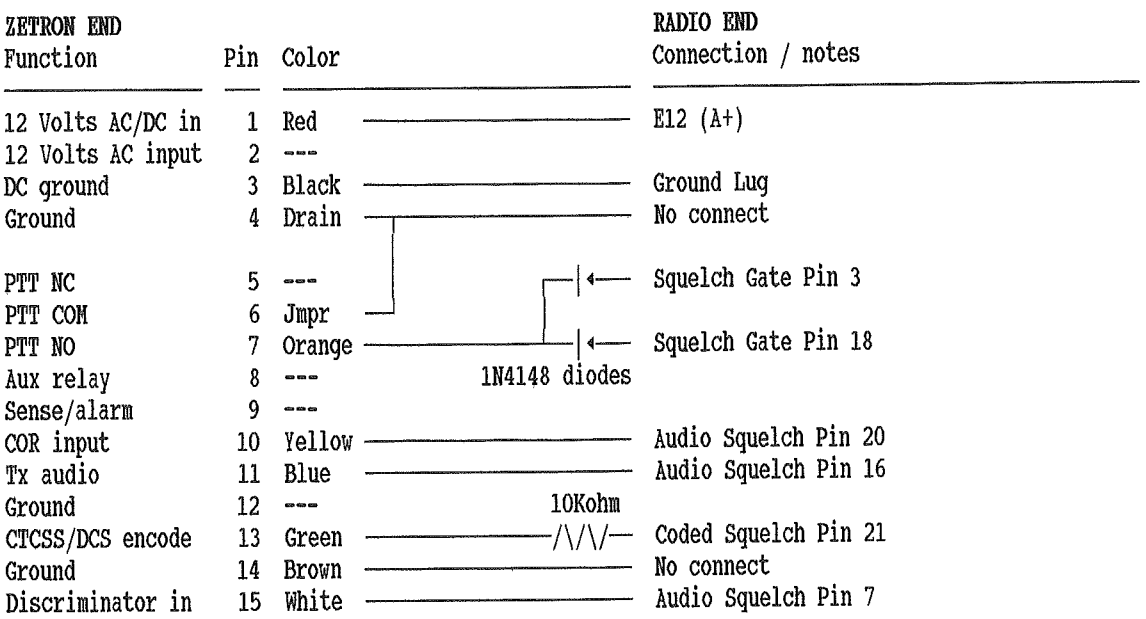
CR1010 CONFIGURATION:

- Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).

- NOTE: This configuration uses the limiter and high-pass filter in the exciter. Since the Model 45B has a high-pass filter to remove the CTCSS or digital coded squelch encode from the repeat audio, as well as the exciter, two high-pass filters in series may degrade the audio quality. The repeat audio quality may be improved by deleting (bypassing) the high-pass filter in either the Model 45B or the exciter.

CONNECTION TO A MOTOROLA MSR 2000 BASE/REPEATER

For: Zetron Model 45B
To: Motorola MSR 2000 base/repeater
Using: 709-7112 Generic radio cable or
709-7105 MSR 2000 cable



MSR 2000 CONFIGURATION:

- Remove all jumpers on the RF control chassis backplane except JU1, JU4, JU5 and JU9
- Only R1 Audio and Station Control Modules are required
- Changes to control cards:
  - R1 Audio: install JU1 and JU101
    Remove JU2, JU103, JU104, JU105, CR2 and CR106
  - Station Card: install JU2 - JU8, remove JU9 - JU11
  - Line Driver: Remove JU15 and CR3

CONNECTION TO A MOTOROLA MSF 5000 REPEATER

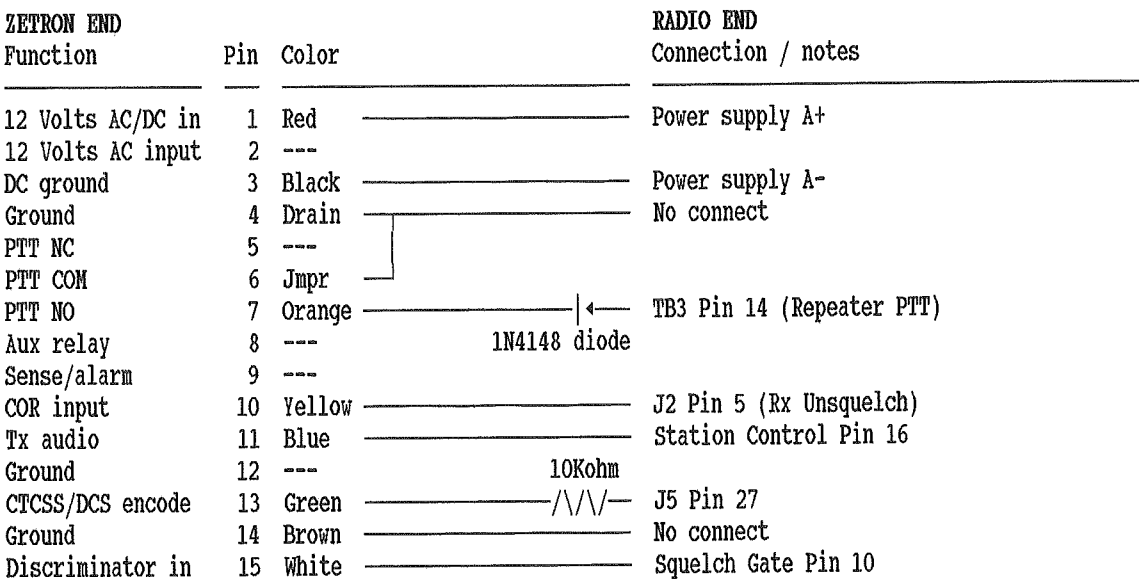
For: Zetron Model 45B
To: Motorola MSF 5000 repeater
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	J800 Pins 1 and 2, or TB601 (A+) on pwr supply
12 Volts AC input	2	---	
DC ground	3	Black	J800 Pins 7 and 8, or TB601 (gnd) on pwr supply
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	J801 Pin 14
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Test Point 6 (0.5v SQ, 2.9v US)
Tx audio	11	Blue /\/\/—	U834 Pin 13 (1vpp=3KHz)
Ground	12	--- both 33Kohm	
CTCSS/DCS encode	13	Green /\/\/—	Wiper of R889 IDC pot (3vpp=0.75KHz)
Ground	14	Brown	No connect
Discriminator in	15	White	Test Point 3 (3KHz=1vpp)

MSF 5000 CONFIGURATION:
- Make all connections to the Station Control Module PCB.
- Set "AccDis" switch UP.

CONNECTION TO A MOTOROLA MICOR COMMUNITY REPEATER

For: Zetron Model 45B
To: Motorola Micor Community Repeater
Using: 709-7112 Generic radio cable



MICOR CONFIGURATION:

1. Remove all modules except Station Control and the Squelch Gate card.
2. Modify the control modules as follows:
   a) Station Control: Jumper the "PL Disable" switch ON.
   b) Squelch Gate: Remove C17, in the exciter output line.
3. Modify Rx audio squelch board (TRN-6006A);
   Add jumper from U202 pin 10 to P903 pin 14.
4. Modify exciter board (TLE-1720A);
   Add jumper from IDC pot wiper to P902 pin 8, cut trace between P902 pin 8 and JU401.
5. Modify backplane board (TRN-6421A);
   Cut trace going to J2 pin 5, cut trace going to J5 pin 27.

CONNECTION TO A MOTOROLA MCR-100 / RADIUS R-100

For: Zetron Model 45B
To: Motorola MCR-100 / Radius R-100
Using: 709-7112 Generic radio cable, or 709-7109

ZETRON END Function	Pin	Color	RADIO END (DB-25P) Connection / notes
12 Volts AC/DC in	1	Red	JAUX Pin 3, A+
12 Volts AC input	2	---	
DC ground	3	Black	JAUX Pin 14, Desk set ground
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	JAUX Pin 4, PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	JAUX Pin 12, Audio Control
Tx audio	11	Blue	JAUX Pin 5, Audio from phone patch
Ground	12	---	
CTCSS/DCS encode	13	Green	JAUX Pin 23, uncommitted
Ground	14	Brown	JAUX Pin 6
Discriminator in	15	White	JAUX Pin 25, uncommitted

RADIO MODIFICATIONS:

- Install a jumper from U601 pin 9 on the TX Command Board to JAUX Pin 23. This routes CTCSS/DCS modulation to the TX Command Board.

- Install a jumper from U551A pin 4 on the RX Board to JAUX Pin 25. This routes unfiltered discriminator audio from the receiver to the JAUX connector.

- Program the R-100 for carrier squelch operation and disable repeater operation using the RPTR Disable Switch on the RPT Control Board.

- Order the R-100 with the DPL Option if DPL is to be used in the Model 45B. If the R-100 is ordered as either the PL or carrier squelch model, several capacitors need to be changed in the receiver and transmitter. See the R-100 service manual for additional information concerning what capacitor values require changing.

- Repeated audio from the Model 45 will be heard in the local speaker if the Model 45 transmit audio is connected to JAUX Pin 5. This is because audio appearing at pin 5 is distributed to several points in the R-100 Interface Board (including the local audio amp, the exciter board, and the line output) before being applied to the TX Command Board. If desired, transmitted voice modulation may be applied directly to the TX Command Board using the emitter of Q601.

CONNECTION TO A STANDARD RPT10/RPT21

For: Zetron Model 45B
To: Standard RPT10/RPT21
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Multitone Pin 4, 13.8v
12 Volts AC input	2	---	
DC ground	3	Black	Multitone Pin 5, Gnd
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Multitone Pin 9, PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Receiver Pin 7, COR
Tx audio	11	Blue	Control Pin 9, Mic Hi
Ground	12	---	
CTCSS/DCS encode	13	Green	Multitone Pin 3, Tone
Ground	14	Brown	Control Pin 6, Mic Lo
Discriminator in	15	White	Multitone Pin 2, Disc

CONFIGURATION NOTES:

- Set the switch on the front of the repeater to "NON-RPT".
- Put JP12 (CTCSS de-emphasis) in B (dmp) for RPT10, A (flat) for RPT21.

8. TROUBLESHOOTING

IN CASE OF DIFFICULTY

In case of installation difficulty, call the Zetron Model 45B applications Engineering Department at (425) 820-6363. Engineers are available. Please have the serial number of the unit and/or the Zetron Order number. If the call is made from the installation site by the installer or radio technician, the problem can usually be solved over the phone.

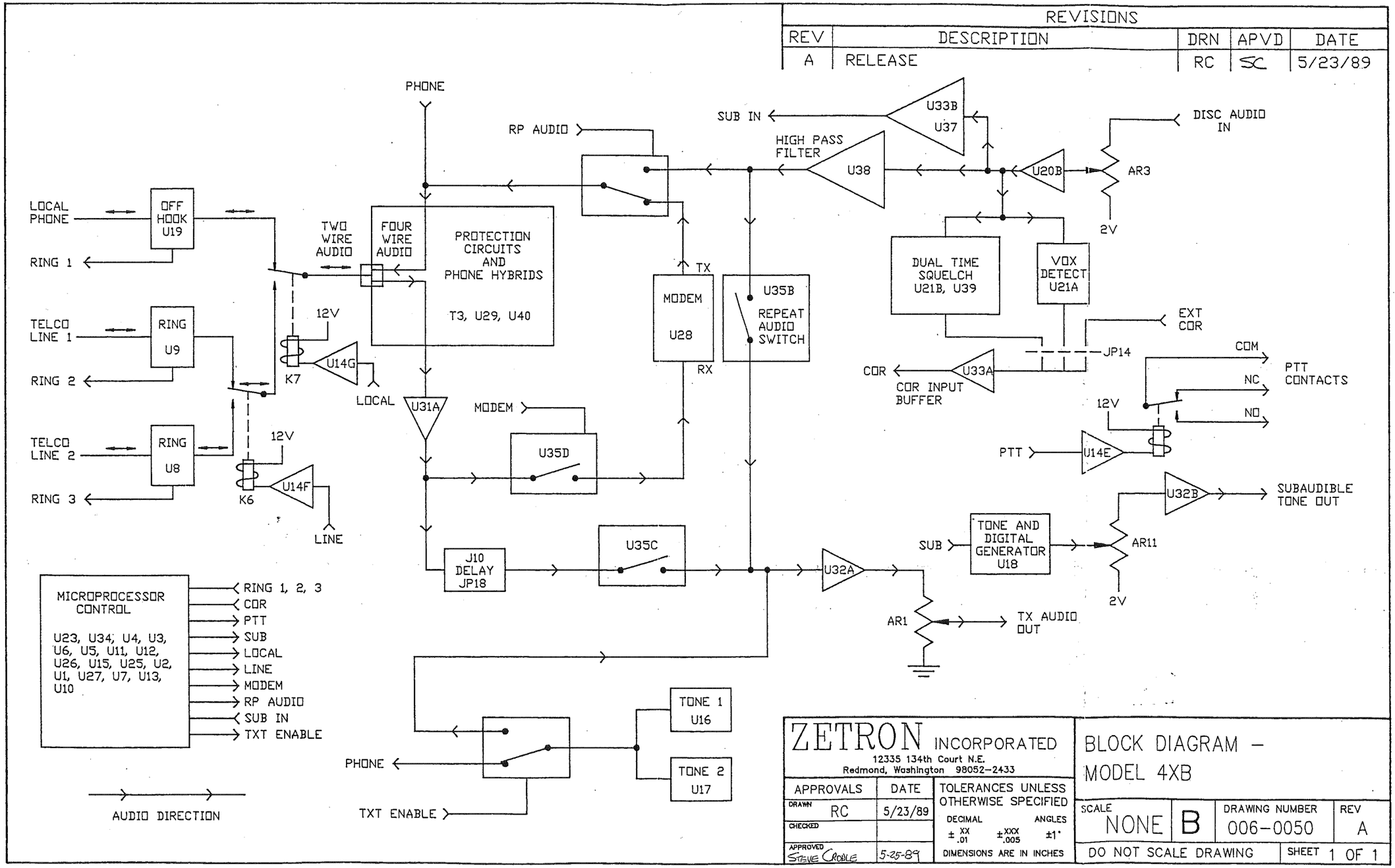
If a problem develops after a unit has been in service for some time, check the fault identification list below to isolate the problem. If help is required, call the Zetron Model 45B Service Department at (425) 820-6363. If the call is made from the installation site by a radio technician, and a spare parts kit is on hand, the problem can usually be solved over the phone. If requested, units returned to Zetron (if received before 11:00am) can be serviced and returned the same day. In the case of units that have been hit by lightning the unit will be powered up over night, retested and shipped the next day.

FAULT IDENTIFICATION

PROBLEM	POSSIBLE CAUSE(S)
No answer on any line, but RING light works.	Relays, relay driver IC.
1000 Hz test tone off frequency. Transmit led works, but doesn't key the transmitter.	Y1 xtal off frequency. TR relay defective. K8
Difficult for mobiles to perform connect.	Gain from receiver wrong, Pre or De-emphasis needed. Power supply voltage to low.
Wrong numbers dialed from mobiles	Same as above, level to phone wrong
Answers phone line & issues dial tone, but doesn't respond to DTMF.	Level from phone wrong, hybrid line balance wrong, Pre or De-emphasis needed from phone line.
Phone party hears unsquelched audio (hiss) when mobile is not talking.	COR not working while transmitter is on.
Dial pulse dialing across tip and ring cause unit to detect ringing.	a. Change dial pulse phone to DTMF dial. b. Connect in parallel, a 100K resistor and a 0.1uF to 0.47uF, 100V capacitor from pin 5 to pin 7 of U3, for line 1, or U1 for line 2.
Modem programming doesn't work	a. Modem or CRT wrong baud rate. b. Poor quality phone line audio. Listen to audio; if snaps or crackles are heard, the modem may be unusable.

