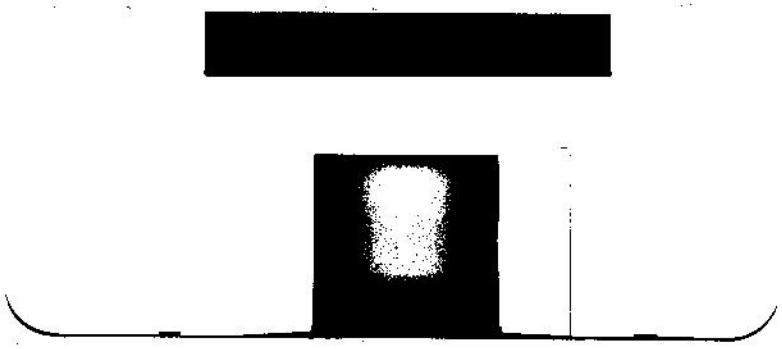
ZETRON



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MODEL 48B REPEATER MANAGER INSTRUCTION MANUAL

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Z E T R O N

MODEL 48B REPEATER MANAGER
INSTALLATION MANUAL

#025-9090K

This manual is for Model 48B with hardware revision B.

WARRANTY STATEMENT

Zetron warrants that all equipment sold pursuant to any resultant agreement shall be free from defects in material and workmanship at the time of delivery. Such warranty shall extend from the time of delivery for One Year. Buyer must provide written notice to Zetron within this prescribed warranty period of any defect; if the defect is not the result of improper usage, service, maintenance, or installation and equipment has not been otherwise damaged or modified after delivery, Zetron shall either replace or repair the defective part or parts of equipment or replace the equipment or refund the purchase price at Zetron's option after return of such equipment by buyer to Zetron. Shipment to Zetron's facility shall be borne on account of buyer.

1. Consequential Damages: Zetron shall not be liable for any incidental or consequential damages incurred as a result of any defect in any equipment sold hereunder and Zetron's liability is specifically limited to its obligation described herein to repair or replace a defective part or parts covered by this warranty.

2. Exclusive Warranty: The warranty set forth herein is the only warranty, oral or written made by Zetron and is in lieu of and replaces all other warranties, expressed or implied, including the warranty of merchantibility and the warranty of fitness for particular purpose.

FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

The following criteria MUST BE MET to comply with FCC rules:
(For 702-9183 Revision A and later.)

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 equipment complies with the requirements in Part 15 FCC rules for a "Class A" computing device. Operation of this device in a residential ("Class B") area MAY CAUSE UNACCEPTABLE INTERFERENCE to radio and television reception.

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

4. 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.

5. 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 .

TRADEMARKS

Hayes is a registered trademark of Hayes Microcomputer Products, Inc.

Touch-Tone is a registered trademark of AT&T.

1. INTRODUCTION

GENERAL

The Model 48 Repeater Manager (Figure 1) is a microprocessor-based, general-purpose repeater tone panel with mobile radio-to-telephone interconnect. It is designed to provide low-cost, yet flexible operation as a full-featured repeater tone panel combined with a full-featured telephone patch with selective calling and advanced airtime billing features.

As a tone panel, the Model 48 not only supports encoding and decoding of all 38 CTCSS tones along with 22 digital Codes for dispatch, it also includes airtime accumulation for all tones/codes, a Morse ID per-tone/code, and Zetron's unique hog mode timers to prevent "airtime hogs" from monopolizing the channel.

The Model 48, as well as a repeater tone panel, 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 data base can be downloaded and uploaded. Remote DTMF programming is also supported.

The compact size of the Model 48 allows inconspicuous shelf mounting or it may be installed in a standard 19-inch equipment rack with the supplied rack-adapter brackets.

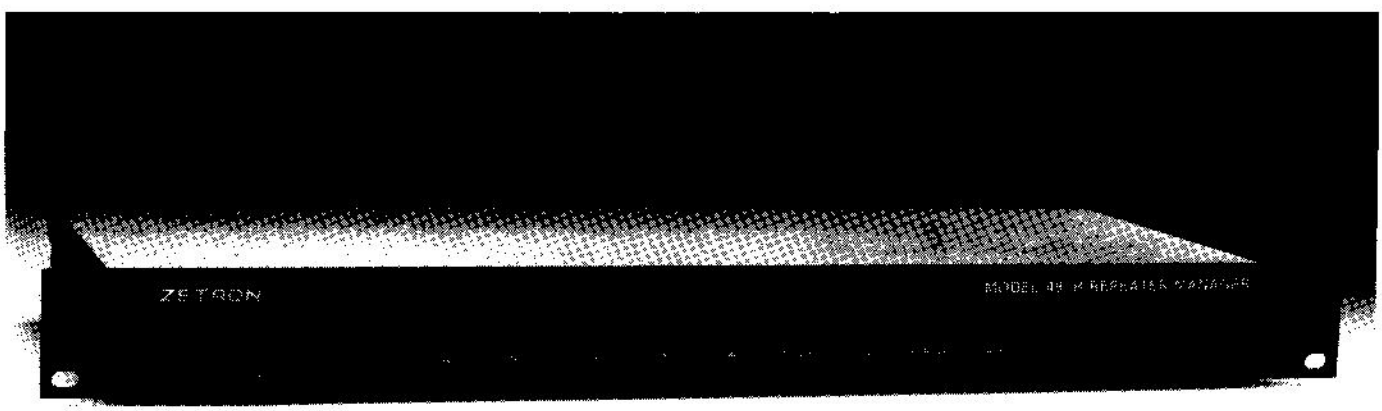


FIGURE 1: The Model 48 REPEATER MANAGER

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 sub-sections. Other information such as specifications, repair and schematic diagrams are found in sections six through eight. The appendices contain information on serial communications between the Repeater Manager and computers, such as the IBM PC, Commodore 64 and Radio Shack Model 100.

FEATURES

Repeater panel features:

* All 38 CTCSS tones standard.
* Optional Digital Squelch, 22 of 104 Digital codes.
* Cross tone/code encoding.
* Separate regenerated CTCSS/Digital output.
* Privacy mode for lockout of other tones during repeater hang time.
* High pass filtered receive audio.
* Airtime accumulation for all tones.
* Morse ID programmable per tone user.
* Stuck mic identification.
* Courtesy tone.
* Reserved tone mode.
* Airtime hog penalty mode.

Interconnect features:

* Supports full and half duplex mobile operation.
* Internal 300/1200 baud modem for remote computer or terminal programming.
* 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.
* Programmable tone/code requirement for access.
* 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, transmitter hold, number entry time-out, etc.
* Full COR 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.
* Four control relays allow control of devices from either the telephone or mobile.
* All tones (DTMF, etc.) are regenerated for error-free coding.
* 110/220 VAC at 50/60 Hz or 12-15 VDC 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.

* Optional real-time clock for detailed airtime billing.
* Optional DID interface.
* Optional dial click detector.
* Optional Digital Squelch, 104 Digital codes.
* Optional ZCU software package for uploading and downloading of the system and user database

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 DISPATCH	38 CTCSS Tones. Optional 22 of 104 Digital Squelch codes--60 total.
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.
Tone/Code Requirement	Per user requirement of CTCSS tone to validate user. In addition to ANI. Optional 104 Digital Squelch codes.
DECODER SPECIFICATIONS	
Freq range	67 to 250.3 Hz
Number of tones	38 EIA tones
Number of digital codes	22 for dispatch/104 for ANI users
Bandwidth	1.5%
Hold time	0.1 to 3.0 sec adjustable
Tone acquisition time	120 msec
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. ←
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	Half-duplex and full-duplex, per user.
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.

3. OPERATION

TONE PANEL OPERATION

The Model 48 supports all 38 standard CTCSS tones, and optionally includes 22 out of 104 commonly used Digital Squelch (DPL) codes. When a valid tone or code is detected, the unit will regenerate the tone/code (if enabled) out the transmitter, and perform the necessary audio processing between the receiver and transmitter.

System programmable features include carrier and tone hold ("hang") times, repeater hold time and time-out, and hog limit, idle and penalty times.

Impending repeater time-out warnings are indicated by double "beeps" occurring 15 seconds before the transmitter drops.

If desired, "carrier-only" dispatch operation may be enabled, allowing mobiles to access the repeater simply by keying up, with no tone or code transmission requirements.

Tone Validation
Each tone may be selectively enabled or disabled, as desired. Airtime accumulation is maintained whether or not a tone is enabled, providing the system operator with co-channel loading information. Each tone or code can be assigned any other valid tone or code for output to the transmitter, allowing "cross-tone" encoding between tone and/or digital codes.

Reserved Tones
If a tone is "reserved", the transmitter will be keyed, and a fast "busy" signal will be transmitted, preventing use of the repeater, whenever the tone is detected.

Tone in Tail
If enabled, the output tone/code is "held", or continued during the transmitter hold time, even though a mobile has unkeyed. If off, tone is only output when the mobiles tone is detected (and for the CTCSS hold time). If control station phone patches are also to be used through the repeater, tone-in-tail should be turned off so that the station knows when the mobile has unkeyed.

Privacy
If enabled, the Model 48 will not allow another tone/code user to access the repeater during the repeater hold time. This prevents other mobiles from "grabbing" the repeater during momentary pauses in a conversation. If privacy is enabled, it is usually desirable to enable tone-in-tail so that other mobiles know that the channel is busy.

Courtesy Tone
If turned on, a prompt or courtesy "beep" will be transmitter whenever a mobile unkeys.

Hog Mode
The hog mode feature, if enabled, allows the system operator to control access to the repeater based upon whether a user is utilizing too much channel time, and preventing other users from completing dispatch operations. If a user has exceeded the specified conversation time limit (1-99 minutes), the Model 48 will ignore the user for a programmed penalty time (10-2500 seconds). The user is warned of impending time-out by a series of "be-do's" issued 20 seconds before the time-out occurs. To avoid the penalty time, the mobile must unkey for an idle duration (1-25 seconds), or must allow another user to use the repeater.

Morse ID
Each tone or code may be assigned an eight-character Morse code ID, that will be automatically sent when a mobile keys up after a specified amount of time has expired. The ID is transmitted at a low deviation, so that voice communications can occur while the ID occurs. If an ID is not specified for a tone/code, an ID will not be sent.

INTERCONNECT (ANI) OPERATION

The Model 48, in addition to tone panel operation as previously described, is designed to operate as a full-featured phone interconnect in full-duplex and/or half-duplex 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.

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 the telephone audio is muted whenever the mobile is transmitting, and if selected (per user) a privacy tone is transmitted. If the privacy tone is not selected the mobiles audio will be repeated out the transmitter.

Access to the system may be setup to require just an ANI code, an ANI code plus a tone/code, or just a single digit plus a tone/code (short sign-on).

Access to the repeater, if normal dispatch operation is disabled (all tone users are turned off), or interconnect may be done with a single digit, Short Sign-on, if the user has a receive tone or code (user specific). Access for dispatch or interconnect, can be done selectively with or without the presence of one of the 38 tones or any of the 104 digital codes if the user uses an ANI code. Note that only 22 of the 104 digital codes may be used with short sign-on.

PHONE-TO-MOBILE/PAGER ACCESS

In phone-to-mobile/pager communication, a caller accesses the Model 48 simply by dialing the Model 48's phone number or by taking the local phone off-hook. Line 1 and line 2 of the Model 48 can be programmed for one of three telephone answering modes: answer/beep/ring-out, answer/dial tone/ring-out and no-answer/ring-out. The local phone may only be programmed for the answer/beep/ring-out or answer/dial tone/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 Model 48 answers the call with a 400-msec beep 750 msec after a programmed number of rings (rings-until-answer). If the caller does not enter a code and the auto-call user number is set to '0' then, 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. Alternately, 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 48 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/dial tone/ring-out mode, the operation is identical to answer/beep/ring-out except that the Model 48 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, if valid, 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 dose 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/dial tone/ring-out.