HYBRID ADJUSTMENT: To adjust the hybrid balance, first remove the label over the adjustment pots. The Hybrid Balance should be adjusted after the M45B is installed at the site and the correct phone line is hooked up to the patch. If using both line inputs on the M45B, only one needs to be adjusted, preferably the line that gets the most use. Call the phone patch from another line and enter the DTMF programming code (00098) when the overdial prompt is heard. First, enter "102* 100#" to set the hybrid tone to 1000 Hz. Then enter "106* 1#" to turn on the hybrid tone. The transmitter should key up and the tone should be heard on the TX frequency. The tone will be on for 8 seconds and off for 2 seconds. While the tone is on, adjust AR6 and AR7 for a null while listening to the transmitter frequency. Keep adjusting between the two pots for the best null. The tone should actually seem to go away completely. When this happens, the Hybrid is adjusted properly. To exit the Hybrid mode, wait for the pause in the tone and enter "#" from the phone.

MODEL 45B BLOCK DIAGRAM (006-0050A)



MODEL 45B/CSA CONTROL BOARD PARTS LIST (702-9183-5D.5)

LEGEND:
= NOT INSTALLED
^ = INSTALLED ON HIGHER ASSEMBLY
+ = OPTION, INSTALL PER CUSTOMER ORDER

Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	1	R58	101-0013	2.2 OHM 1/4W 5% CARBON FILM	
2	4	R35,R36,R37,R190	101-0047	47 OHM 1/4W 5% CARBON FILM	
3	4	R61,R107,R120,R136	101-0049	100 OHM 1/4W 5% CARBON FILM	
4	10	R125,R152,R153,R154,R155, R160,R163,R164,R168,R189	101-0057	220 OHM 1/4W 5% CARBON FILM	
5	1	R76	101-0059	270 OHM 1/4W 5% CARBON FILM	
6	4	R77,R92,R106,R188	101-0065	470 OHM 1/4W 5% CARBON FILM	
7	8	R2,R22,R28,R34,R39#,R40#, R57,R104,R117,R186	101-0066	510 OHM 1/4W 5% CARBON FILM	
8	13	R41,R43,R55,R78,R80#, R95#,R108,R121,R141,R144, R156,R157,R161,R165,R187	101-0073	1K 1/4W 5% CARBON FILM	
9	6	R102,R105,R110,R112,R134, R176	101-0075	1.5K 1/4W 5% CARBON FILM	
10	12	R23,R26,R45,R60,R71,R93, R118,R137,R138,R158,R159, R172	101-0081	2.2K 1/4W 5% CARBON FILM	
11	3	R59,R99#,R113,R169	101-0085	3.3K 1/4W 5% CARBON FILM	
12	1	R177	101-0087	3.9K 1/4W 5% CARBON FILM	
13	8	R3,R13,R16,R52,R53,R70, R131,R174	101-0089	4.7K 1/4W 5% CARBON FILM	
14	1	R171	101-0091	5.6K 1/4W 5% CARBON FILM	
15	1	R100#,R139	101-0094	7.5K 1/4W 5% CARBON FILM	
16	12	R1,RX1,R19,R20,R21,R67, R75,R89,R91,R116,R151, R191 NOTE 6	101-0097	10K 1/4W 5% CARBON FILM	
17	5	R114,R130,R132,R133,R184	101-0099	12K 1/4W 5% CARBON FILM	
18	3	R65,R97#,R115,R166	101-0101	15K 1/4W 5% CARBON FILM	
19	7	R24,R25,R54,R69,R85,R87, R148	101-0105	22K 1/4W 5% CARBON FILM	
20	7	R62,R63,R119,R123,R124, R126,R129	101-0109	33K 1/4W 5% CARBON FILM	
21	4	R47,R49,R50,R111	101-0111	39K 1/4W 5% CARBON FILM	
22	21	R5,R6,R7,R8,R9,R10,R31, R32,R42,R44,R73,R122,R145, R146,R150,R162,R178,R180, R181,R183,R185	101-0113	47K 1/4W 5% CARBON FILM	
23	3	R74,R109,R135	101-0115	56K 1/4W 5% CARBON FILM	
24	3	R46,R48,R51,R84#	101-0117	68K 1/4W 5% CARBON FILM	
25	1	R103	101-0119	82K 1/4W 5% CARBON FILM	
26	10	R14,R18,R29,R30,R64,R72, R128,R149,R173,R182	101-0121	100K 1/4W 5% CARBON FILM	

MODEL 45B/CSA CONTROL BOARD PARTS LIST (702-9183-5D.5) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
27	1	R167	101-0123	120K 1/4W 5% CARBON FILM	
28	0	R83#	101-0129	220K 1/4W 5% CARBON FILM	
29	3	R68,R81#,R90,R142	101-0131	270K 1/4W 5% CARBON FILM	
30	5	R4,R88,R170,R175,R179	101-0145	1M 1/4W 5% CARBON FILM	
31	1	R147	101-0150	2.7M 1/4W 5% CARBON FILM	
32	1	R86	101-0160	10M 1/4W 5% CARBON FILM	
33	1	R56	103-0175	75 OHM 2W 5%	RD-200BJ75
34	4	RV1,RV2,RV3,RV4	105-0001	VARISTOR 250V AC	V250LA20
35	4	R11,R12,R15,R17	106-0047	4.7 OHM 1/2W 5% FUSIBLE	BW1/2F-4.7OHM5%B
36	1	R27	106-0115	15 OHM 1/2W 5% FUSIBLE	BW1/2F-15OHM5%B
37	0	AR2#	107-0500	500 OHM POT 1 TURN	3386P-1-501
38	2	AR1,AR5#,AR6,AR9#	107-0501	5K POT 1 TURN	3386P-1-502
39	5	AR3,AR7,AR10,AR11,AR12	107-0502	50K POT 1 TURN	3386P-1-503
40	2	AR4,AR8 *NOTE 3	107-3085	10K POT 1 TURN	3386P-1-103
41	4	C52,C53,C56,C57	150-0024	24 PF 1KV +-10% CERAMIC DISC	GG-240K
42	0	C50#,C80#	150-0033	33 PF 1KV +-10% CERAMIC DISC	GH-330K
43	2	C42,C63	151-0047	470 PF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C471K
44	3	C76,C83,C91	151-0199	.47 UF 50V +-5% POLYESTER	ECQVIH474JZ
45	26	C1,C6,C11,C15,C17,C28, C29,C30,C31,C48,C49#,C51, C54,C55,C62,C66,C67,C81, C84,C86,C89,C92,C93,C97, C98,C103,C104	152-0012	.1 UF 50V +-5% POLYESTER	ECQ-V1H104JZ
46	2	C12,C13	152-0021	.47 UF 250V +-10% POLYESTER	713A1KK474PK251SM
47	1	C35	152-0030	2.2 UF 250V +-10% POLYESTER	ECQ-E2225KS
48	2	C18,C19	152-0040	4.7 UF 50V NON-POLAR ELECTROLYTIC	EHN-4.7M50BA
49	2	C45,C61	152-0080	.22 UF 50V +-5%	ECQ-VIH224JZ
50	10	C22,C23,C24#,C27#,C34, C39,C40,C44,C88,C94,C100, C101	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-V1H103JZ
51	11	C16,C20,C21,C32,C33,C41, C46,C47,C64,C73,C87	152-0089	.001 UF 50V +-5% POLYESTER	ECQBIH102JZ
52	4	C58,C72,C82,C90	152-0250	.047 UF 50V POLYESTER	ECQ-VIH473JZ
53	4	C7,C96,C99,C105	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
54	2	C8,C95	154-0100	10 UF 16V TANTALUM	ECS-FICE106K
55	5	C9,C25#,C26#,C36,C43,C71, C75	155-0012	2.2 UF 100V +50-10% RADIAL ALUMINUM ELECTROLYTIC	ECEA2AV2R2S
56	11	C2,C3,C4,C5,C10,C59,C68, C69,C70,C79,C102	155-0052	10 UF 35V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECEA1VU100
57	6	C37,C60,C65,C74,C77,C78	155-0077	100UF 25V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECEA1EU101
58	1	C38	155-0090	1000 UF 25V +-20% RADIAL ALUMINUM ELECTROLYTIC	ECE-A1EU102
59	1	C14	155-0120	2200 UF 25V +-20% AXIAL ALUMINUM ELECTROLYTIC	ECE-B1EU222
60	1	C85 NOTE 4	155-0140	3300 UF 25V +50%-10% AXIAL ALUMINUM ELECTROLYTIC	ECEB1EU332
61	2	E1,E2 NOTE 1	305-0007	BEAD FERRITE PLZ	56-590-65-3

MODEL 45B/CSA CONTROL BOARD PARTS LIST (702-9183-5D.5) cont'd

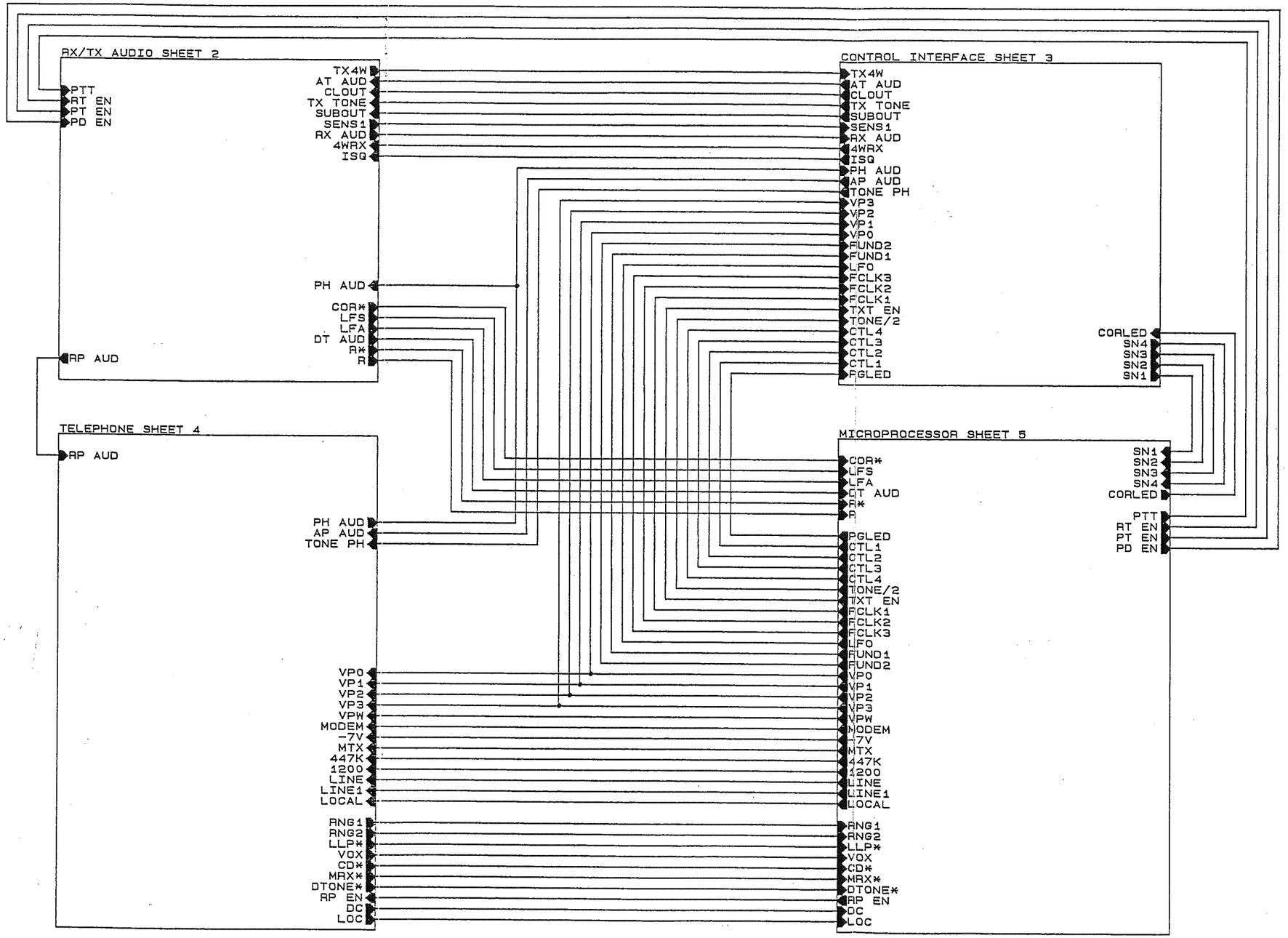
Item	Quantity	Reference	Part	Description	Mfg.Part No.
62	0	T1#,T2#	305-0600	600:600 OHM AUDIO	MR671-8205
63	1	T3	305-1540	LO SIZE/COST PHONE HYBRID XFMR	671-1540
64	10	DS1,DS2,DS3,DS4,DS5,DS6, DS7,DS8,DS9,DS10	311-0011	LED RED FLUSH	TLSR-5201
65	1	DS11	311-0012	LED GREEN FLUSH	TLSG-5201
66	3	U8,U9,U19	311-1001	OPTO ISOLATOR, BI-POLAR	H11AA1
67	3	U16,U17,U18	316-0004	TONE FILTER	MF4CN-50
68	1	U7	316-0232	RS232 DRIVER	MAX 232
69	10	U20,U21,U22#,U29,U31,U32, U33,U37,U38,U39,U40	316-0358	OP-AMP, DUAL	LM358N
70	1	U30	316-0567	PLL, TONE DECODER	LM567
71	1	VR1	316-7805	REGULATOR, +5V 1.5A	LM340T-5
72	1	U27	321-0202	DTMF DECODER	SSI-202P
73	0	U6^	321-6264	8K X 8 RAM 150ns	HM6264ALP-15
74	1	U23 NOTE 5	321-6811	UP-HC MOS	MOT68HC11A0FN
75	2	U1,U2	321-6840	PTM	MC6840
76	0	U5^	321-8256	32K X 8 RAM LP	HPD43256-15L
77	0	U3^,U4^	322-7256	32Kx8 CMOS EPROM	MBM27C256-25
78	0	U28^	323-0212	MODEM 1200 BAUD	UA212AT-DC
79	1	U36	323-4053	3PDT SWITCH	MC144053
80	1	U35	323-4066	QUAD ANALOG SWITCH	MC14066B
81	2	U11,U12	324-4138	DECODER 1 OF 8	MCH74HC138
82	3	U15,U25,U26	324-4259	LATCH, 8 BIT ADDRESSABLE	74HC259
83	2	U24,U34	324-4373	OCTAL LATCH	MC74HC373
84	1	U10	324-7400	QUAD NAND	MC74HC00
85	1	U13	324-7414	HEX SCHMIDT	74HC14
86	1	U14	340-2003	RELAY DRIVER 50V/.5A	ULN2003
87	1	Q4	340-3821	JFET N-CHAN Vp=-2.5V	MPF3821
88	7	Q1,Q5,Q6,Q7,Q8,Q9,Q11	340-3904	NPN 40V/200MA	2N3904
89	2	Q2,Q3	340-3906	PNP 40V/200MA	2N3906
90	1	Q10	340-5460	JFETP-CHAN	2N5460
91	2	CRX1,CRX2 NOTE 7	342-0103	SCHOTTKEY .37V @ 20MA	SD103A
92	9	CR1,CR6,CR7,CR8,CR9,CR11, CR12,CR20,CR22	342-3009	SILICON .50 SP	1N4148
93	4	CR13,CR14,CR15,CR16	342-3011	SILICON 1A 1000V .50 SP	1N4007
94	7	CR2,CR3,CR4,CR5,CR10, CR18,CR21	343-3030	1W 6.2V +-5% .50 SP	1N4735A
95	2	CR17,CR19	343-3035	1W 12V +-5% .50 SP	1N4742A
96	1	SW1	371-0005	SINGLE KEY RA PWB MOUNT	L21217-2-MV-02-G
97	1	Y1	376-0004	4.000 MHZ HC 18 CASE	SKO-DS400A
98	1	Y3	376-0358	3.58 MHZ HC 18 CASE	SKO-DS357
99	1	Y2	376-3686	3.6864 MHZ HC18 CASE	368S
100	4	K1,K2,K3,K4	380-0001	SPDT 12V	MZ-12HG
101	3	K5,K6,K7	380-0030	DPDT 12V COIL MINI	DS2E-M-DC12V
102	1	J1	401-0021	DB9 S	DEP-9S-CA
103	1	J6	401-0059	15 POS R/A HEADER	6923.6
104	1	J2	401-0086	12-POS R/A HEADER	1116.6
105	0	J7#	401-0129	6 POS RA HEADER	1122.6
106	1	J8	401-6001	10-POS FEMALE	09-52-3103
107	1	J12	401-6005	6-POS FEMALE	09-52-3063
108	1	J10 NOTE 2	401-6006	6-POS MALE	09-64-1061

MODEL 45B/CSA CONTROL BOARD PARTS LIST (702-9183-5D.5) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
109	3	J3,J4,J5	401-7000	6-POS TELCO JACK	66011-002
110	1	JP1#,JP2#,JP3#,JP4#,JP5#, JP7#,JP10#,JP18#,JP19, JP23#	403-0002	2 OF 401-0052	
111	11	JP6,JP8,JP9,JP11,JP12, JP13,JP16,JP17,JP20,JP21, JP22,JP24#	403-0003	3 OF 401-0052	
112	1	J11	403-0010	10 OF 401-0052	
113	1	J9	403-0018	18 OF 401-0052	
114	1	JP15	403-0202	4 OF 401-0052 [2X2]	
115	1	JP14	403-0203	6 OF 401-0052 [2x3]	
116	4	TP1,TP2,TP3#,TP4#,TP5, TP6	403-3001	1 OF 401-1365	
117	1	F1	416-1202	FUSE AGC 2A	AGC 2A
118	6	XVR1,XJ1, STANDOFFS	210-0001	440 KEPT NUT	
119	3	XVR1,XJ1	220-0102	440X3/8 PAN PHILLIPS	
120	3	XY1,XY2,XY3	236-0005	HC 18 CRYSTAL INSULATOR	
121	3	STANDOFFS	250-0104	440X1/2 W/STUD	
122	10	XR11,XR12,XR15,XR17,XR27	251-9000	1/4" RESISTOR LEAD SPACER	
123	1	XVR1	381-0010	HEATSINK TO-220	
124	1	XJ1	401-0042	DB LOCK SCREWS	
125	14	XJP6,XJP8,XJP9,XJP11, XJP12,XJP13,XJP14, XJP15(2),XJP16,XJP17,XJP20, XJP21,XJP22 (POS A)	402-3040	MINI JUMPER	
126	3	XU8,XU9,XU19	407-0006	6-PIN DIP SOCKET	
127	14	XU16,XU17,XU18,XU20,XU21 XU22# NOTE 8,XU29,XU30, XU31,XU32,XU33,XU37,XU38, XU39,XU40	407-0008	8-PIN DIP SOCKET	
128	3	XU10,XU13,XU35	407-0014	14-PIN DIP SOCKET	
129	8	XU7,XU11,XU12,XU14 XU15,XU25,XU26,XU36	407-0016	16-PIN DIP SOCKET	
130	1	XU27	407-0018	18-PIN DIP SOCKET	
131	2	XU24,XU34	407-0020	20-PIN DIP SOCKET	
132	7	XU1-XU6, XU28	407-0028	28-PIN DIP SOCKET	
133	1	XU23	407-0052	52-PIN HC11 SOCKET	
134	1	PCB	410-9183C.2	M4XB CONTROL BOARD	
135	2	XF1	416-3040	FUSE CLIPS	
136	10	XDS2-XDS11	417-0010	LED MOUNT R/A	

NOTES: Notes are for production use only.

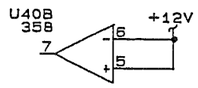
REV	DESCRIPTION	DRN	APV	DATE
B	RELEASE	DW		04/29/89
C	ECN 737	GH	[illegible]	10/04/89
D	ECN 1056	DW	[illegible]	7/30/90



NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ARE IN OHMS, 1/4W, 5%.
2. CAPACITORS ARE IN MICROFARADS.
3. POTENTIOMETERS ARE 1 TURN.
4. USA VERSION OMITS R102, CRX1. CRX2: SETS R114 = 5.6K; INCLUDES PHONE TX POT AR9

UNUSED PARTS:



LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
-	INSTALLED ON HIGHER ASSEMBLY.
#	NOT INSTALLED
___X___	CUT TRACE
_____	JUMPER WIRE

ZETRON, INC.

12335 134TH COURT N.E.
REDMOND, WASHINGTON, 98052-2433

Title: MODEL 45B/CSA

Size	Document Number	REV
B	008-9183-5	D

Date: October 6, 1989 Sheet 1 of 5

RECEIVER - TRANSMITTER AUDIO

DISCRIMINATOR BUFFER

SUBAUDIBLE LOW-PASS 250HZ

SQUARING

COR INPUT BUFFER

VOX DETECTOR

TRANSMIT COMBINING AMP

AUDIO HI-PASS 300HZ

FREQUENCY RESPONSE

DTMF DE-EMP PRE-FILTER

POWER-UP RESET

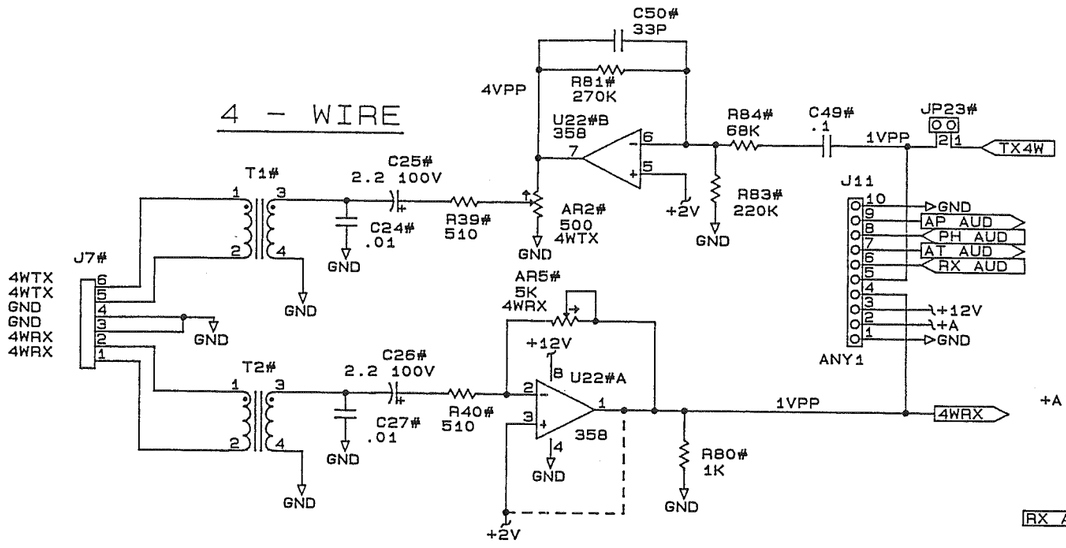
POWER SUPPLY

DISC IN
GND
SUB OUT
GND
TX AUD
COR
SENSE 1
CONTROL 1
PTT NO
PTT COM
PTT NC
GND
DC GND
AC
AC/DC

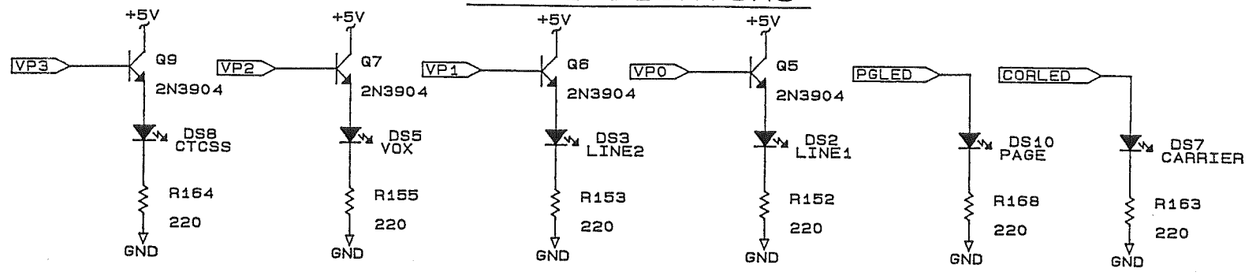
ISQ = B COR 12:00
EXT = A+/B-
VOX = A

ZETRON, INC.		
Title: MODEL 45B/CSA		
Size: B	Document Number: 008-9183-5	REV: D
Date: October 6, 1989	Sheet 2 of 5	