There are four modes of decode from the phone line. In all modes the Model 48 will decode DTMF, during or after dial 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 after the dial tone drops is extended to 15 seconds.

To using dial click decode, modes 1 or 2, the dial click board must be installed (#702-9119). The Model 48 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 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 tone/code.

After entering a valid user number (or ANI) in both the answer/beep/ring-out and answer/dial tone/ring-out 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 disconnected after channel ring-outs or channel busy rings occur, whichever is greater.

If the channel is busy the caller will hear broken rings until channel busy rings minus rings to answer, 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. Note: If COR or the Channel busy input are active the channel will be considered busy by the Model 48.

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 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 a user has a receive tone specified then that tone must be detected for an answer to occur. 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.

Phone-to-Mobile/Pager Paging Access

If the Model 48 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 48 for dial-access paging is identical to that for phone-to-mobile communication. The Model 48 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 talktime (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.

MOBILE-TO-PHONE ACCESS

A user is programmed to sign-on to the Model 48 using one of four formats: Zetron style, RCC style 1 or RCC style 2, or short sign-on. 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 finish or until the mobile answers. Each user may be setup 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).
"1" = Mobile-to-mobile access (if allowed).
"2" = Access alternate phone line (if allowed).

After entering 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).

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. This is why the Model 48 checks for "ANI conflicts". If an ANI conflict exists, the user will be prompted to enter another ANI code.

If a receive tone or digital code is specified for an ANI user, the tone/code must first be detected to validate the user. Note that all 104 Digital codes may be used for ANI users.

Short Sign-On
If desired mobiles can access the unit using the Zetron style steering digits (*, 0, 1, 2) alone with a CTCSS tone or Digital code, Short sign-on. When using a single digit to sign-on, the mobile must encode a CTCSS tone or a Digital code for an ANI user number that has been programmed for short sign-on (Rx tone/code and ANI), and encode the DTMF sign-on digit for at least 0.8 seconds with no digits following for 1.5 seconds. The same steering digits are used regardless of the sign-on mode chosen. To make Short sign-on work with a digital code, the Digital code must be entered as one of the 22 dispatch codes, although it need not be enabled. Up to 60 users (38 tone and 22 digital) can be programmed for short sign-on. See the user specific menu for more information.

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 either, slow or fast, in either DTMF or dial pulse. If the DTMF from the mobile is entered before the 'delay before dial-out' timer expires, the digits will be buffered and dialed out after the timer expires. If DTMF dialing is selected, the regenerated digits will "follow" the mobile's transmitted digit duration after the 'delay before dial-out' expires or if the mobile unkeys and listens for dial tone.

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 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 and the mobile unkeys.

If the mobile is designated as full-duplex, regeneration ceases upon condition 1) or 2); (unkeying is not required, but if done, regeneration will cease).

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.

Alternately, 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: the 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 "#" (0.125 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 setup 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 fast ANI is required then the DTMF will have to be received at 5 digits/sec or faster.

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. If enabled, a 2nd dial tone (due to the telephone party hanging up) will also terminate the call.

In all cases, when a call is terminated, the unit will transmit five beeps or "bee-doos" in a row to indicate disconnect.

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. The dial tone lasts 4 seconds and the transmitter will stay keyed for the DTMF time-out. The mobile must enter the user number of the mobile to be called (or ANI if selected) before the DTMF timeout. The unit will drop the dial tone upon receipt of the first digit. 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 issue the users tone/code, if programmed, wait the keyup delay time and then begin ring-out, if the mobile does not unkey the Model 48 will error off the call after 5 seconds. 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. When 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, 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), and the unit drops into repeat; If a tone-only pager is called, the operation is completed immediately after the page is issued, and the transmitter is dropped.

If the calling mobiles tone/code drop mode is not '0' then the Model 48 will not transmit a tone/code when the mobile gets dial tone.

ANI REPEATER OPERATION

In addition to the standard tone panel operation, the Model 48 can be set up to require an access code (ANI-for-Repeat) to gain access to the repeater, with or without a tone/code. Note that this is usually only for mobiles without tone encoders, or for tones that are not enabled for normal dispatch operation.

ANI-for-repeater operation is ended if the repeater time-out timer expires, the 25-second hold timer expires, or 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 will issue five beeps to indicate repeater drop. If either the call limit or repeater time-out timers expire, the error tone will be issued. Once the repeater drops, ANI sign-on is again required to rekey the transmitter.

If a mobile wishes to send live DTMF over the air, the mobile must wait for the DTMF time-out, after access, without sending any DTMF. After the DTMF time-out the Model 48 allows DTMF to pass from the receiver to the transmitter. The Model 48 mutes any DTMF audio for the DTMF time-out after COR becomes valid. 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 not used.

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. 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 48 for external control: 2 for system level controls, relays 1 & 2 (J6 Pin 8 and J2 Pin 2) and 2 for user level controls, relays 3 & 4 (J2 Pin 4 and J2 Pin 6). The other contact is connected to ground. 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 48 has ten front panel indicator LEDs (Figure 1). Eight of the indicators have an associated number as well as description. 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 decoded.
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 48 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 48 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 Repeater Manager. The Model 48 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 48 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 done even without power applied. Once the unit is programmed and operating the database may be downloaded to your PC. 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. Caution: When uploading a database the accumulated air time for the users is also uploaded, since this data is all stored together in the user database.

The Model 48 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 48. One connection method is directly through the Model 48's serial port. This method is simple and quick, but it requires that the CRT and Model 48 be within 100 feet of each other. Since this is not always possible, the Model 48's programming features may be accessed over the phone line and through its internal 300/1200 baud modem. **The Model 48's serial port is not a standard "AT Style" nine-pin configuration. See the Application Note in Section 7 to make up an appropriate cable.**

Null modem cable

ACCESSING PROGRAMMING MODE USING DIRECT CONNECT

Before attempting to program the Model 48 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 48's serial port and configured with the proper communication protocol (4800 baud, 8 data bits, 1 stop bit, no parity), Model 48 programming may begin. Press reset on the Model 48. A 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 48 sign-on message and Top Menu selections (Figure 2). If the Repeater Manager does not respond, it may be processing a call or page. The Model 48 must be idle before direct connect programming may begin. Instructions on actual programming are continued in "CRT Programming Menus and Commands" in later in this section . When programming is finished, be sure to EXIT PROGRAMMING or the Model 48 will not detect subsequent call activity until the programming mode activity timer expires (1 min.).

300/1200-BAUD MODEM

The 300/1200-Baud modem that comes with the unit allows remote programming of the system and user programming remotely on the same phone line that is used for interconnect. The modem is factory defaulted to operate at 1200 baud and may be changed in the 'system misc.' menu or may be changed via DTMF programming.

ACCESSING PROGRAMMING MODE VIA MODEM

The Model 48's programming may be accessed without any additional connections by using a standard phone line to the device, coupled with the unit's internal modem. This method is slightly more involved than the direct connect method because the Model 48 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 48. 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 48 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 48 will issue modem tone, if the Model 48 detects modem carrier signal and a RETURN is entered from the keyboard it will display the "Top Menu" (Figure 2). The unit will issue modem carrier for 20 seconds, after which it will go into DTMF programming (see "Programming via DTMF"). Note that answer mode 2 does not answer the line and allow you to overdial, so programming access is not possible unless you disable the auto-call user.

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 a quick "ttt" followed by "ATH" RETURN hangs up the phone. Detection of dial tone, loss of carrier or detection of a break will cause the Model 48 to hang up the phone. Consult your modem manual for further modem command information.

```
Model 48   Ver:5.00
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 2: Model 48 sign-on and "Top Menu" for programming

CRT PROGRAMMING MENUS AND COMMANDS

The Model 48'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. The operator may also access a help menu that gives a short programming summary. 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. This ensures subsequent calls will be processed. Since supervisor information is the simplest, it will be discussed first, followed by system and user programming. Before programming is discussed, a few general words about menus 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. If a menu item is not displayed then the option is not installed in the unit.

PROGRAMMING SUPERVISOR INFORMATION

Pressing "V" followed by the RETURN key from the Top Menu, displays eight supervisor variables (Figure 3). Select one of the variables to be changed. For example to change the program mode ANI to 787123, press A, type 787123 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 48 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 Log on 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
 D. Reset dispatch programming = No
 U. Reset ANI user programming = No
*I. Clear SMDR storage = No
 M. Log on message =
 L. List system programming = No

Please select:
```

FIGURE 3: Supervisor programming

PROGRAM MODE ANI--the code is used to gain access to DTMF programming from a mobile, or modem and DTMF 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 for that user.

*does not apply to software version 6.3 and later

RESET DISPATCH PROGRAMMING--If a "Y" is entered, the units dispatch user programming is reset to factory defaults. Caution: When the dispatch user programming is reset, the accumulated airtime for dispatch users is also cleared. The accumulated airtime can also be cleared in the accounting menu; clear tone/code dispatch accumulated.

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

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

LOG ON MESSAGE--The message entered hear will appear in the log on 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. If your terminal program allows you to capture the screen to a file you can save the system programming in a file on disk and print it.

PROGRAMMING SYSTEM INFORMATION

Pressing "S" followed by RETURN from the top menu, display's the System Menu (Figure 4). From this menu, 12 system-related programming options are available, discussed below.

```
SYSTEM MENU

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

Please select:
```

FIGURE 4: System Programming Menu

*does not apply to software version 6.3 and later

COR Programming
Pressing "C" followed by RETURN from the System Programming Menu will display seven variables which affect COR operation (Figure 5) described in detail below.

```
COR MENU

 Q. Quiet time (*100 msec) = 30
*M. Mob Tx-to-Rx time (*100 msec) = 2
 A. Mob act time (*sec) = 30
 B. Channel busy active high = No

 Please select:
```

FIGURE 5: COR programming information

QUIET TIME--the quiet time is the amount of time the radio channel must remain quiet (no COR) before the Model 48 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.

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.

CHANNEL BUSY--the unit is also provided with an auxiliary channel busy input (SENSE 2) for use with a monitor receiver. When this input is active the COR LED will flash. 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). Alternately, a "Y" indicates active high channel busy on the input. Note that the channel busy input is pulled high internal to the Model 48. So if the channel busy input is not being used set it to active low and leave the input open. Caution: If this input is active, the COR LED is flashing, access from a mobile will be impossible.

*does not apply to software version 6.3 and later

Access Programming
Pressing "A" followed by RETURN from the System Programming Menu will display ten access oriented variables (Figure 6), discussed below.

```
ACCESS MENU

S. Sign-on mode = 0
D. DTMF time-out (*100 msec) = 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
C. Dial click decode mode = 0




Please select:
```

FIGURE 6: 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

DTMF TIMEOUT--this is the maximum amount of time the Repeater Manager will wait 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. If COR drops for 2 seconds or longer between sign-on digits, sign-on will have to be restarted.

MINIMUM REGENERATED DIGITS--this is the minimum number of digits the Model 48 accepts from a dialing mobile before deciding that dial-in is complete, if the mobile unkeys. 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 timeout 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.

TELCO 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 user number before ring-outs are issued.

#+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 their 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.

DIAL CLICK DECODE MODE--Dial click may be enabled by 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 48 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 3 is for use with an external dial click decoder. When mode 3 is used the normal dial click functions of the Model 48 will be disabled and the pause before disconnect or auto call is extended to 15 seconds. When mode '0' is selected the nonvolatile memory is initialized to the timing of a standard phone. CAUTION: YOU MUST HAVE THE DIAL CLICK BOARD INSTALLED BEFORE DIAL CLICK OPERATION WILL OCCUR.

Dispatch Programming
Pressing "H" followed by RETURN from the System Programming Menu will display twelve dispatch oriented variables (Figure 7), discussed below.

```
DISPATCH MENU

 H. Repeater hold time (*100 msec) = 30
 S. CTCSS hold time (*100 msec) = 8
 T. Timeout (*min) = 3
 I. Hog idle time (*sec) = 5
 L. Hog limit time (*min) = 5
 P. Hog penalty time (*10sec) = 30
 R. Dispatch ID rate (*min) = 15
*D. CTCSS for dispatch = Yes
 C. Courtesy tone = Yes
 M. Stuck mic ID = No
 V. Invert DCS output = No
 O. Invert DCS input = No

 Please select:
```

FIGURE 7: Dispatch programming information

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

CTCSS HOLD TIME--The amount of time that the mobile's tone must be gone before the unit will squelch the mobiles audio (with carrier present). If frequent "talk-down" occurs, the hold time should be increased.