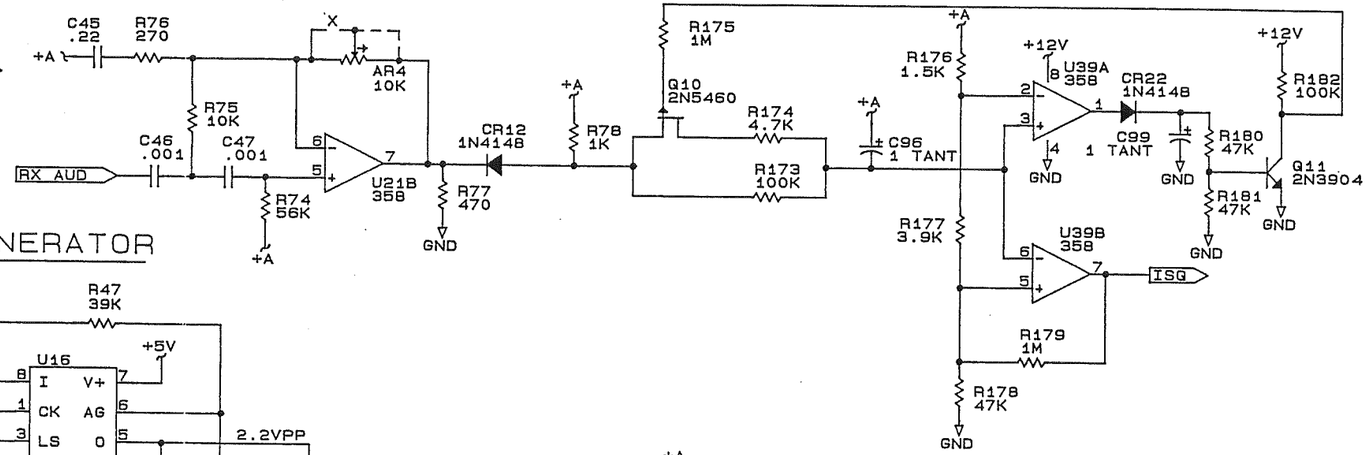
4 - WIRE



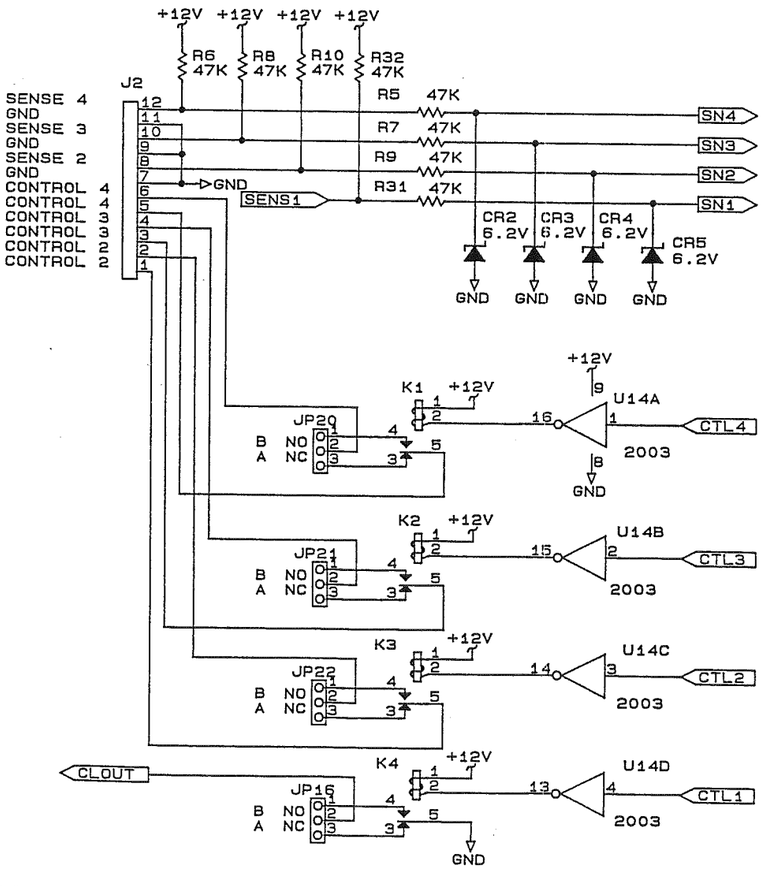
LED INDICATORS



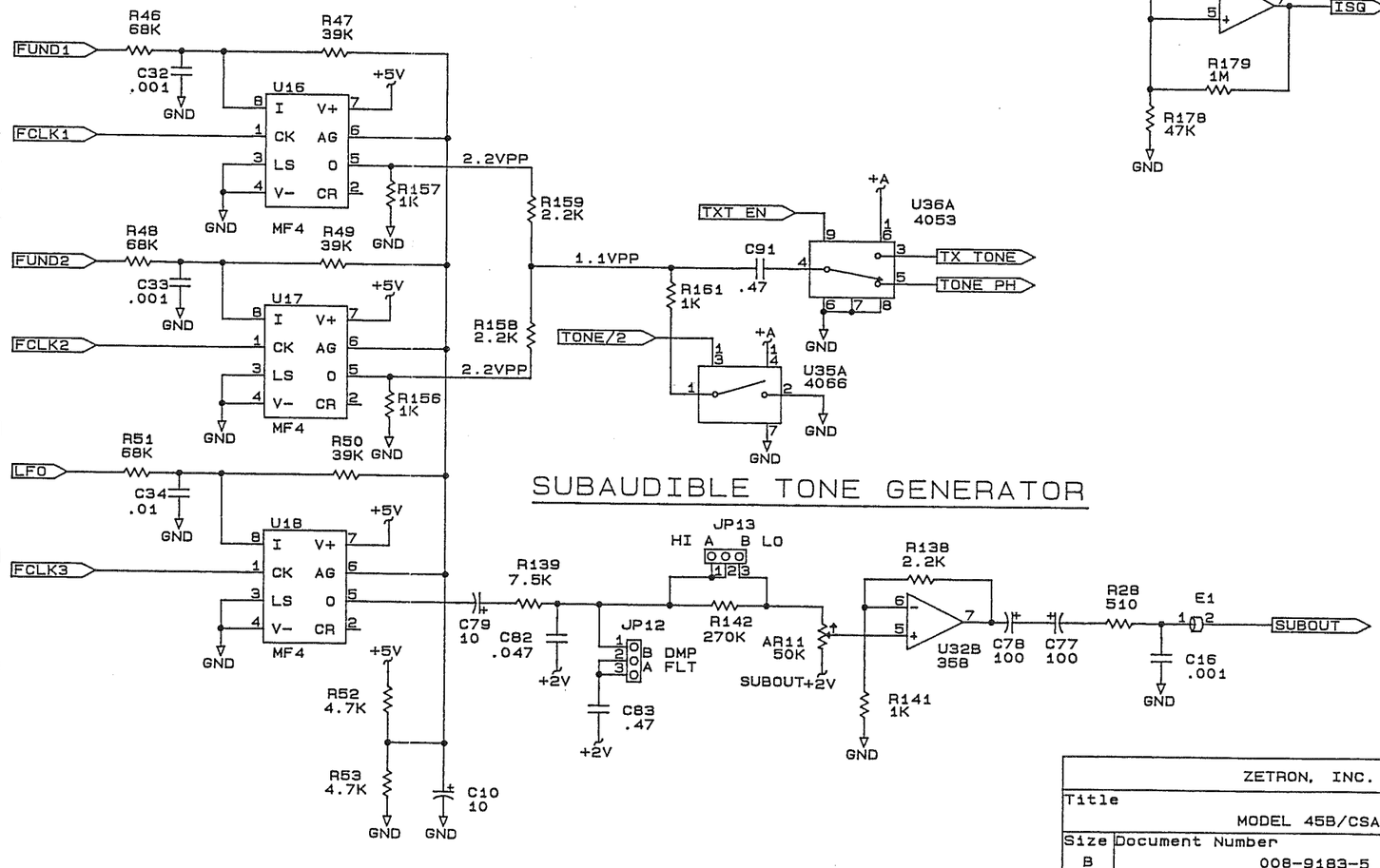
DUAL-TIME SQUELCH



CONTROL/SENSE

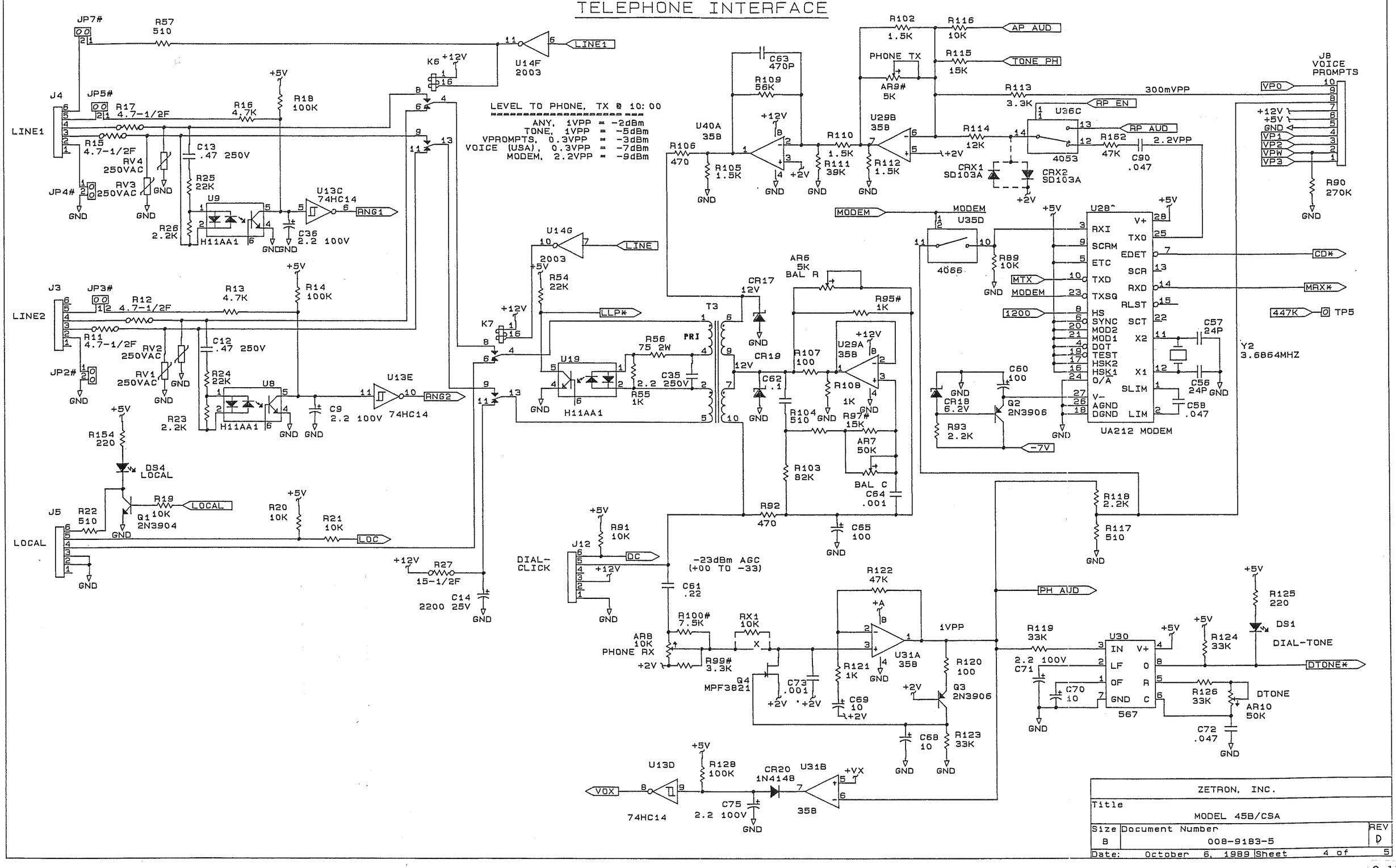


AUDIO TONE GENERATOR

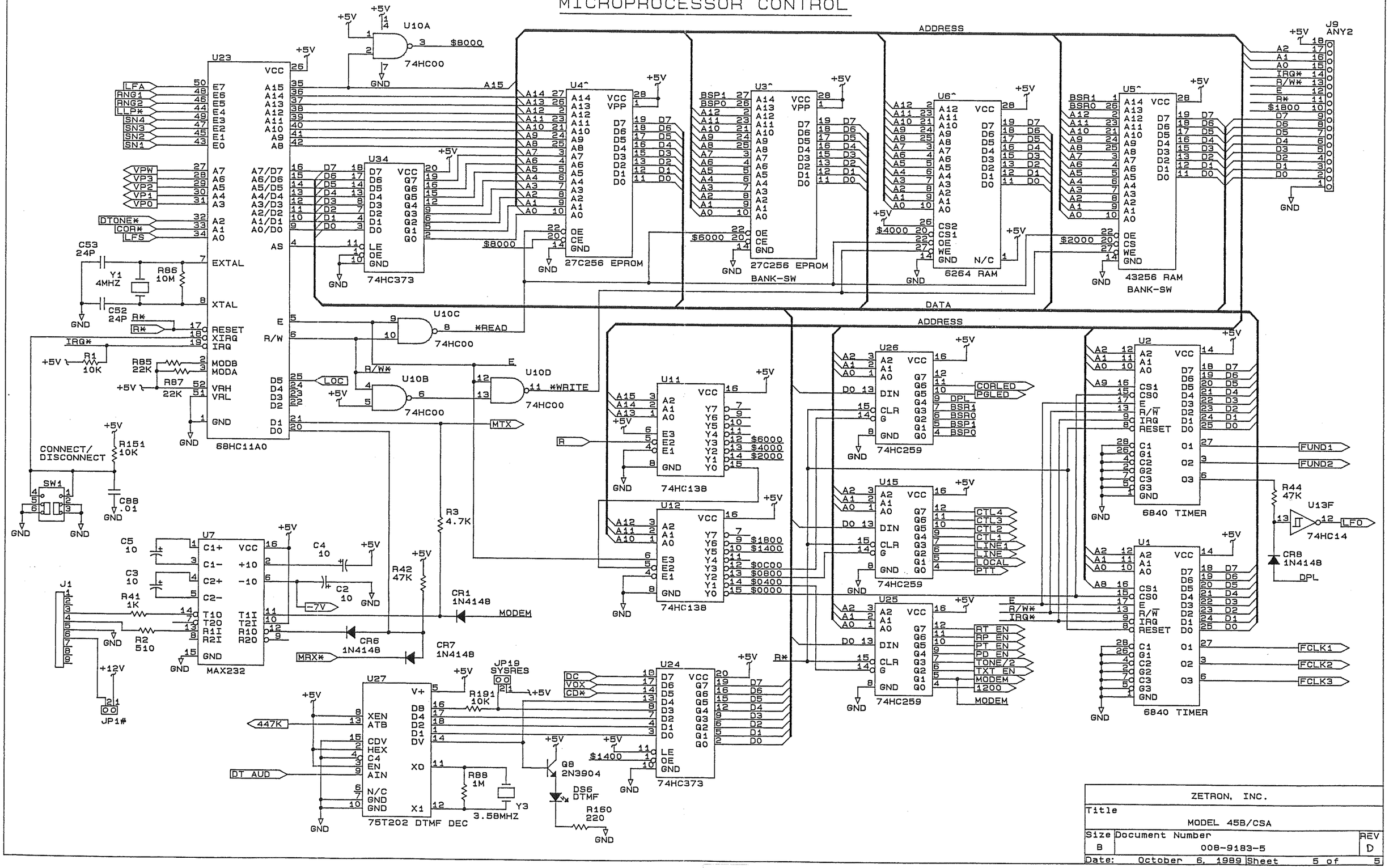


ZETRON, INC.		
Title: MODEL 45B/CSA		
Size: B	Document Number: 008-9183-5	REV: D
Date: October 6, 1989	Sheet 3 of 5	

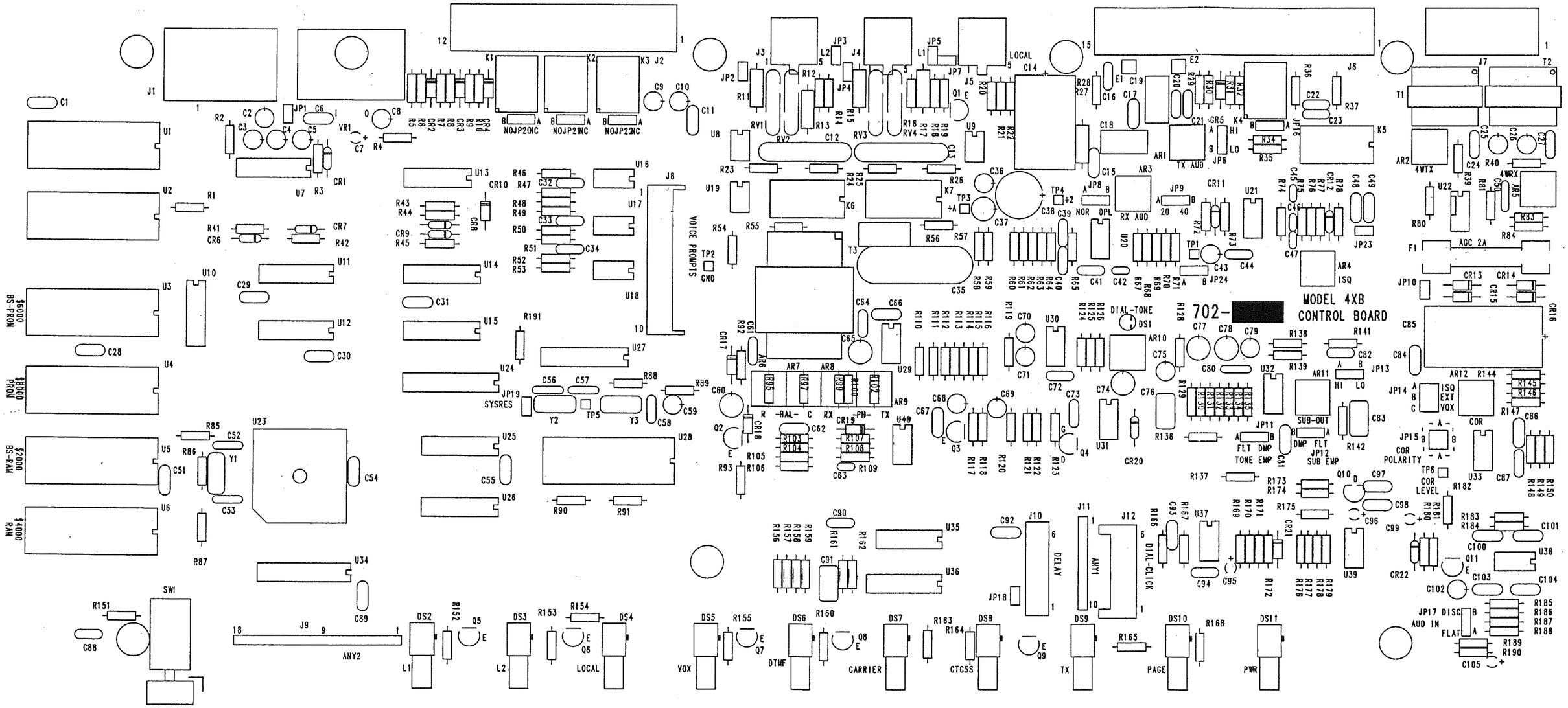
TELEPHONE INTERFACE



MICROPROCESSOR CONTROL



MODEL 45B/CSA CONTROL BOARD SILKSCREEN (702-9183-5D.5)



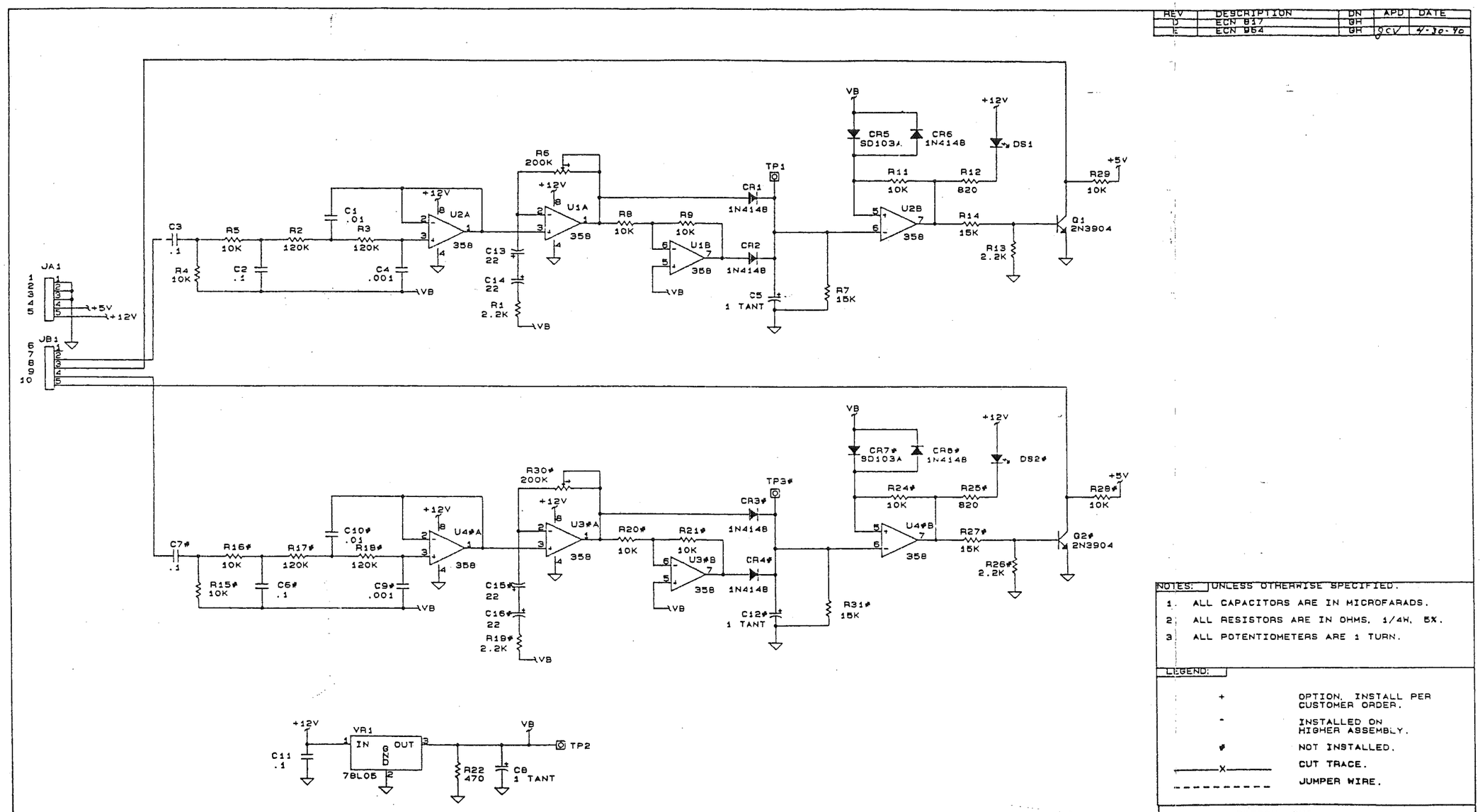
MODEL 4XB DIAL CLICK BOARD PARTS LIST (702-9242E)

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

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	MANUFACTURE P/N
1	1	R22	101-0065	470 OHM 1/4W 5% CARBON FILM	
2	1	R12,R25#	101-0071	820 OHM 1/4W 5% CARBON FILM	
3	2	R1,R13,R19#,R26#	101-0081	2.2K 1/4W 5% CARBON FILM	
4	6	R4,R5,R8,R9,R11,R15#, R16#,R20#,R21#,R24#,R28#, R29	101-0097	10K 1/4W 5% CARBON FILM	
5	2	R7,R14,R27#,R31#	101-0101	15K 1/4W 5% CARBON FILM	
6	2	R2,R3,R17#,R18#	101-0123	120K 1/4W 5% CARBON FILM	
7	1	R6,R30#	107-0504	200K POT 1 TURN	3386P-1-204
8	1	C4,C9#	151-0020	.001 UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C102K
9	1	C1,C10#	151-0120	.01 UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C103K
10	3	C2,C3,C6#,C7#,C11	151-0180	.1 UF 50V +-10% CERAMIC, UNSTABLE	AVXSR205E104MAA
11	2	C5,C8,C12#	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
12	2	C13,C14,C15#,C16#	155-0055	22 UF 25V +50%-10% AXIAL ALUMINUM ELECTROLYTIC	TLBIE220M
13	1	DS1,DS2#	311-0010	LED RED LAMP	HLMP3300
14	1	VR1	316-0005	REGULATOR 5V LOW POWER	LM78L05
15	2	U1,U2,U3#,U4#	316-0358	OP-AMP, DUAL	LM358N
16	1	Q1,Q2#	340-3904	NPN 40V/200MA	2N3904
17	1	CR5,CR7#	342-0103	SCHOTTKEY .37V @ 20MA	SD103A
18	3	CR1,CR2,CR3#,CR4#,CR6, CR8#	342-3009	SILICON .50 SP	1N4148
19	2	JA1,JB1 *NOTE 1	401-6008	5-POS MALE	09-64-1051
20	2	TP1,TP2,TP3#	403-0001	1 OF 401-0052	
21	2	XU1,XU2	407-0008	SKT, 8 PIN DIP	
22	1		410-9119B	PCB	

NOTES:
1. INSTALL JA1 AND JB1 FROM COMPONENT SIDE - LONG PINS THROUGH PCB (PLASTIC BASE ON COMPONENT SIDE) - CUT PINS FLUSH WITH BASE.

MODEL 4XB DIAL CLICK BOARD SCHEMATIC (008-9242E)



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.

LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
-	INSTALLED ON HIGHER ASSEMBLY.
#	NOT INSTALLED.
——X——	CUT TRACE.
- - - - - - - - - -	JUMPER WIRE.

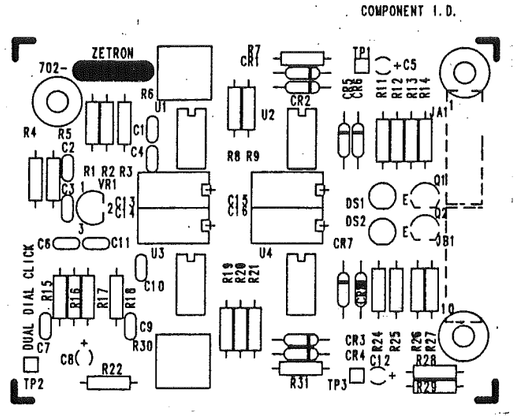
ZETRON, INC.
12335 134th COURT N.E.
REDMOND, WA 98052-2433

Title: M4XB DIAL CLICK

Size: B | Document Number: 008-9242 | REV: E

Date: April 30, 1990 | Sheet 1 of 1

MODEL 4XB DIAL CLICK BOARD SILKSCREEN (702-9242E)



MODEL 4X VOX DELAY PARTS LIST (702-9031K)

LEGEND:
+ = OPTION
# = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY

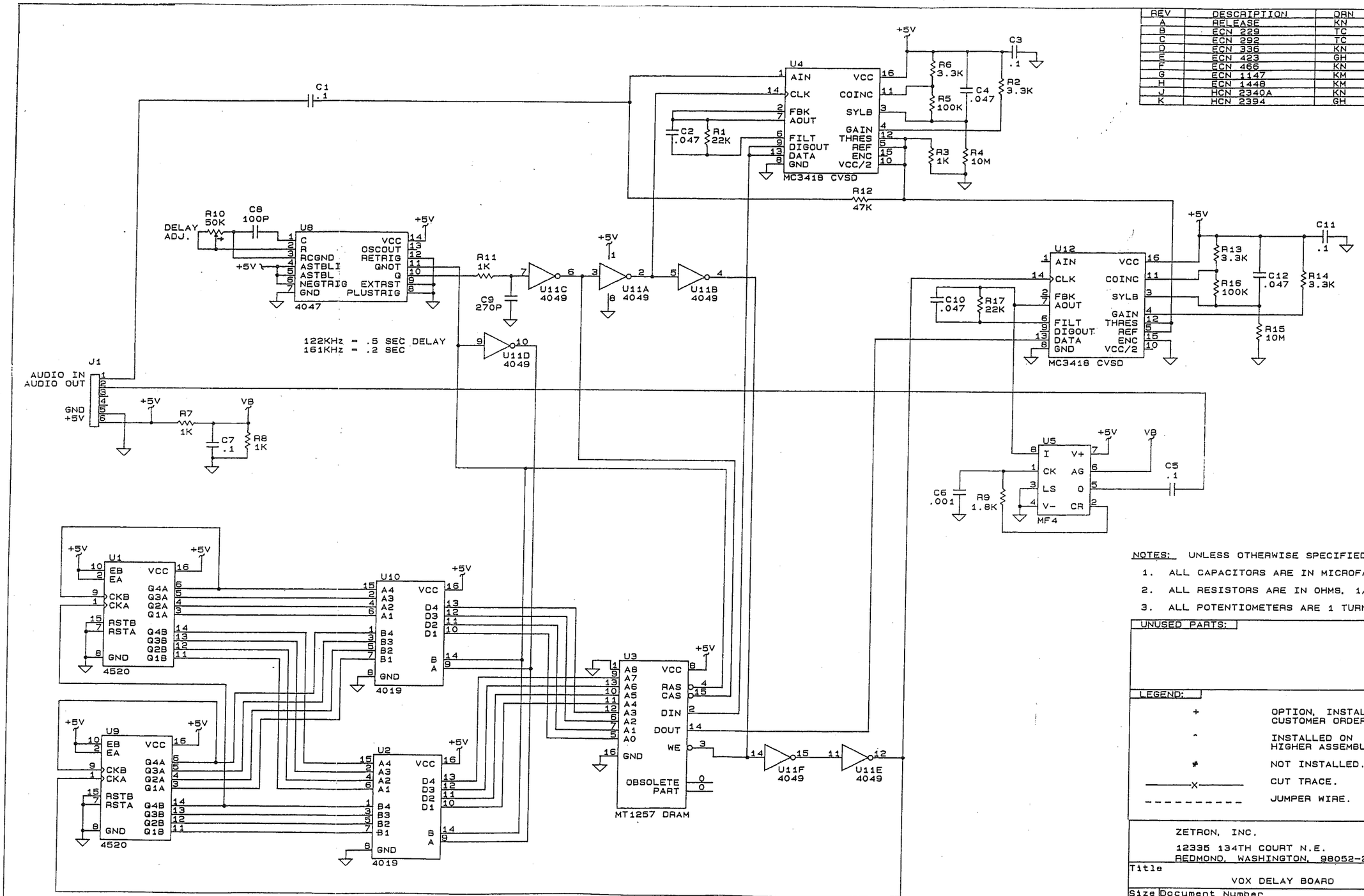
Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	4	R3,R7,R8,R11	101-0073	1K 1/4W 5% CARBON FILM	
2	1	R9	101-0078	1.8K 1/4W 5% CARBON FILM	
3	4	R2,R6,R13,R14	101-0085	3.3K 1/4W 5% CARBON FILM	
4	2	R1,R17	101-0105	22K 1/4W 5% CARBON FILM	
5	1	R12	101-0113	47K 1/4W 5% CARBON FILM	
6	2	R5,R16	101-0121	100K 1/4W 5% CARBON FILM	
7	2	R4,R15	101-0160	10M 1/4W 5% CARBON FILM	
8	1	R10	107-0502	50K POT 1 TURN	3386P-1-503
9	1	C8	151-0010	100PF 50V/100V +-10%/5% CERAMIC, TEMPERATURE STABLE	CW15C101K
10	1	C6	151-0020	.001UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C102K
11	1	C9	151-0027	270PF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C271K
12	4	C2,C4,C10,C12	151-0130	.047UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW20C473M
13	5	C1,C3,C5,C7,C11	151-0180	.1UF 50V +-10% CERAMIC, UNSTABLE	AVXSR205E104MAA
14	1	U5	316-0004	TONE FILTER	MF4CN-50
15	1	U3	321-0256	256K X 1 DRAM	UPD41256C10
16	2	U4,U12	323-3418	CVSD VOICE DIG	MC3418CP
17	2	U10,U2	323-4019	MUX	MC14019
18	1	U8	323-4047	MONOSTABLE MULTIVIBRATOR	CD4047BE
19	1	U11	323-4049	HEX BUFFER INV	MC14049B
20	2	U1,U9	323-4520	COUNTER	MC14520
21	1	J1 NOTE 1	401-6005	6-POS FEMALE	09-52-3063
24	1	XU5	407-0008	8-PIN DIP SOCKET	
25	1	XU8	407-0014	14-PIN DIP SOCKET	
26	8	XU1-4 9-12	407-0016	16-PIN DIP SOCKET	
27	1	PCB	410-9031E	VOX DELAY BOARD	

REFERENCE DESIGNATORS NOT USED: U6,U7

NOTES:

Notes are for production use only.

REV	DESCRIPTION	DRN	APD	DATE
A	RELEASE	KN		
B	ECN 229	TC		
C	ECN 292	TC		
D	ECN 336	KN		
E	ECN 423	GH		
F	ECN 466	KN		
G	ECN 1147	KM		
H	ECN 1448	KM		
J	HCN 2340A	KN		
K	HCN 2394	GH	SR	12-21-93



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.

UNUSED PARTS:

LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
^	INSTALLED ON HIGHER ASSEMBLY.
#	NOT INSTALLED.
——X——	CUT TRACE.
- - - - - -	JUMPER WIRE.