TIMEOUT--the maximum amount of time the repeater may remain in transmit mode during normal dispatch operations. During ANI dispatch, or on a mobile-to-mobile call, the call limit timer for the originator is used.

HOG IDLE TIME--The amount of time that a user must remain inactive to reset his conversation timer (hog limit timer).

HOG LIMIT TIME--The amount of time a dispatch user can continuously use the repeater, without allowing another mobile access or without unkeying for the idle time.

HOG PENALTY TIME--If a mobile exceeds the Hog Limit time, the repeater manager will not allow that tone/code to access the repeater until the Hog Penalty time has expired.

DISPATCH ID RATE--This timer controls how often a dispatch users Morse code ID will be sent, if its tone is detected. This is not the same as the system Morse ID.

*does not apply to software version 6.3 and later

*CTCSS FOR DISPATCH--if 'yes', a mobile must encode a CTCSS tone or Digital code (that is enabled in the user dispatch menus) to gain repeater access by just keying up. If 'no', simply keying-up will key up the repeater. If 'yes', an ANI user may gain access to the repeater by entering the proper access code.

COURTESY TONE--if 'yes', a courtesy tone is issued when a mobile unkeys if CTCSS for dispatch is 'no'. If CTCSS for dispatch is 'yes', the courtesy tone setting for the tone/code user is used, as set in the user dispatch menu. If the user gains access with an ANI code the courtesy tone setting for the originating user is used in the user operation menu.

STUCK MIC ID--If yes, a 3-digit DTMF number every 15 seconds indicates the dispatch user number if a repeater timeout occurs.

INVERT DCS OUTPUT--If yes, the transmitted Digital code is inverted to compensate for inversions in the transmitter. To test for inversions see the test menu.

INVERT DCS INPUT--If yes, the receive Digital code is inverted to compensate for inversions in the transmitter. To test for inversions see the test menu.

Paging Programming

Pressing "P" followed by RETURN from the System Programming Menu will display five paging oriented variables (Figure 8). Each variable is discussed in detail below.

```
PAGING MENU

  D. Key-up delay (*25 msec) = 40
  1. DTMF timing #1 (*25 msec) = 3
  2. DTMF timing #2 (*25 msec) = 8
**R. RTX enable = No
  T. Talk time (*sec) = 5
  V. VOX hold time (*100 msec) = 7

  Please select:
```

FIGURE 8: Paging information programming

KEY-UP 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. This time is also used on mobile to mobile paging, between tone/code transmission and paging tones. This time delay does not affect the key-up to ringing, if the user being called does not have paging tones.

*does not apply to software version 6.3 and later
**applies only to software version 6.3 and later

DTMF TIMING--two variables for setting the timing of DTMF digits for DTMF paging. One of these 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 48 will send the DTMF digit 'D' for 2.5 seconds before sending the actual DTMF page. The hang up beeps are also replaced with the DTMF digit 'A' for 2.5 seconds. This question only appears if the DTMF option has been ordered.

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, the talk time is prematurely terminated and the call is ended.

VOX HOLD TIME--this time is only used during tone and voice paging to determine that the telephone party is no longer talking. If the VOX goes quiet for 2 times the VOX hold time, the voice page will be terminated.

Station ID Programming

Pressing "I" followed by RETURN from the System Programming Menu will display three station ID oriented variables (Figure 9), discussed below. The station ID frequency is fixed at 1200 Hz. These settings do not affect the user Morse ID.

```
STATION ID MENU

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

Please select:
```

FIGURE 9: 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 all calls.

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.

**applies only to software version 6.3 and later

Auto-Dials Programming
Pressing "D" followed by RETURN from the System Programming Menu will display the nine auto-dial numbers (Figure 10).

```
AUTO-DIAL MENU

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

Please select:
```

FIGURE 10: 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 11). 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 11: 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 or 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 however, are never restricted, but the last number redial is toll restricted. The digits that are restricted for 1st digit are independent of the 2nd digit restrict. Therefore a 4 for 1st digit and a 1 for 2nd digit will both restrict 411 access but any number that begins with a 4 will also be restricted. When entering the digits they must be entered without any spaces or other characters between them. The digit toll restriction is done after the 3rd digit is dialed.

Telco Control Programming

Pressing "T" followed by RETURN from the System Programming Menu displays eight telco control oriented variables (Figure 12), 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
 *0. Delay before dial-out (*100 msec) = 20
  D. Disconnect on 2nd Dial Tone = Yes
  M. Dial-out mode = 0
  V. Override dispatch = No
**B. Broken ring for busy = No

  Please select:
```

FIGURE 12: 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 and will limit repeater time if a user gains access to the repeater with an ANI code. This timer does not affect normal dispatch operation.

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.

*does not apply to software version 6.3 and later
**applies only to software version 6.3 and later

*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. If DTMF dial-out is selected, then dialing will occur at the rate selected until the dialing has caught up with the mobile, then the dial-out will follow the mobiles dialing. If the mobile unkeys, and waits for dial tone, this timer is not used.

DISCONNECT ON 2ND DIAL TONE--if 'yes', the Repeater Manager will disconnect a call after 2 seconds of dial tone, once the unit has dropped out of DTMF regeneration (2nd dial tone) or 5 busy signal cycles (after dialing phone number). Note that this function is not intended to be used for toll restriction.

DIAL-OUT MODE--this variable determines how the Model 48 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)
See delay before dial-out.

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 call out to the user. This overrides the quiet timer.

**BROKEN RING FOR BUSY--if 'yes' the Model 48 will send the old broken ringing to the telco calling party when the channel is busy. If 'no', the Model 48 will send a true busy signal.

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 13), 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 13: Line 2 (1) information programming

* does not apply to software version 6.3 and later
**applies only to software version 6.3 and later

RINGS UNTIL ANSWER--this variable determines the number of rings the Model 48 must receive from a landline before it determines that a call on that line needs to be processed.

CHANNEL BUSY RINGS--this variable determines the number of rings that may occur before the Repeater Manager 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 chan nel ring-outs then the phone will hear channel busy number of rings while the channel will still only get channel ring-outs.

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

0= Answer/beep/Ring-out
Line is answered with a 400-msec beep 750 msec after Rings-Until-Answer, the Model 48 waits 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 it is clear. If the caller does not enter a number before the line times out, the Model 48 will disconnect if the auto call user number is '0', if it 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/Dial tone/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 no code or user number is 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. If the auto call user is disabled or set to '0', the answer mode will be as mode 1 above.

AUTO CALL USER--allows a user number to be the default recipient of an incoming call. If set to '0' the call will disconnect after the line times out. If set to a valid user then the auto call will occur after the line times out if the caller does not enter a number.

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.

Miscellaneous Programming
Pressing "M" followed by RETURN from the System Programming Menu will display nine miscellaneous variables (Figure 14). Each variable is discussed in detail below.

```
MISCELLANEOUS MENU

*D. Courtesy tone duration (*25 msec) = 3
 F. Courtesy tone frequency (*10 Hz) = 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
 E. DID delay billing = No

 Please select:
```

FIGURE 14: 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 1200 Hz.

*does not apply to software version 6.3 and later

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 Relay 1, and "System Relay 2" is Control Relay 2.). See operation section--Control Relays.

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.)

RUN MODEM at 300 BAUD--If set to 'yes' the modem will operate at 300 baud, if set to no the modem will operate at 1200 baud. This item may be changed while programming the unit via direct connected, modem, or DTMF.

DID DELAY BILLING--If set to 'yes' the local phone relay will pulse once when a mobile answers the call. This is used with the Model 50 DID Converter

PROGRAMMING USER INFORMATION

Pressing "U" followed by RETURN from the Top Menu will display the User Programming Menu (Figure 15). 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 and the dispatch menus work 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            T. TONE DISPATCH
D. DIGITAL DISPATCH    L. LIST

Please select:
```

FIGURE 15: User programming menu

User Numbers
The access, operation and specific menus work with the 99 (325) ANI users. The tone dispatch menu allows programming of the 38 CTCSS tone dispatch users, while the Digital dispatch menu provides programming of the 22 Digital dispatch users. Note that the 99 (325) users are independent of, and have no relationship to the 38-tone dispatch users or the 22 Digital dispatch users.

User Tone Dispatch
Entering a "T" from the User Programming Menu will display the User Tone Dispatch menu (Figure 16). The current user is displayed in parentheses after the menu name, and any changes made will only change that users parameters. If a comma is entered while in the tone dispatch menu, the current user number will be incremented by one. If a comma is entered after data (rather than a return), the data will be stored, and the same menu item will be displayed but for the next user. Caution: When using digital decode with CTCSS, the digital squelch tail elimination sequence sent by a mobile is approximately 134 Hz. This is in between the CTCSS frequencies 131.8 and 136.8, so it is not a good idea to use these two tones (users 20 and 21).

```
USERS TONE DISPATCH MENU (1)

U. Current user = 1
E. Enabled = Yes
R. Reserved = No
X. Tx tone/code = 1
T. Tone in tail = Yes
V. Privacy = No
O. Courtesy tone = Yes
H. Hog mode = No
M. Morse ID (chrs) =

Please select:
```

FIGURE 16: User tone dispatch menu

The user number in the tone dispatch menu corresponds to a subaudible receive tone number (1-38). For example, if user 2 is enabled, subaudible tone 2 (71.9 Hz) is enabled for tone dispatch operation on the repeater. Note that the 38 tone users are independent of the 99 (325) ANI users. See the appendix for the cross reference from/to numbers to tone frequencies.

Current User--The number entered selects the user number (receive tone number) to be displayed and programmed in the menu.

Enabled--If yes, corresponding receive tone no. enables for dispatch.

Reserved--If yes, whenever the corresponding tone is received by the unit, a fast busy will be issued out the transmitter to prevent use of the channel. Note that the tone does not need to be "ENABLED".

TX tone/code--Specifies the output tone/code that is to be transmitted when the corresponding receive tone is detected. See the appendix for cross reference, tone to frequency, and digital code to digital number.

Tone in tail--If yes, the output tone/code will continue to be sent for the duration of the repeater hold time (assuming another mobile doesn't key up, see privacy below), after the mobile unkeys.

Privacy--If yes, another tone/code cannot gain access to the repeater until the transmitter has been allowed to drop. Normally, tone in tail should be enabled if privacy is enabled, so that other mobiles know that the channel is busy. Caution: When using Digital Squelch if the mobile encodes the off code, which will false user 20 or 21, the output tone may switch to user 20 or 21 if privacy is turned off and user 20 or 21 is enabled.

Courtesy tone--If yes, a courtesy tone is issued whenever the mobile unkeys. If CTCSS for dispatch is set to no, COR dispatch, then the system courtesy tone enables or disables the courtesy tone.

Hog mode--If yes, a mobile is subject to the Hog Mode timers entered in the System Repeater Menu.

Morse ID (chrs)--Enter the ID for the user (up to 10 characters). To clear an entry, enter a space, followed by a return. Note the ID rate is set in the System Dispatch Menu (Dispatch ID Rate) and it is not the same as the Station ID.