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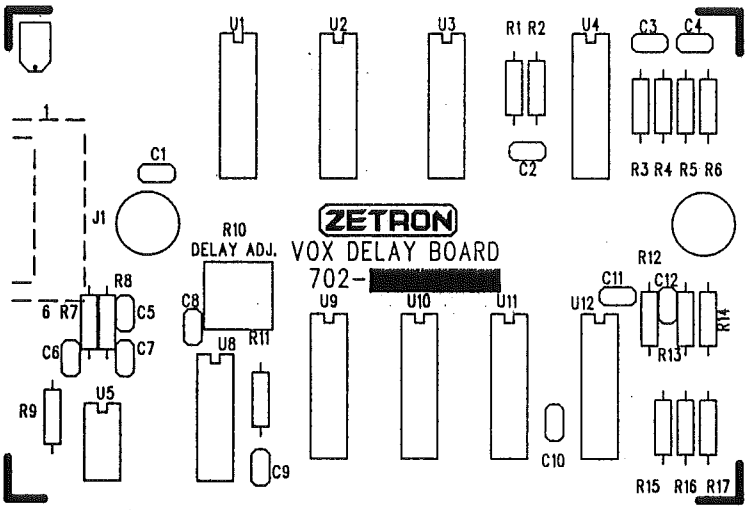
REDMOND, WASHINGTON, 98052-2433

Title: VOX DELAY BOARD

Size: B | Document Number: 008-9031 | REV: K

Date: November 18, 1993 | Sheet 1 of 1

MODEL 4X VOX DELAY BOARD SILKSCREEN (702-9031K)



MODEL 4XB VOICE CARD PARTS LIST (702-9236F)

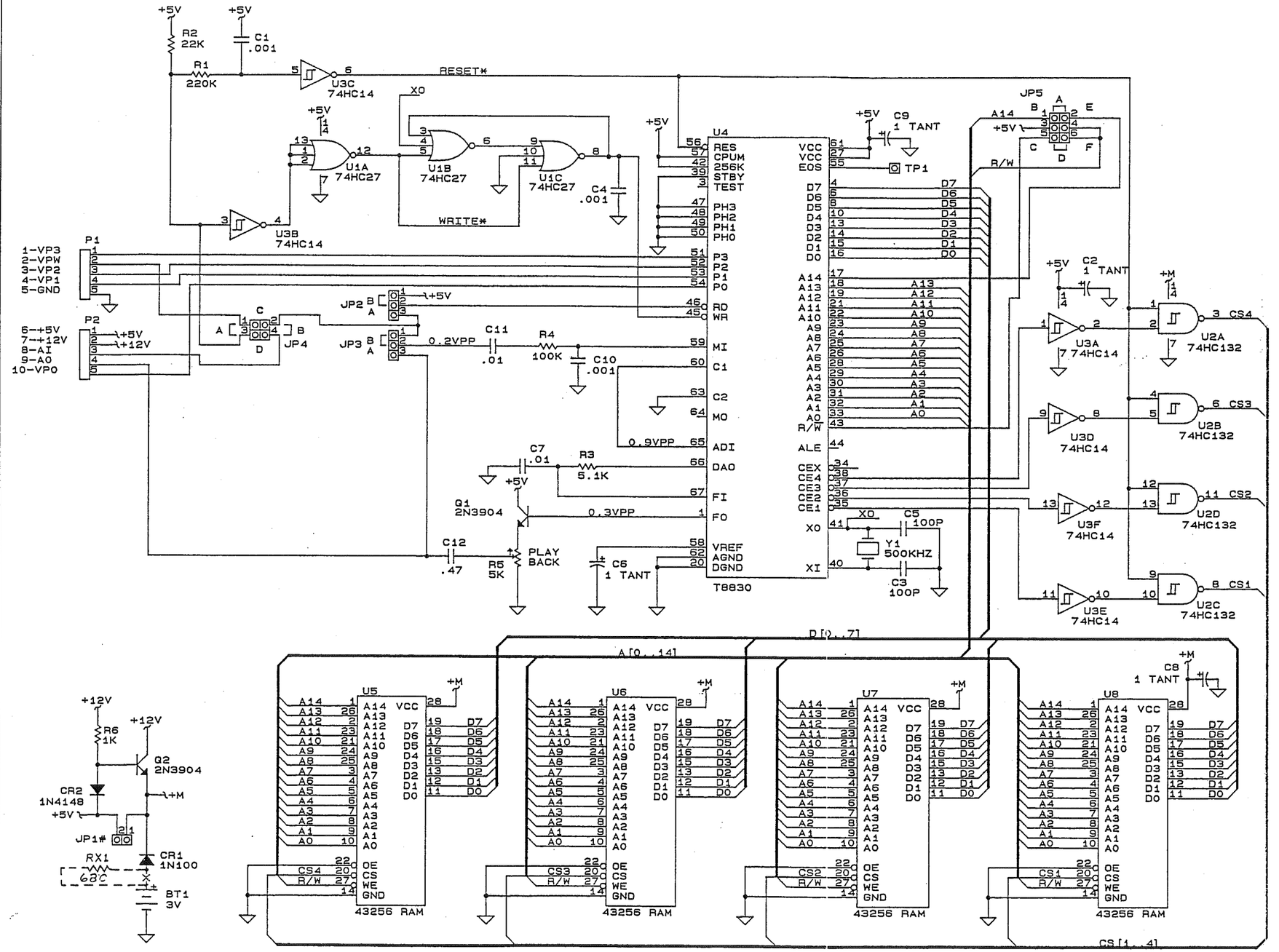
LEGEND:

^ = INSTALLED ON HIGHER ASSEMBLY
# = NOT INSTALLED
+ = OPTION, INSTALL PER CUSTOMER ORDER

Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	1	RX1 NOTE 5	101-0069	680 OHM 1/4W 5% CARBON FILM	
2	1	R6	101-0073	1K 1/4W 5% CARBON FILM	
3	1	R3	101-0090	5.1K 1/4W 5% CARBON FILM	
4	1	R2 NOTE 2	101-0105	22K 1/4W 5% CARBON FILM	
5	1	R4	101-0121	100K 1/4W 5% CARBON FILM	
6	1	R1 NOTE 2	101-0129	220K 1/4W 5% CARBON FILM	
7	1	R5	107-0501	5K POT 1 TURN	3386P-1-502
8	2	C3,C5	151-0010	100 PF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C101K
9	1	C12	151-0199	.47 UF 50V +-5% POLYESTER	ECQVIH474JZ
10	2	C7,C11	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-V1H103JZ
11	3	C1 NOTE 2, C4,C10	152-0089	.001 UF 50V +-5% POLYESTER	ECQBIH102JZ
12	4	C2,C6,C8,C9	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
13	4	U5,U6,U7,U8	321-8256	32K X 8 RAM LP	HPD43256-15L
14	1	U4	323-8830	STATIC VOICE REC/PLAY LSI	T8830
15	1	U2	324-4132	QUAD NAND SCHMIDT	MCH74HC132
16	1	U3	324-7414	HEX SCHMIDT	74HC14
17	1	U1	324-7427	TRIPLE 3 INPUT NOR	74HC27
18	2	Q1,Q2	340-3904	NPN 40V/200MA	2N3904
19	1	CR1 NOTES 5,6	342-3008	DIODE, GERMANIUM	1N100
20	1	CR2	342-3009	DIODE, SILICON 100V 250MW	1N4148
21	1	Y1	376-0500	500 KHz CER RESONATOR	CSB500E
22	2	P1,P2 NOTE 1	401-6008	5-POS MALE ROUND	26-51-0051
23	1	TP1	403-0001	1 OF 401-0052	
24	0	JP1#	403-0002	2 OF 401-0052	
25	1	BT1	416-0002	LITH CELL BATT	BR2325
26	1	NOTE 3	251-1240	440X.062 FIBER	
27	3	XU1,XU2,XU3	407-0014	SKT, 14 PIN DIP	
28	4	XU5,XU6,XU7,XU8	407-0028	SKT, 28 PIN DIP	
29	6	XJP2,XJP3 (POS B) XJP4 (POS A & B) XJP5 (POS A & D)	408-0001	WIRE JUMPER	
30	1	PCB	410-9193C.1	VOICE CARD	
31	1	XBT1 NOTE 4	415-9432A	BATTERY INSULATOR	
32	1	XBT1	416-0001	LITH COIN BATT HOLDER	BH906
33	A/R	NOTE 3	561-0010	TAK PAK	

NOTES: Notes are for production use only.

REV	DESCRIPTION	DN	APR	DATE
A	RELEASE	DW		
B	ECN 719	GH		
C	ECN 1478	KM	KM	11/8/91
D	ECN 1657	KN	SK	1-15-95
E	ECN 3359	DD	AH	1-10-96
F	ECN 3389	DD	AH	1.24-96



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.

UNUSED PARTS:

LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
-	INSTALLED ON HIGHER ASSEMBLY.
*	NOT INSTALLED.
——X——	CUT TRACE.
- - - - - - - - - -	JUMPER WIRE.

ZETRON, INC.

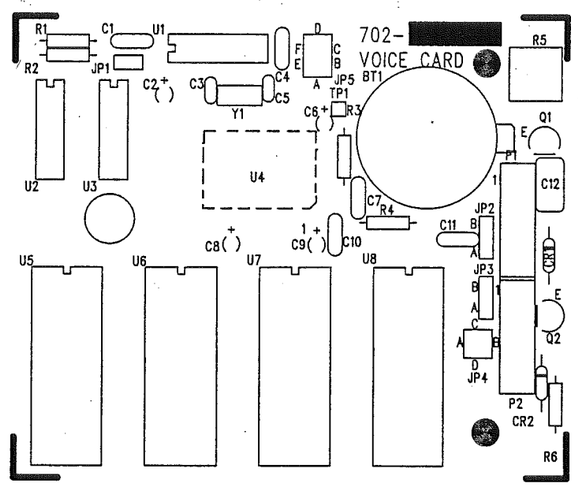
12335 134TH COURT N.E.
REDMOND, WASHINGTON, 98052-2433

Title: MODEL 4XB VOICE CARD

Size	Document Number	REV
B	008-9236	F

Date: October 2, 1991 Sheet 1 of 1

MODEL 4XB VOICE CARD SILKSCREEN (702-9236F)



9. CONNECTIONS AND JUMPERS

INTRODUCTION

This section includes the connections to the Model 45B's three input/ output ports, jumper functions and descriptions, and block diagrams.

PRIMARY CONNECTIONS (to J6)

Type:

1 - AC/DC Input
Power input. +10.5 to +15V DC or 12V AC input.

2 - AC Input
When AC power is used the other side of AC power is hooked here.

3 - Power Ground
When DC power is used the negative side (ground) should be hooked here.

4 - Ground

5 - TR Relay A NC
Pins 5 through 7 are the TR (Transmit/Receive) relay connections. The contacts will take 150V DC at 500 mA max.

6 - TR Relay Common

7 - TR Relay A N.O.

8 - Control 1 (K4) N.O.
System Relay #1 output - Active causes closure to ground.

9 - Sense-1
External Sense Line 1. This line is used for the COR validation input. This input may be set for active high or active low operation. See system COR menu. This input is internally pulled high so setting COR validation to active high and leaving the input open will cause the normal COR input to be validated. If the COR validation input is pulled low it would cause the COR input to be invalidated. The COR and COR validation inputs must both be valid before mobile operation will occur. Note: This input is normally not used.

10 - COR
Carrier-Operated-Relay. (Also known as CAS, Carrier-Active-Signal, and CAR, Carrier-Activated-Relay.) This pin is activated by (a) closing it to ground with a contact closure, (b) pulling it to ground or to pin 14 with a transistor or logic gate. It may also be activated by supplying it with a signal that goes from some positive voltage to a lesser voltage or ground or vice-versa. In all cases the "direction" of the signal when the Rx detects a carrier is not important, as the sense of the signal may be changed in the software. Caution: the COR signal must swing around 0 and +4V, adjustable via R136.

11 - Transmit Audio Out
Audio to Transmitter. Often, this signal is connected to the "MIC" input of the transmitter. It is adjustable from 0 to 400 mV P-P, JP6 in B; or 0 to 4 V P-P, JP6 in A.

12 - Transmit Audio Common
The return for pin 11. Ground.

13 - CTCSS/Digital Squelch Output
The CTCSS (subaudible) or Digital Squelch output for direct modulation of the transmitter. The signal is capacitively coupled and may be adjusted for swings from 0 to 400 mV P-P, JP13 in B; or 0 to 4 V P-P, JP13 in A. JP12 selects the output to be flat or de-emphasized.

14 - Audio In / Discriminator Lo.
The return pin for pin 15. This pin is connected to chassis-ground.

15 - Audio In / Discriminator Hi.
This is the audio input to the Z-Patch from the Receiver's discriminator. It has an input impedance greater than 50 kΩ. It is sensitive to discriminator levels on the order of 20 mV P-P. Ensure the output from the receiver has the tone/code information. JP8 selects normal CTCSS decode or CTCSS and DPL decode. JP9 selects low or high gain; input of 20 to 200 mV P-P, JP9 in B; 200 mV to 6 V P-P, JP9 in A.

AUXILIARY CONNECTIONS (to J2)

Type: Weidmüller SL15 (# 6923.6) Male
Mating connector BL15 (# 12604.6) Female

1 - Control 2 Common

2 - Control 2 N.O. or N.C. via JP22
System Relay #2 output

3 - Control 3 Common

4 - Control 3 N.O. or N.C. via JP21
User Relay #1 output

5 - Control 4 Common

6 - Control 4 N.O. or N.C. via JP20
User Relay #2 output

7 - Ground

8 - Sense #2
External Sense Line 2. This line is used for the Channel busy input. This input may be set for active high or active low operation. See the system COR menu. This input is internally pulled high so setting Channel busy to active low and leaving the input open will cause the channel to look idle. When this input is active the COR LED will flash. If this input is pulled low then the Z-Patch will not allow any calls from the landline to go out because the channel will look busy. This input also will inhibit dispatch, mobile-to-phone and mobile-to-mobile operation. This input may be used on a monitor receiver to test for channel activity on the transmit channel or as a busy inhibit.

9 - Ground

10 - Sense #3
This line and the other Sense Line are designed for closure to ground for activation. The closure may be by transistor, logic gate, or relay contact. Logic gates and transistors must be able to sink only 300 microamperes. When this input is pulled low it will do a page out with user one's page format and page code. User 1 must be setup with a valid page format and page code. The page will be sent 3 times. If the input is still low after 10 minutes the page will be sent again.

11 - Ground

12 - Sense-4
This input operates the same as Sense #3 but uses the parameters of User 2.

SERIAL CONNECTIONS (to J1)

Type: AMP-207084 or eq. 9-pin "Subminiature-D" (female)

1 - Not Used

2 - Not Used

3 - TDATA (Transmitted-Data)
This pin is the RS-232 data FROM the Z-Patch. It swings from -5V (mark) to +5V (space) through a 1 kΩ resistor.

4 - RDATA (Received-Data)
This pin is the RS-232 data TO the Z-Patch. It should swing from -5V (mark) to +5V (space) through no less than a 3 kΩ resistor. It may swing through ±25V max.

5 - Ground
All signals refer to this pin for ground. It is physically connected to the metal chassis of the Z-Patch, and all internal logic and audio signals refer to this same potential.

6 - +12 Volts
If JP1 is installed +12V DC will be supplied to this pin.

7 - Not Used

8 - Not Used

9 - Not Used

JUMPER SETTINGS

JUMPER	FUNCTION	OPTIONS
JP- 1	RS-232 Power	In= +12 Volts to J1 Pin 6
2	Phone line jumpers	In= L2 pin 2= ground
3	" " "	In= L2 pin 5= ring detector
4	" " "	In= L1 pin 2= ground
5	" " "	In= L1 pin 5= ring detector
6	Tx Audio Hi/Lo	A= Hi B= Lo
7	L1 Answer OUT	In= L1 pin 6→ground=answered
8	used	
9	Rx Audio Gain	A= 20 dB B= 40 dB
10	Supply Ground	Etched--Do not cut
JP-11	Tx Tone Filter	A= Flat B= De-emphasized
12	Tx Subaud Filter	A= Flat B= De-emphasized
13	Tx Subaud Hi/Lo	A= Hi B= Lo
14	COR Mode	A= Internal Squelch B= Externally Supplied COR C= Voice operated (VOX)
15	COR Polarity	A= Active Lo B=Active Hi
16		
17	Tx Audio Filter	A= Flat B=De-emphasized
18	Delay	Etched
19	System Reset	In =Clears all system memory on power-up

A. APPENDICES

USING A TERMINAL EMULATOR

An IBM PC (or compatible) may be used to program the Z-Patch. The computer must contain an RS-232 serial interface in order to function as a "dumb terminal". The only connections required between the Model 45B and the computer are: Ground, Tx-data, and Rx-data (as described in "Computer or CRT Connections," Section 7). The baud rate is defaulted to 4800 baud from the factory. If you want to change it to 300 baud, use function code 78 in the DTMF programming mode. 300 baud = 78* 0# (See "Computer or CRT Connections" in Section 7).

GENERAL SERIAL COMMUNICATIONS

If you have problems determining which connections are correct the following information should help.