User Digital Dispatch

The Digital Dispatch menu is selected by entering a "D" from the user programming menu. The menu in Figure 17 is almost identical to the Tone dispatch menu except for the additional item for Input Code. Caution: When using Digital Squelch, the off code is in between tone users 20 and 21.

```
USERS DIGITAL DISPATCH MENU (1)

U. Current user = 1
E. Enabled = Yes
R. Reserved = No
C. RX code = 1
X. TX tone/code = 1
T. Tone in tail = Yes
V. Privacy = No
O. Courtesy tone = Yes
H. Hog mode = No
M. Morse ID (chrs) =

Please select:
```

FIGURE 17: User digital dispatch menu

The user number entered and displayed corresponds to one of the 22 Digital users that may be programmed in the unit. Note that these 22 users are in addition to the 38 tone users and the 99 (325) ANI users. The input code specified (1-104, see appendix for cross reference) is the receive Digital Code for the user. All other parameters are programmed as in the tone dispatch menu. Note: The leading 'D' is not required when entering an Input Code but is required when entering an output code.

User Access Programming
Pressing "A" followed by RETURN from the User Programming Menu will display the User (ANI) Access Menu (Figure 18). In both "common" menus, the ANI 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
H. 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. Auto-dial mode = 0

Please select:
```

FIGURE 18: User access menu

USER RANGE--this variable defines a single user or range of users to be effected 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. If the return is entered without entering any data, no changes are made and the next menu item will be displayed. Note that typing a comma will increment the current user number (c).

USER ENABLED--if 'yes', this user may access the Model 48 or receive calls through the Model 48 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 land line.

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

DISPATCH--if 'yes', this user may access the repeater with an ANI Code. Note that this is usually only done for mobiles without tone encoders, or when a level of security is desired for gaining access to the repeater, a tone/code is disabled in the user dispatch menu.

COR to ANSWER--if 'yes', an incoming call to this user will be answered by a mobile keying up, a valid COR signal, and the correct tone/code (if a receive tone/code is programmed in the user specific menu) being decoded by the Model 48, this answer mode overrides "*" to Answer.

* to ANSWER--if 'yes', the user may answer incoming calls by simply pressing a long DTMF "*", along with encoding the correct tone/code (if a receive tone/code is programmed in the user specific menu). 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 and be encoding the correct tone/code if required. 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 125 msec DTMF "#", along with encoding the correct tone/code (if a receive tone/code is programmed in the user specific menu). If 'no', the user must enter their ANI code and be encoding the correct tone/code if required, 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', the user may determine which phone line to use for outgoing calls. If 'no', all outgoing calls are made on the user's default line (see below). Line selection is controlled by the 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 re-dial. 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 = Auto-dial access and last number redial is not allowed.
1-9= Forced automatic dialing of the indicated auto-dial number upon mobile access (normal dialing not allowed).
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 (ANI) 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. Tone/code drop mode = 0
1. Enable relay 1 = No
2. Enable relay 2 = 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.

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 the user gains access to the repeater with an ANI code, 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). This question does not affect normal dispatch operation.

FULL-DUPLEX MOBILE--if 'yes' this user operates as a full-duplex mobile. The COR signal is not used to mute the phone to mobile audio, therefore privacy tones and the mobile tx-to-rx timer will not apply. If the mobile does unkey, if enabled, courtesy tones will be issued. The phone AGC is also turned off. 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, but the repeat audio is not muted.

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. If the user is setup as half-duplex, then the mobiles audio is repeated, unless privacy is on.

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 48 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.	3 = 2805 paging (not available in software versions after V6.5).
1 = DTMF paging timing 1.	4 = Two-tone paging.
2 = DTMF paging timing 2.	5 = Five/six-tone paging.

TONE/CODE DROP MODE--if '0', the sub-audible tone (CTCSS) or digital code is not dropped on a phone to mobile call and the users tone/code is transmitted when the user originates a 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 mode '2' is selected the tone/code will not be dropped until the mobile called answers. If mode '1' or '2' is selected the subaudible tone or digital code will not be sent out when the mobile signs on to the system. On a mobile to mobile page if either mobile has a drop mode other than '0' then cross tone operation will not work. If both mobiles have a drop mode of '0' then the Model 48 will encode the tone/code of the user that is not keyed up based on the tone/code it is decoding.

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 K5 and the N/O contacts come out on J2 pins 1 & 15, user relay 2 is K7 and the N/O contacts come out on J2 pins 2 & 14.

User Specific Programming

Pressing "S" from the User Programming Menu will display the User (ANI) Specific Menu (Figure 20). The current (ANI) 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 increments by one. If a comma is entered after data, data is entered and the current user number is incremented while staying on same menu item.

```
USER SPECIFIC MENU(1)

U. Current user = 1
E. User enabled = Yes
A. ANI code (chrs) = D (S)  <- short sign on
F. Page format = 0
P. Page code (chrs) =
X. Tx tone/code = 0
R. Rx tone/code = 0

Please Select:
```

FIGURE 20: User specific menu

CURRENT USER--this variable selects the user that is effected 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 48 (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 48 detects another ANI that is the same or a sub-set, 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. If an 'S' is entered, the user is allowed to use "short sign-on" - i.e. a long (0.8 sec) single digit corresponding to the Zetron style sign-on steering digits ("*", "0", "1", "2") will validate the user. Note that a receive tone (see below) must be specified for the user, otherwise, the user will never be validated. If more that one user is enabled for short sign-on with the same receive tone, then short sign-on will always occur on the lower user number. In order for short sign-on to work with Digital codes, the users receive digital code must be one of the programmed 22 digital dispatch codes. And as with tone short sign-on, if two users have short sign-on with the same code, the lowest user number will be the one that signs on. The tone or code that is used for short sign-on does not need to be enabled in the user dispatch menus.

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--The number entered specifies the transmit subaudible (CTCSS) tone or Digital Code for the user. The CTCSS tone is selected from 1 to 38, or zero for none. A digital code is specified by entering a "D", followed by a code number (1-104). See the Appendix section for tone frequencies vs. tone numbers or Digital Code vs. Digital numbers.

RX TONE/CODE--The number entered specifies the receive subaudible (CTCSS) tone or Digital code for the user. The CTCSS tone is selected from 1 to 38, or zero for none. A digital code is specified by entering a "D", followed by a code number between 1-104 (i.e. D1). See the appendix section for tone frequencies vs. tone numbers or Digital code vs. digital numbers. Note that if a receive tone/code is not entered then the user can gain access with just an ANI code. If you wish to use Short sign-on a tone/code must be entered, see above.

USER LISTS

Pressing "L" from the User Programming Menu will display the User List Menu, shown in Figure 21. The menu allows the system operator to review parameters for ANI, Tone dispatch, and Digital dispatch users. The user range to be displayed is selected by pressing "U", followed by a the first user a space or "-" then the last user to be listed (i.e. 2-5). If only a single number is entered, only that users parameters will be listed. The largest number entered is 99 (325). The range for the tone dispatch users is 1-38 and 1-22 for the digital dispatch users. If the last user to be listed is larger than the highest number for the dispatch list the listing will stop at 38 or 22.

```
USER LIST MENU

U. User range = 1
A. List ANI users = No
T. List tone dispatch users = No
D. List digital dispatch users = No

Please Select:
```

FIGURE 21: User list menu

List ANI Users

Press U and enter the range of users to list (i.e.1-20) and press RETURN. Enter "Y" and RETURN to list the ANI 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 receive tone/code, the transmit tone/code, the paging format and finally the page code. A typical ANI user list is shown in Figure 22. 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 as 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). The pause will time-out after 30 seconds.

```
Model 48 (Station ID) 09/23/87 08:00:24
Usr      Programming          ANI      Rx   Tx   Type    Page
--- ABCDEFGHIJKLMNOPQRSTUVWX -------- ---- ---- ------ --------
  1 nYYYn1Onnn1nnnnYYYYYOOOY Short SO    1    1 *NONE*
  2 nYYYn1Onnn1nnnnYYYYYOOOY Short SO D  1 D  1 *NONE*
  3 nYYYn1Onnn1nnnnYYYYYOOOY 3          3    3 *NONE*
  4 nYYYn1Onnn1nnnnYYYYYOOOY 4        D 2 D  2 *NONE*
  5 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
  6 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
  7 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
  8 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
  9 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
 10 nnYYn1Onnn1nnnnYYYYYOOOY D          0    0 *NONE*
** End of list **
```

Figure 22: ANI 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

If a programming variable is enabled or allowed, a "Y" is printed, otherwise a "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

If short sign-on is specified for a user, the phrase "Short SO" will appear for the users ANI. If a Digital code has been selected for a users receive or transmit tone/code, a "D", followed by the code number will be shown.

List Tone Dispatch Users

A typical tone dispatch user list is shown in Figure 23. The user number (corresponding to the receive tone) is listed first, followed by seven digits (A-G), followed by the output tone/code and the users Morse ID.

```
Model 48 (Station ID) 09/23/87 08:00:24
Usr  Programming    OUT TONE     ID
------ ABCDEFG ------------------------
  1    YnYnYnn          1
  2    YnYnYnn          2
  3    nnnnYnn          3
  4    nnnnYnn          4
  5    nnnnYnn          5
  6    nnnnYnn          6
  7    nnnnYnn          7
  8    nnnnYnn          8
  9    nnnnYnn          9
 10    nnnnYnn         10
** End of list **
```

Figure 23: Tone Dispatch User List

The program summary characters are as follows:

A. Enable User	B. Reserved
C. Tone in tail	D. Privacy
E. Courtesy tone	F. Hog Mode
G. Not used.	

Note: If a Digital code is specified instead of an output tone, a "D" followed by the code number will be displayed.

List Digital Dispatch Users

A typical digital dispatch user list is shown in Figure 24. It is the same as the tone dispatch list, with the addition of the receive Digital Code column after the user number, followed by seven digits (A-G), followed by the output tone/code and the users Morse ID.

```
Model 48 (Station ID) 09/23/87 08:00:24
Usr Code  Programming     OUT TONE      ID
---------- ABCDEFG -------------------------
  1    1   YnYnYnn         D  1
  2    2   YnYnYnn         D  2
  3    0   nnnnYnn            0
  4    0   nnnnYnn            0
  5    0   nnnnYnn            0
  6    0   nnnnYnn            0
  7    0   nnnnYnn            0
  8    0   nnnnYnn            0
  9    0   nnnnYnn            0
 10    0   nnnnYnn            0
** End of list **
```

Figure 24: Digital Dispatch User List

The program summary characters are as follows:

A. Enable User	B. Reserved
C. Tone in tail	D. Privacy
E. Courtesy tone	F. Hog Mode
G. Not used.	

Note: If an output tone is specified instead of a digital code the "D" is left off and just the tone number is displayed.

PROGRAMMING ACCOUNTING INFORMATION

Pressing "A" from the top menu will display thirteen SMDR variables and the number of SMDR records stored in the unit will be displayed in parentheses (Figure 25). This menu lets you control the storage and printing of airtime billing records as well as set the date and time of the Model 48'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 ANI accumulated = No
1. Clear ANI accumulated = No
4. List tone dispatch accumulated = No
3. Clear tone dispatch accumulated = No
6. List DCS dispatch accumulated = No
5. Clear DCS dispatch accumulated = No

Please select:
```

FIGURE 25: 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, 0 and 1 for pretty print, or 2 for FP-10. See the options section for more information on the format. This option does not print any of the dispatch use, it only prints the use of the system by users that gain access by an ANI code, users 1-99 (325).

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 will go out the serial port. Enter 'Y' to store the data at the end of each call or 'N' to suppress internal storage. As with the print option, dispatch use is not stored with this option.

MINIMUM CALL TIME--this is the minimum duration a call must reach before the call is printed or stored.

SET CLOCK--use this function to set the Model 48'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. 0 and 1 for pretty print, or 2 for FP-10 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 ANI ACCUMULATED--enter a 'Y' to list the accumulated billing information for the ANI users specified with the USER RANGE command above. The maximum accumulated time is 18 hours and the maximum hit count is 999 per user.

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

LIST TONE DISPATCH ACCUMULATED--enter a 'Y' to list the accumulated airtime for the tone dispatch users in hours:minutes:seconds (99 hours max.) as specified under User Range, above. Note: Even if the tone user is disabled, time will still be accumulated. This can be used to track the use of tones on co-channel systems.

CLEAR TONE DISPATCH ACCUMULATED--enter a 'Y' to clear the tone dispatch users accumulated airtime for the users specified under User Range above.