1. The DC voltage on the TX data signal from your CRT/Computer should be between -5V and -15V.

2. The DC voltage on the RX data signal from your CRT/Computer should be at ground.

If the Initial message appears on your screen but nothing happens when you hit return do the following:

1. Tie DTR to DSR on the connector on your CRT/Computer.

2. Tie RTS to CTS on the connector on your CRT/Computer.

If you still do not get the top menu from the M45B check the following:

1. With a Scope measure the signal coming from your TX data. It should be sitting low and then, when you hit the return or enter key, you should see three pulses going high to +5V to +15V DC.

2. If the signal looks O.K. then look for the signal at pin 11 of U46. The signal at pin 11 should be sitting at +5V DC. then go low with the incoming signal.

If you do not get the Initial message then do the following:

1. Verify the baud rate and set up of the M45B and your CRT/Computer.

2. Check that data is coming out of the M45B, pin 12 of U46, and pin 3 of J3. The data will come out each time you hit the reset button on the M45B.

3. The TX data output of the M45B should be sitting between -3 and -5V DC. If not check the -5V regulator, U9.

4. Check your cable.

SERIAL COMMUNICATIONS WITH THE RADIO SHACK MODEL 100

Direct Connection Cable Diagram

Model 45B	Data Direction	Model 100
3 Txdata	⟹	3 Rxdata
4 Rxdata	⟸	2 Txdata
5 Ground	⟺	7 Ground

Initiating Terminal Emulation at 4800 Baud

A. Move the Cursor over the word TELCOM and press ENTER
B. Press STAT (F3 function key)
C. Type: 78N1E ENTER
D. Press TERM (F4 function key)
E. Press the "LABEL" key to turn on or off the status line for a larger display area.

Procedure for Remote Access via Modem

A. The Model 45B must have the modem baud rate set to 300.
B. Set the Model 100 computer for modem operation as follows:
   1. Move the Cursor over the word TELCOM and press ENTER
   2. Press STAT (F3 function key)
   3. Type: M7ile ENTER
C. Dial the number of the Model 45B from a DTMF phone.
D. When the line is answered, enter the program mode (see Section 3. for details).
E. When the modem tone is heard, press TERM (F4) on the Model 100.
F. Press the ENTER key, the sign-on menu should appear.
   1. If the menu fails to appear and the computer does not respond, press F8 to return to TELCOM mode.
   2. Fault identification for "garbaged" (wrong characters) sign-on display:
      a. Poor quality phone line audio. Listen to the audio, if snap, crackle or pops are heard, the modem may be unusable.
      b. Be sure RS-232 cable is disconnected from Model 100.
      c. Verify proper phone line connections. Gray to phone.

NOTE: For detailed information, consult the Model 100 portable computer operation manual.

TWO-TONE TIMING AND FREQUENCIES

Two-Tone Sequential Timings (in seconds)

This is format #4.

T =	1st	Gap	2nd	Grp	Timing Group
1	1.0	0	3.0	8.0	(Mot/GE Tone & Voice)
2	0.4	0	0.8	8.0	(Mot Tone Only)
3	1.0	0	3.0	6.0	(NEC-B)
4	1.0	.25	3.0	6.0	(NEC-A)
5	1.0	0	1.0	4.0	(NEC-C)
6	0.4	0	0.8	4.0	(NEC-M)
7	0.5	0	0.5	3.0	(NEC-L)
8	0.4	0	0.4	3.0	(NEC-D)

Two-Tone Tone Groups

	TONE GROUPS						
Tone Number	Mot 1 1	Mot 2 2	Mot 3 3	Mot 4 4	Mot 5 5	Mot 6 6	Mot A 7
0	330.5	569.1	1092.4	321.7	553.9	1122.5	358.9
1	349.0	600.9	288.5	339.6	584.8	1153.4	398.1
2	368.5	634.5	296.5	358.6	617.4	1185.2	441.6
3	389.0	669.9	304.7	378.6	651.9	1217.8	489.8
4	410.8	707.3	313.0	399.8	688.3	1251.4	543.3
5	433.7	746.8	953.7	422.1	726.8	1285.8	602.6
6	457.9	788.5	979.9	445.7	767.4	1321.2	668.3
7	483.5	832.5	1006.9	470.5	810.2	1357.6	741.3
8	510.5	879.0	1034.7	496.8	855.5	1395.0	822.2
9	539.0	928.1	1063.2	524.6	903.2	1433.4	912.0
A	569.1	979.9	569.1	569.1	979.9	979.9	979.9

	TONE GROUPS						
Tone Number	Mot B 8	Mot Z 9	GE A' A	GE B' B	GE C' C	Mot 10 D	Mot 11 E
0	371.5	346.0	682.5	652.5	667.5	1472.9	1930.2
1	412.1	384.6	592.5	607.5	712.5	1513.5	1989.0
2	457.1	426.6	757.5	787.5	772.5	1555.2	2043.8
3	507.0	473.2	802.5	832.5	817.5	1598.0	2094.5
4	562.3	524.8	847.5	877.5	862.5	1642.0	2155.6
5	623.7	582.1	892.5	922.5	907.5	1687.2	2212.2
6	691.8	645.7	937.5	967.5	952.5	1733.7	2271.7
7	767.4	716.1	547.5	517.5	532.5	1781.5	2334.6
8	851.1	794.3	727.5	562.5	577.5	1830.5	2401.0
9	944.1	881.0	637.5	697.5	622.5	1881.0	2468.2
A	979.9	979.9	742.5	742.5	742.5	none	none

FIVE/SIX TONE TIMING AND FREQUENCIES

This is format #5.

	Tone Number	EIA	CCIR	ZVEI	
	0	600	1981	2400	Tone Freq. in Hz
	1	741	1124	1060	
	2	882	1197	1160	
	3	1023	1275	1270	
	4	1164	1358	1400	
	5	1305	1446	1530	
	6	1446	1540	1670	
	7	1587	1640	1830	
	8	1728	1747	2000	
	9	1869	1860	2200	
2nd Addr	X	2010	2247	970	
Repeat	R	459	2110	2600	
	Preamble	690	690	690	Tone Timing in msec
	Gap	65	65	65	
	Tone	33	100	100	
	X Tone	65	100	100	

CTCSS TONES

Number	Frequency (Hz)	Number	Frequency (Hz)
01	67.0	20	131.8
02	71.9	21	136.8
03	74.4	22	141.3
04	77.0	23	146.2
05	79.7	24	151.4
06	82.5	25	156.7
07	85.4	26	162.3
08	88.5	27	167.9
09	91.5	28	173.8
10	94.8	29	179.9
11	97.4	30	186.2
12	100.0	31	192.8
13	103.5	32	203.5
14	107.2	33	210.7
15	110.9	34	218.1
16	114.8	35	225.7
17	118.8	36	233.6
18	123.0	37	241.8
19	127.3	38	250.3

DIGITAL SQUELCH CODES

The following table is a list of the digital codes the Model 45B encodes. In the user specific menu the digital number is preceded by the letter 'D' when entering an encode code. When programming a digital code via DTMF programming, add 39 to the digital number (ie. digital code D1=40). Note that 'D0' and '0', both set the tone/code off.

Digital Number	Code	Inverted Code	Digital Number	Code	Inverted Code	Digital Number	Code	Inverted Code
1	023	047	36	223	134	71	445	043
2	025	244	37	225	122	72	446	255
3	026	464	38	226	411	73	452	053
4	031	627	39	243	351	74	454	266
5	032	051	40	244	025	75	455	332
6	036	172	41	245	072	76	462	252
7	043	445	42	246	523	77	464	026
8	047	023	43	251	165	78	465	331
9	051	032	44	252	462	79	466	662
10	053	452	45	255	446	80	503	162
11	054	413	46	261	732	81	506	073
12	065	271	47	263	205	82	516	432
13	071	306	48	265	156	83	523	246
14	072	245	49	266	454	84	526	325
15	073	506	50	271	065	85	532	343
16	074	174	51	274	145	86	546	132
17	114	712	52	306	071	87	565	703
18	115	152	53	311	664	88	606	631
19	116	754	54	315	423	89	612	346
20	122	225	55	325	526	90	624	632
21	125	365	56	331	465	91	627	031
22	131	364	57	332	455	92	631	606
23	132	546	58	343	532	93	632	624
24	134	223	59	346	612	94	654	743
25	143	412	60	351	243	95	662	466
26	145	274	61	356	212	96	664	311
27	152	115	62	364	131	97	703	565
28	155	731	63	365	125	98	712	114
29	156	265	64	371	734	99	723	431
30	162	503	65	411	226	100	731	155
31	165	251	66	412	143	101	732	261
32	172	036	67	413	054	102	734	371
33	174	074	68	423	315	103	743	654
34	205	263	69	431	723	104	754	116
35	212	356	70	432	516			

PROGRESS AND RING-OUT TONE DEFINITIONS

The following is a list of all of the tones that the Model 45B generates. The name of the tone(s), the timing and the frequency is listed.

Tones to mobile or telco:

Mobile/telco illegal access/error:
Repeat, 540Hz for 0.15 sec then 393Hz for 0.15 sec, five times.

Line 2 override:
Same as mobile illegal access/error.

Dial tone:
440Hz plus 350Hz.

Beep: Answer mode on telco:
800Hz for 0.400 sec, 1 sec after the line is answered.

Fast busy:
Repeat, 432Hz plus 471Hz, 0.125 sec on, 0.125 sec off. This tone is issued to telco before disconnect.

Normal ring:
Repeat, 432Hz plus 471Hz, 2 sec on, 4 sec off.

Broken ring:
Repeat, 432Hz plus 471Hz, 0.5 sec on, 0.5 sec off, 0.5 sec on, 4 sec off.

DTMF program mode access acknowledgment:
Repeat 2 times, 546Hz for 0.2 sec, then 590Hz for 0.2 sec, then 564Hz for 0.2 sec, then 466Hz for 0.2 sec then 0.025 sec off.

Ring-out styles to mobile:

Normal ring:
Repeat, 432Hz plus 471Hz, 2 sec on, 4 sec off.

Double ring:
Repeat, 432Hz plus 471Hz, 0.5 sec on, 0.5 sec off, 0.5 sec on, 4 sec off.

Triple ring:
Rep., (rep. 3 times) 432Hz plus 471Hz, 0.4 sec on, 0.4 sec off, 4 sec off.

Ding-dong ring:
Repeat, 550Hz plus 590 Hz, 1 sec on, 400Hz plus 440Hz, 1 sec on 4 sec off.

Singer ring:
Repeat, 700Hz plus 708Hz, 2 sec on, 4 sec off.

Warbler ring:
Repeat, 20 repetitions of {741Hz for 0.05 sec then 500Hz for 0.05 sec} then 4 sec off.

DTMF MORSE CODE ID PROGRAMMING CHART

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

QUICK REFERENCE

System Items

1. Sign-On Mode: 0=Zetron style, 1=RCC Mode 1, 2=RCC Mode 2. Zetron = *+ANI, RCC 1 = ANI+steering digit, RCC 2 = *+ANI+steering digit.

2. Station ID Mode: 0=Off; 1=End of call and timer; 2=End of timer and quiet channel; 3 = End of timer, quiet channel and after channel activity.

3. Dial-out Mode: 0=Slow DTMF, 1=Fast DTMF, 2=Slow Pulse, 3=Fast Pulse.

4. Line 1, 2 and Local Answer Mode: 0=Answer Ring-out, this allows a user to be called if the caller does not overdial; 1=Answer/Access/Ring-out, the M45B returns dial tone; 2=No-Answer/Ring-out, the M45B does not answer the line until the mobile answers, not a valid mode for the local phone.

5. User Relay Mode: 0=On at mob. orig., OFF at Disconnect; 1=ON at mob. ans., OFF at mob. disconnect; 2=ON at telco Acc., OFF at mob. ans.; 3=ON at telco Acc., OFF at disconnect; 4=ON at telco Acc. or Mob. org., OFF at disconnect.

6. SMDR Print Mode: 0=No output to printer; 1=Output in Pretty print; 2=FP-10.

7. Dial click decode mode: 0=DTMF only; 1=DTMF/Click decode without the calibration digit '0'; 2=DTMF/Click decode with the calibration digit '0' from dial pulse phones; 3=DTMF only, for use with the external dial click decoder.