LIST DCS DISPATCH ACCUMULATED--enter a 'Y' to list the accumulated airtime for the digital dispatch users in hours:minutes:seconds (99 hours max.) as specified under User Range, above. Note: Even if the Code is disabled, time will still be accumulated. This can be used to track the use of codes on co-channel systems.

CLEAR DCS DISPATCH ACCUMULATED--enter a 'Y' to clear the digital dispatch users accumulated airtime for the users specified under User Range above.

LISTING OPTIONS

Press O from the Top Menu to list the options installed in your Model 48.

TESTING THE UNIT

Pressing "T" followed by RETURN from the Top Menu will display the Test Menu (Figure 26). Thirteen tests are displayed.

```
TEST MENU

 A. Tone 1 frequency (*10 Hz) = 54
 B. Tone 2 frequency (*10 Hz) = 60
 1. Single tone (=Telco:1, Tx:2) = 0
 2. Dual tone (=Telco:1, Tx:2) = 0
 3. CTCSS tone/Digital code (=Tone) = 0
 4. Emphasis  = No
 H. Hybrid adjust  = No
 D. DTMF/click detect (=Telco:1, RX:2) = 0
 C. COR detect = No
 K. Click calibrate = No
*S. Sense line states = No
 T. CTCSS decode  = No
 M. Memory = No

 Please select:
```

FIGURE 26: 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 tests are not allowed when programming via modem.

CTCSS TONE/DIGITAL CODE TEST--select 3 for the CTCSS (subaudible) tone/digital code test. Enter the tone number 1-38 or D1-D104 to start the test. The tone/code is sent out the CTCSS output line (J6-13). The tone/code is generated for 10 seconds, after which the test ends. Note that Invert Digital Output will invert the code being encoded.

*does not apply to software version 6.3 and later

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. Press any key to stop test. Telephone line tests are not allowed for access via modem.

HYBRID ADJUST--select H for the hybrid test. This test only needs to be done when using full-duplex users or if there seems to be problems with the modem. 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 Y 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. Start the test. The phone caller will hear a tone. Have them start talking; the voice should be at a higher level than the tone coming out of the transmitter. Adjust the phone balance potentiometer (R98) 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 Model 48. Start the test. Have the friend dial a sequence of 0's. Adjust the click sensitivity potentiometer on the dial click board (R6) 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. Any key will cause the next sense input to be displayed. Once all four have been displayed the test is ended.

*does not apply to software version 6.3 and later

TONE/CODE DECODE--Select "T" to display the CTCSS tone or Digital code currently being received by the unit. The test will display 1-38 for tone numbers, and D1-D104 for Digital Codes. If no tone or code is being decoded, a zero will be shown. Press "Y" and a return to start the test; press any key to end the test. Note that the Invert Digital input will effect what is displayed. If the code is wrong try inverting the input decode. Caution: The Model 48 will not decode and display a digital code unless it has been entered as one of the digital dispatch users Rx codes.

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 is bad or not installed. The Model 48 may still operate if defective memory is detected but the memory should be replaced as soon as possible or unpredictable operation may occur.

SAVING THE DATABASE

Now that you have finished programming the system and user database you can download the database to your computer. 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 severe power disruption. The database in the Model 48 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 use DTMF programming for fine tuning system parameters, enabling or disabling users or changing user parameters. DTMF programming may be accomplished over-the-air from a mobile or from a DTMF telephone from line 1, line 2 or the local phone. Note also that the baud rate for the serial port 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, the current user, may be programmed at a time, rather than a range of users.

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 48 phone number. When the Repeater Manager answers the phone, enter the programming access code. The Model 48 will issue modem tone, if after 20 seconds the Model 48 does not detect modem tone an eight-note tone is sounded to verify the DTMF programming mode has been entered.

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.

DTMF programming commands are classified as system commands (Hog timer, Hold times etc.), and user commands (ANI, tone dispatch, digital dispatch etc.). User commands affect a specific user, which must first be selected via one of the three user number selection commands: 30 for ANI users, 119 for tone dispatch users or 135 for digital dispatch users. Note: Once the current user has been selected, tone or digital, the same function codes are used. To enable a digital dispatch user, select the user with function code 135, then select function code 21, just the same as if enabling a tone user to enable the user.

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 48's phone number has been dialed and the Repeater Manager 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 "163*", Auto-dial number one function code.
(hear two beeps)

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

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

Note: For all DTMF commands 160 to 181, the entry format is: command number and "*", string length and "#", followed by the string with no terminator.

4) Enabling ANI user number 99:

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

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

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

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

Note: additional changes made to ANI user parameters will change user 99 also. It is not necessary to re-enter the user number when changing several of a users parameters.

5) Enabling tone user number 2:
Enter "119*", tone user number function code.
(hear 2 beeps)
Enter "2#", tone user number.
(Select tone user 2, hear three beeps)
Enter "21*", dispatch user enable function code.
(hear two beeps)
Enter "1#", dispatch user enable function argument.
(enable tone user 2, hear three beeps)

Note: additional changes made to tone dispatch user parameters will affect user 2 also. It is not necessary to re-enter the user number when changing several parameters.

6) 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, Sense line states, and CTCSS/Digital decode.

6. OPTIONS

INTRODUCTION

This section covers the options that may be installed in the Model 48. The available options are: paging tones, digital squelch encode/decode, repeat audio, extended users and billing. The options currently installed in a Model 48 are displayed by pressing 'O' from the Top Menu in CRT programming. Installation of one or more of these options affect Model 48 operation and programming. The details of each option are discussed below.

PAGING OPTION

The Model 48 is capable of generating a variety of paging tones including two-tone, five/six-tone, 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 Repeater Manager contains a table of all commonly encountered tones used in two-tone sequential paging. The call code which the Repeater Manager 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

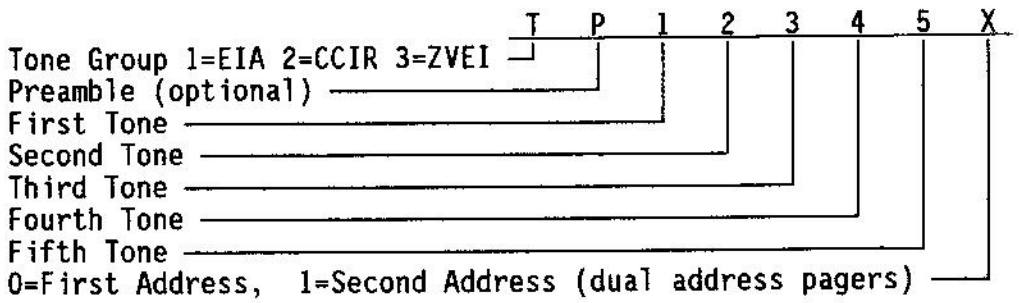
Finally, write them down in the order: T G1 G2 T1 T2. For this example the pager code is 25384.

As a final double check, the last two digits of the actual capcode on the pager should match the last two digits of the page code as entered into the Repeater Manager (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 Repeater Manager, enter the first tone and group for both tones and groups in the page code. (e.g. 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

2805 Paging Option
2805 paging is accomplished by sending a 2805-Hz tone which is modulated by one to seven digits. The format is a 800 msec front porch, followed by the digit-modulated tones at 60 msec on, 40 msec off, followed by a back porch of 4 sec.

Note: Software Version 6.5 is the last version to support this paging format.

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 0.2 sec. DTMF timer 1 and 2 are set in the paging menu and the actual timer is selected in user programming. NOTE: The digit on time and gap are the same time.

DIGITAL SQUELCH ENCODE/DECODE OPTION

The Digital squelch option allows the unit to encode all of the 104 commonly use digital codes (See Appendix A for codes supported), and to decode any 22 of the 104 for digital dispatch operation. In addition any or all of the 104 codes may be used for decode with the 99 (325) ANI users. When using short sign-on for the ANI users, the digital code must be assigned to one of the digital dispatch user numbers, but it does not need to be enabled. Only 22 ANI users can have short sign-on using a digital squelch code. Caution: Do not use CTCSS add-in mode with this option. Also if tone users 20 and 21 are used, the Digital off code may false the Model 48, as the code can look like a valid tone.

EXTENDED USER OPTION

The extended user option incorporates a larger internal memory for user database storage. User numbers are from 001 to 325. This option does not affect the number of dispatch users, it is still 38-tone and 22-digital.

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 J1 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 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. The SMDR print mode will not only affect how the data is printed, but also how it is displayed when the list SMDR storage is invoked. Modes 0 and 1 will display pretty print. Caution: The CTS input and a Control (^S) do not stop the printing of the unit.

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)

FP-10 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

Obtain pretty print by selecting SMDR print mode 1. Below are print-out examples. This is the form the unit will display, if the internal SMDR storage option is installed, when an output is requested (when print mode 0 or 1 is selected) or what will display 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 48. 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, this column contains information about the call; No Answ, is displayed if the call was not answered; if blank the call was answered; User (number), this is the number of the user called on a mobile-to-mobile call. If the mobile didn't 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 is invalid/restricted. The list of calls below is the same as the calls listed in the FP-10 print-out. Under type, the 1st letter is who originated the call, the 2nd letter or number is what line 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 Printout Examples

Model 48 (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 timeout.
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 capabilities to store up to 999 transactions in addition to the accumulated air time for each user. 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 48 is accessed either directly or over a phone line using the Model 48's internal modem. The internal billing records stored in the Model 48 can be downloaded and stored on disk.

When displaying the internal storage the SMDR print mode will affect its format. Print modes 0 and 1 will cause the display to be in pretty print format and mode 2 will cause it to be in FP-10 format. See above.

When the SMDR buffer is getting full, (over 900 records) the sign-off tones will change from their normal beeps to 1/2 of the DTMF programming access tones. This alerts the system operator that it is time to download the SMDR.

DIAL CLICK DECODER OPTION

Dial click allows a phone party caller to overdial user numbers or access codes with a rotary dial (dial pulse) telephone. There are two 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.

When installing a unit with dial click, use the "DTMF" and "Click Detect" tests in the test menu to calibrate the Model 48. The "Click Detect" test will display "ON" or "OFF" when clicks are decoded or not. Adjust R6, on the dial click board so an "ON" indication is given for the entire duration of all digits 1-0. Next, use the DTMF test to display decoded dialed digits. If the click decode mode is set to 1, just dial digits from a dial pulse phone. Dial all digits 1-0 and verify they are correctly decoded. An "A" or "B" is displayed if the dialed number is decoded above or below the limit for a valid digits. If an "A" or "B" is displayed along with valid digits, decoding is okay. These errors are ignored during normal overdial and are presented in the test routine as an aid for adjustments. If the digits are not decode properly, select dial click decode mode 2. When mode 2 is selected, a leading '0' is required to calibrate the software. After the line is picked up, dial a '0', then dial all digits from 1 to 0. See the installation section for more information of set up. CAUTION: One of the dial click decode modes must be selected before the tests can be done and the dial click board can be installed.

ZCU OPTION

ZCU, Zetron Communication Utility, is a user friendly software communications program for use with IBM PC or compatible computers. It allows easy communication with Zetron equipment for programming, downloading billing data, and upload/download of system configurations. It requires a Hayes 300 or 300/1200 modem, either internal to the computer or externally connected to a serial COM port. For more detailed information, refer to the ZCU User's Guide.

7. INSTALLATION

Continued ...

7. INSTALLATION
(cont'd)

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 Repeater Manager 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.