User Items

1. Autodial Mode: 0=Manual dial only; 1-9=Number automatically dialed; 14=Manual and Autodials; 15=Autodials only.

2. Equipment Type: 0=Mobile; 1=Talk-back pager; 2=T+V pager; 3=T.O. pager; 4=Direct channel access.

3. Ringout Style: 0=Normal; 1=Double; 2=Triple; 3=Ding-Dong; 4=Singer; 5=Warbler; 6=Normal; 7=Repeat paging tones.

4. Call timer Mode: 0=No call limit; 1=Call limit timer 1; 2=Call limit timer 2.

5. Toll Mode: 0=No toll restricts; 1=Toll/length 1; 2=Toll/length 2.

6. Page Format: 0=none; 1=DTMF using timer 1; 2=DTMF using timer 2; 3=2805; 4=2-tone; 5=5/6 tone.

P. PROGRAMMING REFERENCE

DTMF PROGRAMMING REFERENCE SHEET

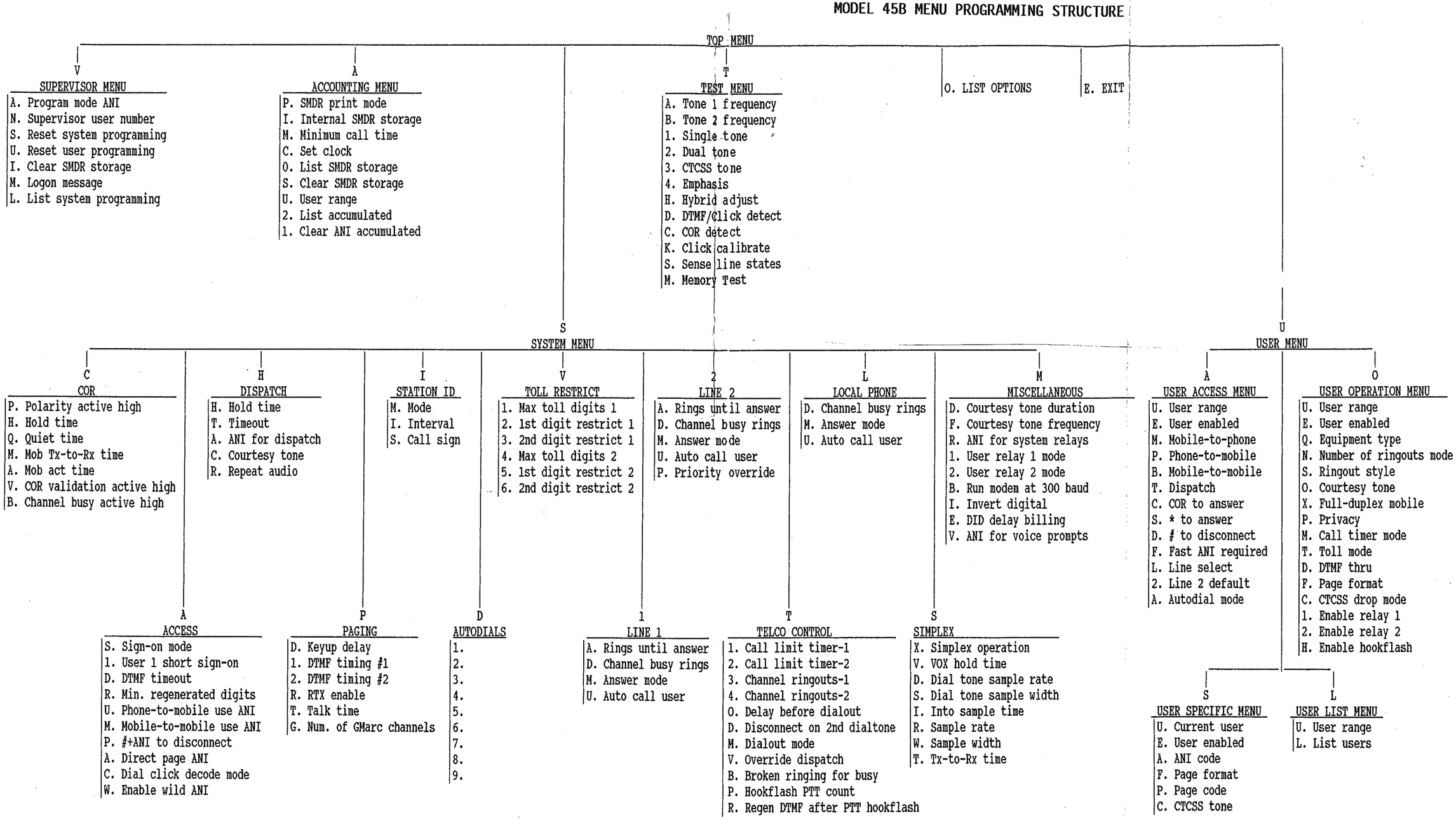
DTMF	MENU	RANGE	DESCRIPTION	
COR				
2	!SCH	0-50	COR HOLD TIME (2)	X100(MS)
3	!SCQ	0-100	COR QUIET TIME (30)	X100(MS)
18	!SCM	0-20	MOBILE TX-TO-RX TIME (2)	X100(MS)
7	!SCA	15-255	MOBILE ACTIVITY TIME (30)	(SEC)
111	!SCV	0-1	COR VALIDATION ACTIVE HIGH (1)	(0=NO,1=YES)
110	!SCB	0-1	CHANNEL BUSY ACTIVE HIGH (0)	(0=NO,1=YES)
SYSTEM ACCESS				
67	!SAS	0-2	SIGN-ON MODE(0) (0=ZETRON, 1=RCC, 2=RCC W/LEAD *)	
76	!SA1	0-1	USER 1 SHORT SIGN-ON (1)	(0=NO,1=YES)
6	!SAD	30-250	DTMF TIME-OUT (50)	X100(MS)
5	!SAR	1-15	MINIMUM REGENERATED DIGITS (7)	
36	!SAU	0-1	PHONE-TO-MOBILE USE ANI (0)	(0=NO,1=YES)
64	!SAM	0-1	MOBILE-TO-MOBILE USE ANI(0)	(0=NO,1=YES)
32	!SAP	0-1	# + ANI TO DISCONNECT (1)	(0=NO,1=YES)
169	!SAA	1-8	DIRECT PAGE ANI (A)	(DIGITS)
113	!SAC		DIAL CLICK	
91	!SAW	0-1	ENABLE WILD ANI (0)	(0=NO,1=YES)
DISPATCH				
58	!SHH	0-255	DISPATCH HOLD TIME (30)	X100(MS)
57	!SHT	1-10	DISPATCH TIME-OUT TIME (3)	(MIN)
56	!SHA	0-1	ANI FOR DISPATCH? (1)	(0=NO,1=YES)
63	!SHC	0-1	DISPATCH COURTESY TONE (1)	(0=NO,1=YES)
142	!SHR	0-1	REPEAT AUDIO (1)	(0=NO,1=YES)
PAGING				
79	!SPD	0-200	KEYUP DELAY (40)	X25(MS)
43	!SP1	2-8	DTMF TIMING #1 (3)	X25(MS)
44	!SP2	2-8	DTMF TIMING #2 (8)	X25(MS)
143	!SPR	0-1	ENABLE RTX SIGNALING	(0=NO,1=YES)
65	!SPT	5-25	TALK TIME (5)	(SEC)
100	!SPG	1-20	NUMBER OF GMARC CHANNELS (4)	
STATION I.D.				
70	!SIM	0-4	STATION I.D. MODE (0) (0=NO,1=END+TIME,2=TIMED, 3=ACTIVITY+TIME,4=END OF EACH CALL)	
69	!SII	1-99	STATION I.D. INTERVAL (15)	(MIN)
162	!SIS	1-10	STATION I.D.	(CHARS)
AUTODIALS				
153	!SD1	0-16	AUTODIAL NUMBER 1	(DIGITS)
:	!SDn	0-16	AUTODIAL NUMBERS 2-8	(DIGITS)
161	!SD9	0-16	AUTODIAL NUMBER 9	(DIGITS)

DTMF	MENU	RANGE	DESCRIPTION
TOLL RESTRICTS			
71	!SV1	1-30	MAX TOLL DIGITS SET 1 (15)
163	!SV2	1-4	TOLL RESTRICT SET 1 FIRST DIGITS (DIGITS)
164	!SV3	1-4	TOLL RESTRICT SET 1 SECOND DIGITS (DIGITS)
72	!SV4	1-30	MAX TOLL DIGITS SET 1 (15)
165	!SV5	1-4	TOLL RESTRICT SET 2 FIRST DIGITS (DIGITS)
166	!SV6	1-4	TOLL RESTRICT SET 2 SECOND DIGITS (DIGITS)
LINE 1			
9	!S1A	1-20	RINGS UNTIL ANSWER LINE 1 (1)
11	!S1D	1-25	CHANNEL BUSY RINGS LINE 1 (6)
12	!S1M	0-2	ANSWER MODE LINE 1 (0) (0=AnsRO,1=AnsAccRO, 2=NoAnsRO)
47	!S1U	1-99	AUTOCALL USER LINE 1 (1)
LINE 2			
50	!S2A	1-20	RINGS UNTIL ANSWER LINE 2 (1)
51	!S2D	1-25	CHANNEL BUSY RINGS LINE 2 (6)
52	!S2M	0-2	ANSWER MODE LINE 2 (0) (0=AnsRO,1=AnsAccRO, 2=NoAnsRO)
48	!S2U	1-99	AUTOCALL USER LINE 2 (1)
74	!S2P	0-1	LINE 2 PRIORITY OVERRIDE (0) (0=NO,1=YES)
LOCAL PHONE			
87	!SLD	1-25	CHANNEL BUSY RINGS LOCAL PHONE (6)
37	!SLM	0-1	ANSWER MODE LOCAL PHONE (1) (0=AnsRO,1=AnsAccRO)
49	!SLU	1-99	AUTOCALL USER LOCAL PHONE (1)
TELCO CONTROL			
8	!ST1	1-60	CALL LIMIT TIMER - 1 (3) (MIN)
17	!ST2	1-60	CALL LIMIT TIMER - 2 (15) (MIN)
10	!ST3	1-25	CHANNEL RING-OUTS - 1 (5)
42	!ST4	1-25	CHANNEL RING-OUTS - 2 (5)
4	!STO	5-100	DELAY BEFORE DIAL OUT (20) X100(MS)
77	!STD	0-1	DISCONNECT ON SECOND DIAL TONE (1) (0=NO,1=YES)
26	!STM	0-3	DIALOUT MODE (0) (0=sDTMF,1=fDTMF,3=sPULSE, 4=fPULSE)
75	!STV	0-1	OVERRIDE DISPATCH (0) (0=NO,1=YES)
145	!STP	0-9	HOOKFLASH PTT COUNT (0)
146	!STR	0-1	REGENERATE DTMF AFTER PTT HOOKFLASH (0=NO,1=YES)
SIMPLEX			
16	!SSX	0-1	SIMPLEX (0) (0=NO,1=YES)
20	!SSV	0-50	VOX HOLD TIME (7) X100(MS)
21	!SSD	10-50	DIAL TONE SAMPLE RATE (10) X100(MS)
22	!SSS	1-250	DIAL TONE SAMPLE WIDTH (1) X10(MS)
23	!SSI	10-255	INTO SAMPLE MODE TIME (50) X100(MS)
24	!SSR	10-50	SAMPLE RATE (20) X100(MS)
25	!SSW	1-10	SAMPLE WIDTH (2) X10(MS)
19	!SST	1-250	TX-TO-RX TIME (3) X10(MS)

DTMF	MENU	RANGE	DESCRIPTION	
MISCELLANEOUS				
101	!SMD	1-10	COURTESY TONE DURATION (3)	X25(MS)
15	!SMF	35-250	COURTESY TONE FREQUENCY (54)	X10(HZ)
170	!SMR	1-8	ANI FOR SYSTEM RELAYS (*1)	(CHARS)
27	!SM1	0-4	USER RELAY 1 MODE (0)	
28	!SM2	0-4	USER RELAY 2 MODE (0)	
38	!SMB	0-1	RUN MODEM AT 300 BAUD (0)	(0=NO,1=YES)
120	!SMI	0-1	INVERT DIGITAL (0)	(0=NO,1=YES)
141	!SME	0-1	DID DELAYED BILLING (0)	(0=NO,1=YES)
171	!SMV	1-8	ANI FOR VOICE PROMPTS (*3)	(CHARS)
USER SPECIFIC				
30	!USU	1-99	USER NUMBER	
82	!USE	0-1	USER ENABLE (0)	(0=NO,1=YES)
150	!USA	1-8	USER ANI STRING	(LENGTH = 1 to 8 DIGITS)
41	!USF	0-6	PAGE FORMAT (0) (0=NONE, 1=ADTMF, 2=BDTMF, 3=2805, 4=2T, 5=5/6T, 6=GMARC)	
151	!USP	VAR	USER PAGING CODE	
53	!USC	0-143	USER TONE/CODE	
USER ACCESS				
59	!UAM	0-1	USER MOBILE-TO-PHONE (1)	(0=NO,1=YES)
60	!UAP	0-1	USER PHONE-TO-MOBILE (1)	(0=NO,1=YES)
61	!UAB	0-1	USER MOBILE-TO-MOBILE (1)	(0=NO,1=YES)
62	!UAT	0-1	USER DISPATCH (1)	(0=NO,1=YES)
55	!UAC	0-1	COR TO ANSWER (0)	(0=NO,1=YES)
33	!UAS	0-1	USER * TO ANSWER (1)	(0=NO,1=YES)
34	!UAD	0-1	USER # TO DISCONNECT (1)	(0=NO,1=YES)
35	!UAF	0-1	USER FAST ANI REQUIRED (0)	(0=NO,1=YES)
13	!UAL	0-1	USER LINE SELECT (1)	(0=NO,1=YES)
80	!UA2	0-1	USER LINE 2 DEFAULT (0)	(0=NO,1=YES)
68	!UAA	0-1	USER AUTO DIAL MODE (0) (0=NO,1-9=ONLY,14=ALL+, 15=ALL)	
USER OPERATION				
66	!UOQ	0-4	USER EQUIPMENT TYPE (0) (0=MOB,1=T/B,2=T+V,3=TO, 4=DIRECT)	
39	!UON	1-2	USER CHANNEL RINGOUTS	
40	!UOS	0-7	USER RINGOUT STYLE	
14	!UOO	0-1	USER COURTESY TONE (1)	(0=NO,1=YES)
81	!UOX	0-1	USER FULL DUPLEX MOBILE (0)	(0=NO,1=YES)
31	!UOP	0-1	USER PRIVACY (0)	(0=NO,1=YES)
46	!UOM	0-2	USER CALL TIMER MODE (1)	
73	!UOT	0-2	USER TOLL MODE (0)	
45	!UOD	0-1	USER DTMF THRU (0)	(0=NO,1=YES)
54	!UOC	0-2	CTCSS DROP AFTER PAGE (0) (0=ALWAYS,1=AFTER PAGE, 2=AFTER MOB. ANS.)	
29	!UO1	0-1	USER ENABLE RELAY 1 (0)	(0=NO,1=YES)
107	!UO2	0-1	USER ENABLE RELAY 2 (0)	(0=NO,1=YES)
144	!UOH	0-1	ENABLE HOOKFLASH	(0=NO,1=YES)

DTMF	MENU	RANGE	DESCRIPTION	
SUPERVISOR				
167	!VA	1-7	PROGRAM MODE ACCESS CODE	(DIGITS)
83	!VN	0-99(325)	SUPERVISOR USER NUMBER	
94	!VS	(N/A)	RESET SYSTEM PROGRAMMING (NOT DTMF PROGRAMMABLE)	
95	!VU	(N/A)	RESET USER PROGRAMMING (NOT DTMF PROGRAMMABLE)	
TEST				
102	!TA	20-250	TONE #1 FREQUENCY	X10(HZ)
103	!TB	20-250	TONE #2 FREQUENCY	X10(HZ)
98	!T1	0-2	SINGLE TONE TEST (0)	(0=OFF,1=TELCO ON,2=TX ON)
104	!T2	0-2	DUAL TONE TEST (0)	(0=OFF,1=TELCO ON,2=TX ON)
115	!T3	0-143	CTCSS TONE OUT (0)	(0=TONE OFF,)
105	!T4	0-1	EMPHASIS TEST (0)	(0=NO,1=YES)
106	!TH	0-1	HYBRID ADJUST (0)	(0=NO,1=YES)
ACCOUNTING				
88	!AP	0-2	SMDR OUTPUT TO PRINTER (1)	(0=NO,1=YES)
89	!AI	0-1	INTERNAL SMDR STORAGE (1)	(0=NO,1=YES)
90	!AM	0-180	MINIMUM CALL TIME (1)	(SEC)
168	!AC	1-12	SET CLOCK/CALENDAR	(DIGITS)
NONMENU ITEMS				
78	!	0-4	SET BAUD RATE FOR RS-232 PORT (3)	(0=300, 1=1200, 2=2400,3=4800,4=600)
131	!	0-1	DISABLE/ENABLE DTMF DIGIT BLAP (1)	(0=OFF, 1=ON)
0*0#	EXIT PROGRAMMING			

MODEL 45B MENU PROGRAMMING STRUCTURE



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MODEL 45B CUSTOMER OPTION SHEET

Model Number:_____

Software Revision:_____

Zetron Order Number:_____

Serial Number:_____

Options installed have [x]

[ ] Repeat	[ ] GEMARCV
[ ] Modem	[ ] 2805
[ ] SMDR-Print	[ ] 2-Tone
[ ] SMDR-Internal	[ ] 5-Tone
[ ] DTMF Paging	[ ] 325 User
[ ] CTCSS Paging	

Please note that the DID Interface is a hardware option and will not appear in the list of options.

If you have service problems or need information about your Zetron unit, call Zetron at (425) 820-6363 between 7:30 a.m. and 5:00 p.m. Pacific time and ask for customer service.

When calling for service, please have this sheet and the unit manual available.

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

FAX TO: (425) 820-7031

MAIL TO: B&I Marketing
Zetron, Inc.
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):_____

_____

_____

_____

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

_____

_____

_____

_____

FAX TO: (425) 820-7031

MAIL TO: B&I Marketing
Zetron, Inc.
P.O. Box 97004
Redmond, WA 98073-9704

OPTIONAL

Name/Title:_____

Company:_____

Address:_____

City:_____

State/Zip:_____

Phone/FAX:_____

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.