GENERAL

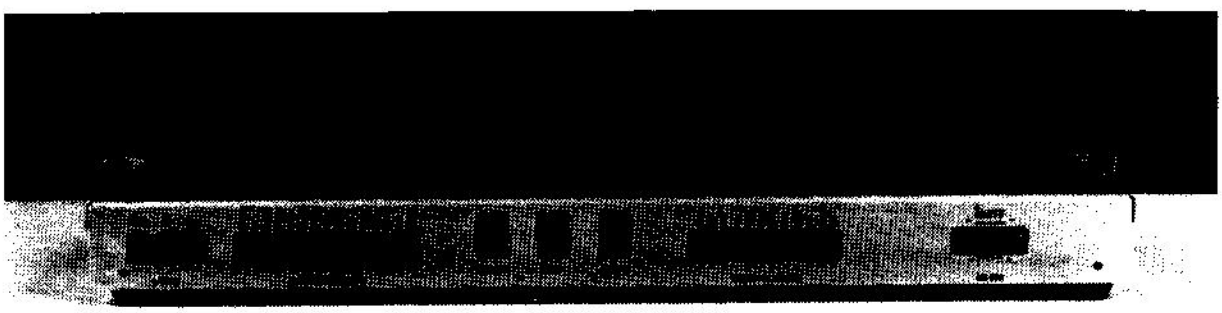
Connections to the transmitter and receiver are grouped on a detachable 15 pin connector on the rear of the Repeater Manager for ease of installation. The Model 48B includes installation test modes accessible with a Touch-Tone phone plugged into the local phone jack to aid in installation.

CAUTION: If the M48B is set up for a DID Converter, R27 may have been changed disabling the local phone jack. R27 should be changed to a 510 ohm for testing, then changed back to 2.2K for proper operation of the Model 50 or removed for the DAPT-1000 DID converters.

REQUIRED TEST EQUIPMENT

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

Figure 27 provides a graphic presentation of a typical Model 48 to transmitter/receiver connection.



TYPICAL CONNECTIONS

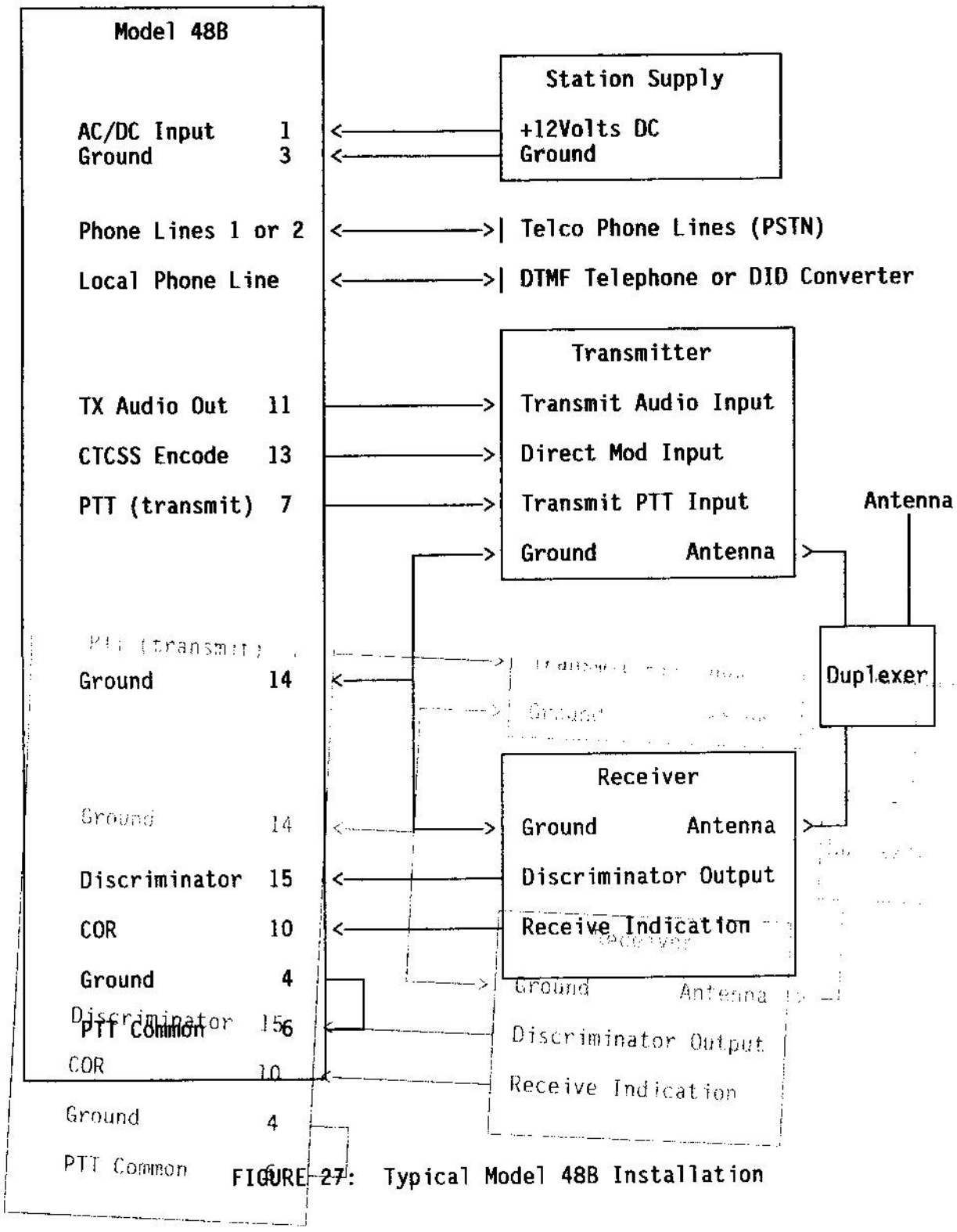
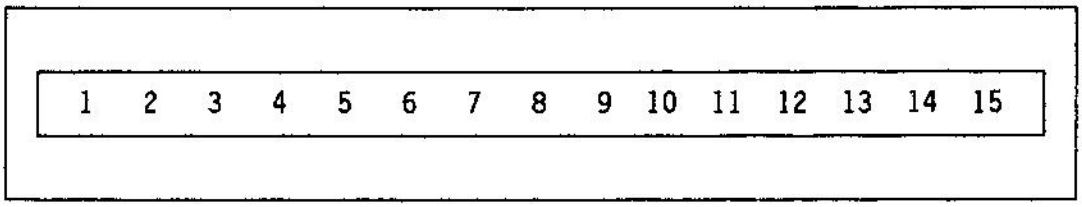


FIGURE 27: Typical Model 48B Installation

FIGURE 27: Typical Model 48B Installation

MODEL 48B 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. Not Used
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 M48B. This is used for all radio interface connections.

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).

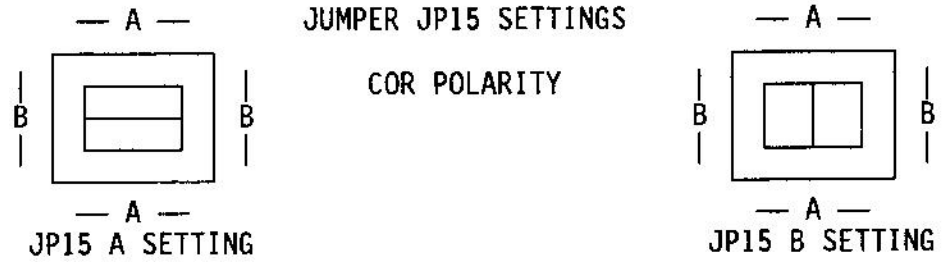
5. CTCSS: Connect Pin 13 (CTCSS OUTPUT) to the direct modulation input of the transmitter. This wire should be shielded with the braid tied to pin 12.

6. DISCRIMINATOR INPUT: Connect pin 15 (RX Audio In) to the receiver discriminator (detector) output. This must be unfiltered, unsquelched receiver audio for proper CTCSS/DCS decode operation. Shielded cable is required for this input. The shield braid should be connected to pin 14 (Ground).

7. COR INPUT: The M48B Repeater Manager 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 Repeater Manager 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 M48B 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 AR14 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 Repeater Manager should be used. When using the wall transformer, connections should be made to J6 terminals 1 and 2. The M48B 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 M48's system database may be reset to the factory defaults by using the following procedure:

1. Turn off the system power
2. Install JP19 or short the leads together.
3. Turn on system power
4. When all the LED's come on except Transmit, DTMF, and Local, remove JP19.

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. If you have version 6.0 or later software in your M48B the system programming will reset back to factory defaults upon power-up if the database has been corrupted and a message indicating SYSTEM RESET will be in the sign-on message.

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". A high pitched tone will be heard for about 20 seconds followed by the programming mode greeting tone sequence. 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 M48. 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 M48 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# = 1kHz). Send the tone out the transmitter by entering the function code "98*", followed by "2#" for Tx Tone On. 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. JP6 can be used to increase or decrease the output if needed. JP6 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. Jumper JP13 can be used to increase or decrease the CTCSS level out of the M48B, A = LOW and B = HI. The CTCSS output can be deemphasized for phase modulated transmitters by putting JP12 in the B position (to make the encode deviation the same for both low and high CTCSS tones).

4. DISCRIMINATOR INPUT: Adjust the receiver audio level by supplying a full quieting signal to the receiver. This signal should have a 1 kHz tone at 3 kHz deviation. Adjust AR3 for 1.5 volts 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 DTMF LED should light with each digit. Jumper JP9 can be used to increase the input gain if needed, A = Low Gain and B = Hi Gain. If the M48B is used to decode both CTCSS and DCS, Jumper JP8 must be in the B position, otherwise JP8 should be in the A position. Jumper JP17 should always be in the B position.

5. REPEAT AUDIO ADJUSTMENT: To adjust the repeat audio in the M48B you need to disable the CTCSS for Dispatch. This can be done by accessing the DTMF Programming Mode (00098) and entering 56* 0#. This allows you to use the M48B as a Carrier Operated Repeater. Next, using a handheld with DTMF encoding capability and a service monitor (or a full duplex service monitor), adjust the repeat audio via AR3. First, measure the DTMF out of the handheld with the service monitor. It should be about 3kHz deviation. Next, while monitoring the repeater TX frequency, key the handheld and send the same DTMF number you measured earlier. Adjust AR3 in the M48B for the same deviation you measured with the handheld. 3 kHz in = 3 kHz out. The handheld should not be sending a CTCSS Tone during this adjustment as the tone will give you a false reading for deviation out of the handheld. Entering 56* 1# puts you back in CTCSS mode for dispatch.

6. COR ADJUSTMENT: If you are using the Internal COR circuit the COR Squelch AR4 should be adjusted now for a good squelch threshold. Looking at the Carrier LED, adjust AR4 counter-clockwise until the LED comes on. Then turn AR4 clockwise until the LED just goes off. If the LED flickers, adjust AR4 a little more. The LED should remain off until a signal is being received. This adjustment is just like a squelch control on a radio and should be adjusted likewise.

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. To verify proper operation, press the Connect button on the front of the unit. The dial tone LED should light.

8. DIAL CLICK ADJUSTMENTS (option): 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 M48B 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 48B from a remote DTMF phone and verify proper access to the program mode. This tests the telco DTMF decode.

2. If the M48B 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 48B.

OPTIONAL CONNECTIONS

1. SENSE LINE 1: Sense line 1 (J6 Pin 9) is not used in the M48B.

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 48B 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 user 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

COMPUTER OR CRT CONNECTIONS

The computer/CRT port on the Model 48 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 28). 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 48 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 Repeater Manager receives an "XOFF" code (Control S), the data output will pause until a "XON" code (Control Q) is received. When the Model 48 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 48 and the Radio Shack Model 100 and Commodore 64.

MODEL 48 DB-9 PIN	LABEL	CONNECTION	COMPUTER DB-25 PIN
1	DTR	(none)	
2	+5VDC	(none)	
3	TX	——→ to CRT RX	3
4	RX	←—— from CRT TX	2
5	GND	←——→ to CRT GND	7
6	N/C	(none)	
7	RTS	(none)	
8	CTS		4
9	N/C		

FIGURE 28: Typical Model 48-to-computer (with 25-pin port) serial connections.

MODEL 48 DB-9 PIN	LABEL		"AT" STYLE RS-232 PORT
1	DTR		
2	+5VDC		
3	TX	——→	2 RX DATA
4	RX	←——	3 TX DATA
5	GND	←——→	5 SIGNAL GND
6	N/C	(none) ┌→	4 Connects DTR
7	RTS	(none) └→	6 to DSR
8	CTS	┌→	7 Connects RTS
9	N/C	└→	8 to CTS

FIGURE 29: Typical Model 48-to-computer (with 9-pin port) serial connections.

CONNECT YOUR COMPUTER OR CRT to the serial connector J1 (DB9). The Model 48 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 48 sign-on message and "Top-menu". Appendix A1 tells how to use the ZETRON supplied terminal emulator DT on an IBM PC (or compatible). Appendix A2 tells how to use a Radio Shack Model 100 computer for communications and Appendix A3 tells how to use a Commodore 64 computer.

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 48'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.

SPECIFIC MODEL 48-TO-RADIO CABLING

The following notes and diagrams have been compiled to help ease the installation of the Zetron Model 48. These notes should be used along with the remainder of this section.

Zetron neither warrants nor assumes any liability for the use of or the accuracy of these notes and diagrams but every effort has been made to insure their accuracy and fitness for the purpose intended.

The connection notes for the Zetron generic cable should be read in addition to the radio specific connection notes and the manual for the radio being used. Please check the radio manual for any changes the manufacturer may have made.

The generic cable and cables for the radios included in the following notes may be purchased from Zetron.

MODEL 48 Radio Interface Cable Connector Pin Numbers and Color Codes

J6

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Pin #	Color	Function
1		9-12 VAC or +12 VDC
2		9-12 VAC
3		Power Ground
4	Shield of Blk/Red	Ground
5		PTT N.C.
6	Black (Red) & Shield (to pin 4)	PTT Common
7	Red	PTT N.O.
8	nc	Control 1
9	nc	Sense 1
10	Yellow	COR
11	Blue	Transmit Audio
12	Black(Blue) Black(Yellow)+Shields	Ground
13	Green	Subaudible tone/code out
14	Black(White) Black(Green)+Shields	Ground
15	White	Receive Audio

Generic
If your radio is equipped with repeat audio it must be removed or disabled.

It is recommended that you use the COR signal from your radio. COR sense may be set to positive or negative in the system programming (COR Menu). The low voltage level of the COR signal must be below 4.0V DC. The detection level is adjustable by R61 from 0 to 4.0V DC. There is a 100K internal pull up in the unit which holds the input to 12.0V DC. If the COR is set to positive, the COR LED will not go out until the input is pulled low.

The TX audio is single ended. The output level is adjustable from 50 mV P-P to 5.0 V P-P. Install JP6 in position A (HI) for desired output greater than 500 mV P-P or position B (LO) for desired output less than 500 mV P-P. To set the transmitter deviation use the single tone test in the Test Menu and adjust R34.

The RX audio from the radio must be unsquelched discriminator (unfiltered) audio. Adjust R66 for proper receive levels.

The CTCSS encode always comes out on connector J6 pin 13. The level of the CTCSS at this pin is adjustable with R133.

NOTE: When using digital squelch decode with CTCSS, the digital squelch tail elimination sequence can interfere with tone users 20 (131.8 Hz) and 21 (136.8 Hz). Since the off code for digital squelch is 134 Hz. which is in between tone users 20 and 21, it is advisable not to use either of these tones.

INSTALLING NEW EPROMS

Most changes to the Model 48 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 48. 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 48B
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 48B
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 48B
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

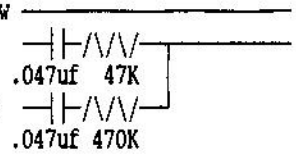
CR1000 CONFIGURATION:

- Move the wire in the receiver off of J211, connect to U201 pin 6. This provides unfiltered receive audio to the Model 48.
- 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 48B
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	---	
CTCSS/DCS encode	13	Green	
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 48.
- 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 48B
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 48B
To: E.F. Johnson CR1010, Alternate hookup
Using: 709-7112 Generic radio cable

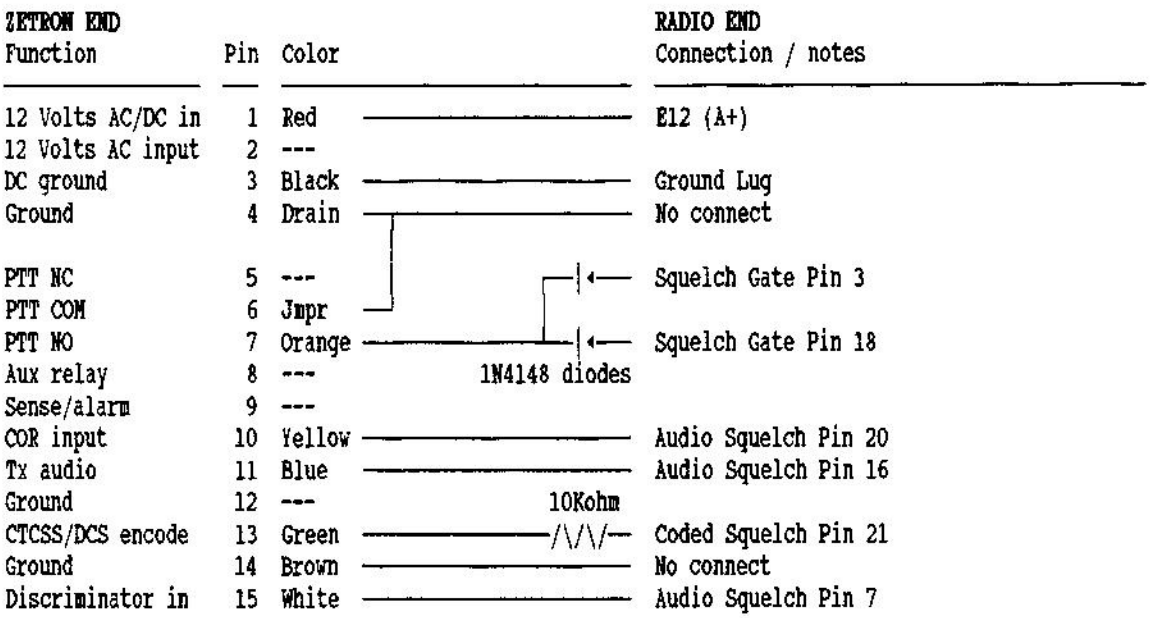
ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Logic Drawer Pin 15, +13.8V
12 Volts AC input	2	---	
DC ground	3	Black	Logic Drawer Pin 13, Gnd
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Logic Drawer Pin 23, $\overline{PTT}$
Aux relay	8	---	
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 48B 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 48B or the exciter.

CONNECTION TO A MOTOROLA MSR 2000 BASE/REPEATER

For: Zetron Model 48B
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 48B
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 48B
To: Motorola Micor Community Repeater
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Power supply A+
12 Volts AC input	2	---	
DC ground	3	Black	Power supply A-
Ground	4	Drain	No connect
PTT NC	5	---	Pin 3, F1/PL Card position on backplane
PTT COM	6	Jmpr	
PTT NO	7	Orange	Pin 16, Guard Tone Card position on backplane
Aux relay	8	---	1N4148 diode
Sense/alarm	9	---	
COR input	10	Yellow	J2 Pin 5 (Rx Unsquelch)
Tx audio	11	Blue	Station Control Pin 16
Ground	12	---	10Kohm
CTCSS/DCS encode	13	Green	/\/\/— J5 Pin 27
Ground	14	Brown	No connect
Discriminator in	15	White	Squelch Gate Pin 10

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 48B
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 48B. 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 48 will be heard in the local speaker if the Model 48 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 48B
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.

CONNECTION TO A REPCO DIMENSION REPEATER

For: Zetron Model 48B
To: Repco Dimension Repeater
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	Pin 8, CTCSS barrier strip (13.6 VDC)
12 Volts AC input	2	---	
DC ground	3	Black	Pin 2, CTCSS barrier strip (GND)
Ground	4	Drain	No connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	Pin 4, Tel barrier strip (KEY)
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	Pin 7, CTCSS barrier strip (COS), active low
Tx audio	11	Blue	Pin 4, CTCSS barrier strip (A IN)
Ground	12	---	
CTCSS/DCS encode	13	Green	Pin 3, CTCSS barrier strip (T IN)
Ground	14	Brown	No connect
Discriminator in	15	White	Pin 1, CTCSS barrier strip (DISC)

REPCO REPEATER CONFIGURATION:

1. Remove factory tone boards from card slots.

2. Set front panel switches as follows:
   - TONE = off
   - LOCAL/RPT = LOCAL

Note: Repeater is not capable of Digital Coded Squelch.

CONNECTION TO REGENCY/WILSON MICROCOMM REPEATERS

For: Zetron Model 48B
To: Regency / Wilson Microcomm Repeaters
Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 Volts AC/DC in	1	Red	+12VDC, power supply in repeater
12 Volts AC input	2	---	
DC ground	3	Black	DC Ground, power supply in repeater
Ground	4	Drain	No connection
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	PTT, C6 on control board
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	K9 or Pin 15 of IC20, SQ indication
Tx audio	11	Blue	U1 on control board
Ground	12	---	
CTCSS/DCS encode	13	Green	U2 on control board
Ground	14	Brown	No connection
Discriminator in	15	White	A0 on receiver shield, Rec Audio

MODIFICATIONS TO RADIO:

1. Remove jumper between A2 and A3 of P706 if present. This will break the repeat audio path if the station was configured for carrier squelch operation.

2. Remove any CTCSS tone decode boards if present.

3. Move jumper JU702 from P709 (transmit) to the NC (disable) position. This disables repeater PTT while still allowing local and M38 generated PTT.

4. Move jumper JU718 from P707 (tone) to P708 (squelch). This configures the unit as a carrier squelch repeater.

5. A series resistor may be needed in the CTCSS and TX modulation encode lines if loading is noted. Values of 10K to 50K ohm are typical.

CONNECTION TO A TAIT T300 SERIES RADIO

For: Zetron Model 48B
To: Tait T300 series base station
Direct plug in replacement for Tait T311 panel

ZETRON END Function	Pin	Color	RADIO END, 25 way "D" range female socket Connection / notes
12 Volts AC/DC in	1	Red	Pin 8, +VE 12V
12 Volts AC input	2	---	
DC ground	3	Grey	Pin 5, GROUND
Ground	4	Link	
PTT NC	5	---	
PTT COM	6	Link	
PTT NO	7	Yellow	Pin 10, TX KEY
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Purple	Pin 20, RX GATE, ** NOTE 2
Tx audio	11	Brown	Pin 7, TX AF
Ground	12	---	
CTCSS/DCS encode	13	White	Pin 2, CTCSS ENCODE
Ground	14	---	
Discriminator in	15	Blue	Pin 6, RX AF

TAIT CONFIGURATION:

1. Links made on "D" range socket:
   - 1-4 Earth one side Rx 600 ohm
   - 1-3 Earth one side Tx 600 ohm
   - 1-5 Earth

2. Check the RX GATE lead goes to RX GATE on the Tait Base Station as on some models this lead may have been left disconnected.

8. REPAIR

IN CASE OF DIFFICULTY

In case of installation difficulty, call the Zetron Model 48 applications Engineering Department at (206) 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 48 Service Department at (206) 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.

For Canadian Service
For all problems occurring with units sold or installed in Canada, contact Cardon Communications, 95 MacNab St. N., Hamilton, Ontario, L8R2L9, (416) 527-1040.

FAULT IDENTIFICATION

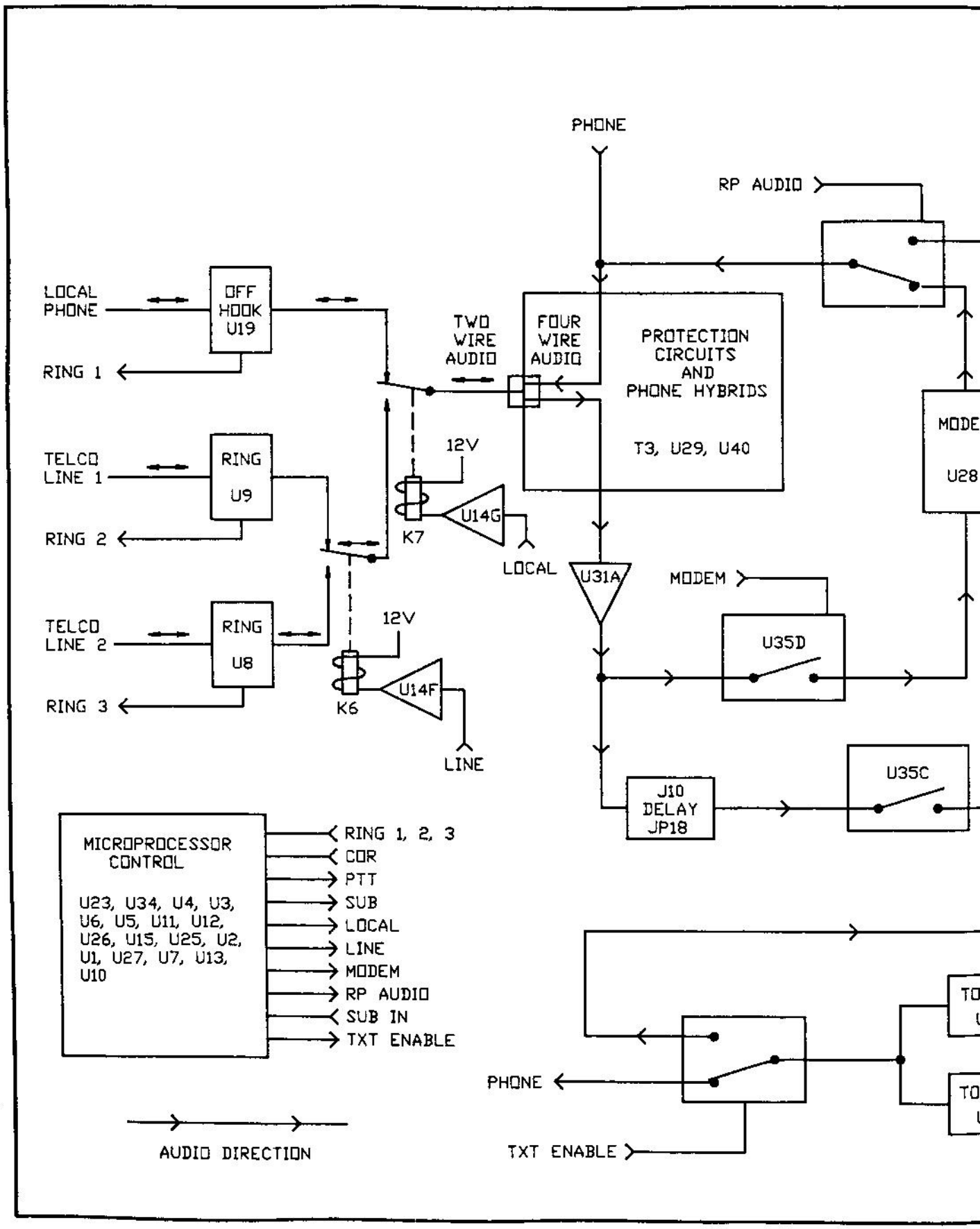
PROBLEM	POSSIBLE CAUSE(S)
No answer on any line, but RING light works.	Relays, relay driver IC.
1000 Hz test tone off frequency. Transmit led works, but doesn't key the transmitter.	Y1 xtal off frequency. TR relay defective. K8
Difficult for mobiles to perform connect.	Gain from receiver wrong, Pre or 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. c. M48 phone line (hybrid) balance poor. d. Audio gain TO or FROM the phone line too high or too low. The levels are set at the factory.

HYBRID BALANCE

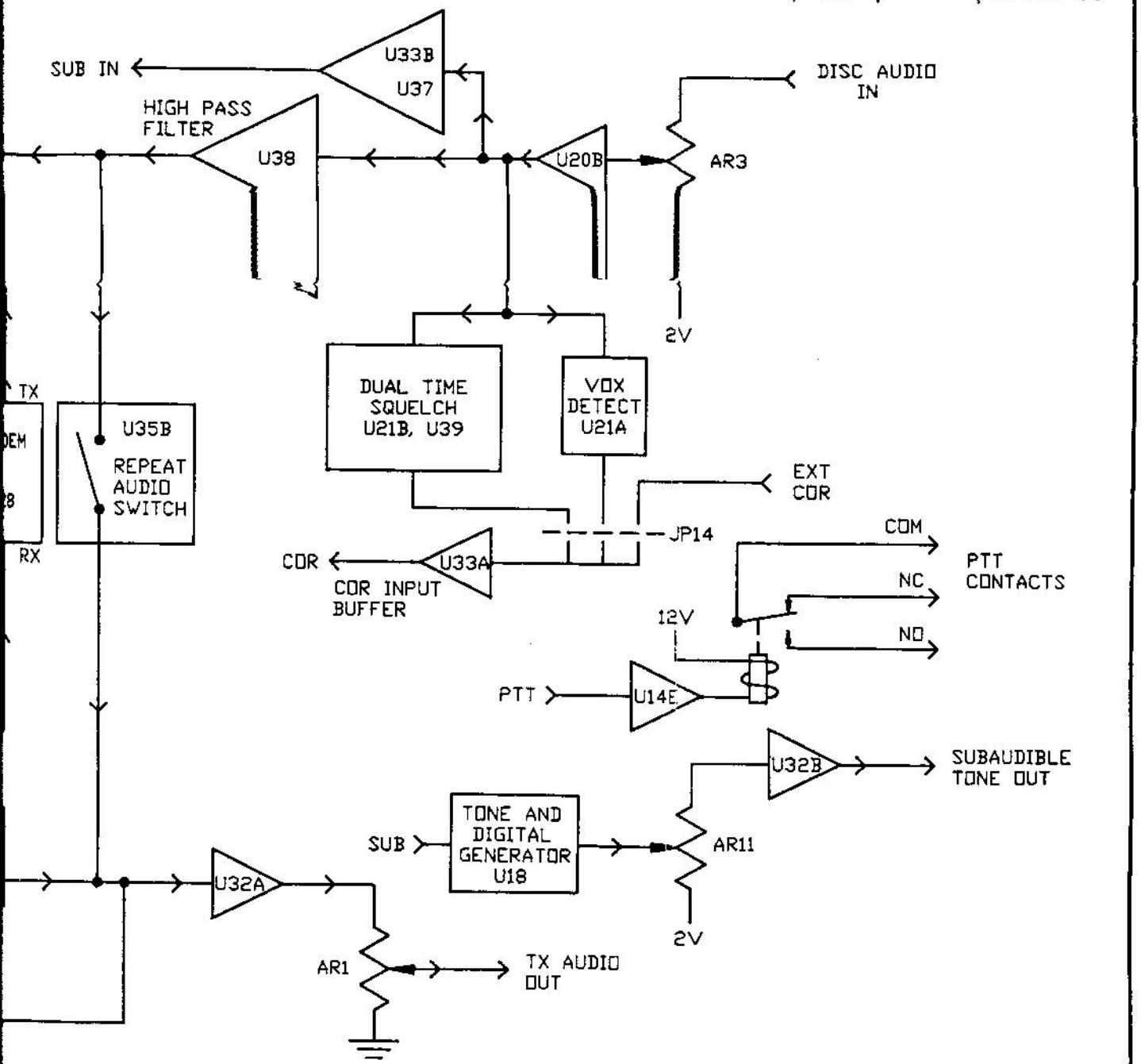
If the phone lines going to the site are poor and you find that you need to compensate for line unbalance, a Hybrid Balance Kit can be ordered for your M48B. This kit includes the variable resistors needed to do a complete hybrid adjustment to your phone lines. A complete installation sheet will accompany the resistors.

HYBRID ADJUSTMENT: With the pots installed, the Hybrid Balance should be adjusted after the M48B is installed at the site and the correct phone line is hooked up to the patch. If using both line inputs on the M48B, 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 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.


PHONE
RP AUDIO
LOCAL PHONE
OFF HOOK U19
RING 1
TWO WIRE AUDIO
FOUR WIRE AUDIO
PROTECTION CIRCUITS AND PHONE HYBRIDS
T3, U29, U40
MODE
U28
TELCO LINE 1
RING U9
RING 2
12V
K7
U14G
LOCAL
U31A
MODEM
U35D
TELCO LINE 2
RING U8
RING 3
12V
K6
U14F
LINE
U35C
J10 DELAY JP18
MICROPROCESSOR CONTROL
U23, U34, U4, U3, U6, U5, U11, U12, U26, U15, U25, U2, U1, U27, U7, U13, U10
RING 1, 2, 3
COR
PTT
SUB
LOCAL
LINE
MODEM
RP AUDIO
SUB IN
TXT ENABLE
PHONE
TXT ENABLE
AUDIO DIRECTION

MODEL 4XB BLOCK DIAGRAM (006-0050A)

REVISIONS				
REV	DESCRIPTION	DRN	APVD	DATE
A	RELEASE	RC		5/23/89



ZETRON INCORPORATED			BLOCK DIAGRAM – MODEL 4XB			
12335 134th Court N.E. Redmond, Washington 98052-2433						
APPROVALS	DATE	TOLERANCES UNLESS OTHERWISE SPECIFIED	SCALE		DRAWING NUMBER	REV
DRAWN RC	5/23/89	DECIMAL ± .XX .01 ± .XXX .005 ANGLES ±1°	NONE	B	006-0050	A
CHECKED		DIMENSIONS ARE IN INCHES	DO NOT SCALE DRAWING		SHEET 1 OF 1	
APPROVED						

MODEL 48B/CSA PARTS LIST (901-9156C)

ITEM	QTY	ZETRON P/N	DESCRIPTION	REFERENCE
1.	1	025-9090	M48B (HARDWARE) MANUAL	
2.	6	210-0001	KEPT NUT	
3.	7	220-0108	#440x1/4 PAN PHILLIPS	
4.	4	220-0250	1032x3/4 FLAT HEAD PHIL BLK	BAG
5.	4	236-0004	#10 WASHER BLK NYLON	BAG
6.	2	250-0104	#440x1/2 W/STUD	FOR PLUG-IN BOARDS
7.	2	321-6264	8Kx8 RAM	U5 U6
8.	1	322-2764	8Kx8 EPROM	U3
9.	1	322-7256	32Kx8 EPROM	U4
10.	1	323-0212	MODEM 1200 BAUD	U28
11.	1	401-0007	6-POS BLOCK FEMALE	
12.	1	401-0016	12 POS BLOCK FEMALE	J2
13.	1	401-0038	9 PIN DB	BAG
14.	1	401-0039	9 PIN DB HOOD	BAG
15.	1	401-0058	15 POS BLOCK FEMALE	J6
16.	1	415-9347	BOTTOM COVER	
17.	1	415-9351-2	FRONT PANEL	M48B REPEATER MANAGER
18.	1	415-9352-1	TOP/REAR COVER	
19.	1	415-9450	M48B MODEL/SERIAL# CSA LABEL	BOTTOM CENTER
20.	1	416-1214	SMT SOCKET 8K/32K	U6
21.	4	431-0006	RUBBER FEET	BAG
22.	1	449-9013	SHIPPING BOX	
23.	1	601-0169	M48B SOFTWARE	U3 U4 *NOTE 1
24.	1	702-9183-6	M48B PCB ASSY	
25.	2	709-7000	6-COND 12' TELCO	BAG

NOTE 1: 325 USER SOFTWARE OPTION

MODEL 48B/CSA CONTROL BOARD PARTS LIST (702-9183-6D.1)

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	
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	

MODEL 48B/CSA CONTROL BOARD PARTS LIST (702-9183-6D.1) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
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-PICE106K
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
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

MODEL 48B/CSA CONTROL BOARD PARTS LIST (702-9183-6D.1) cont'd

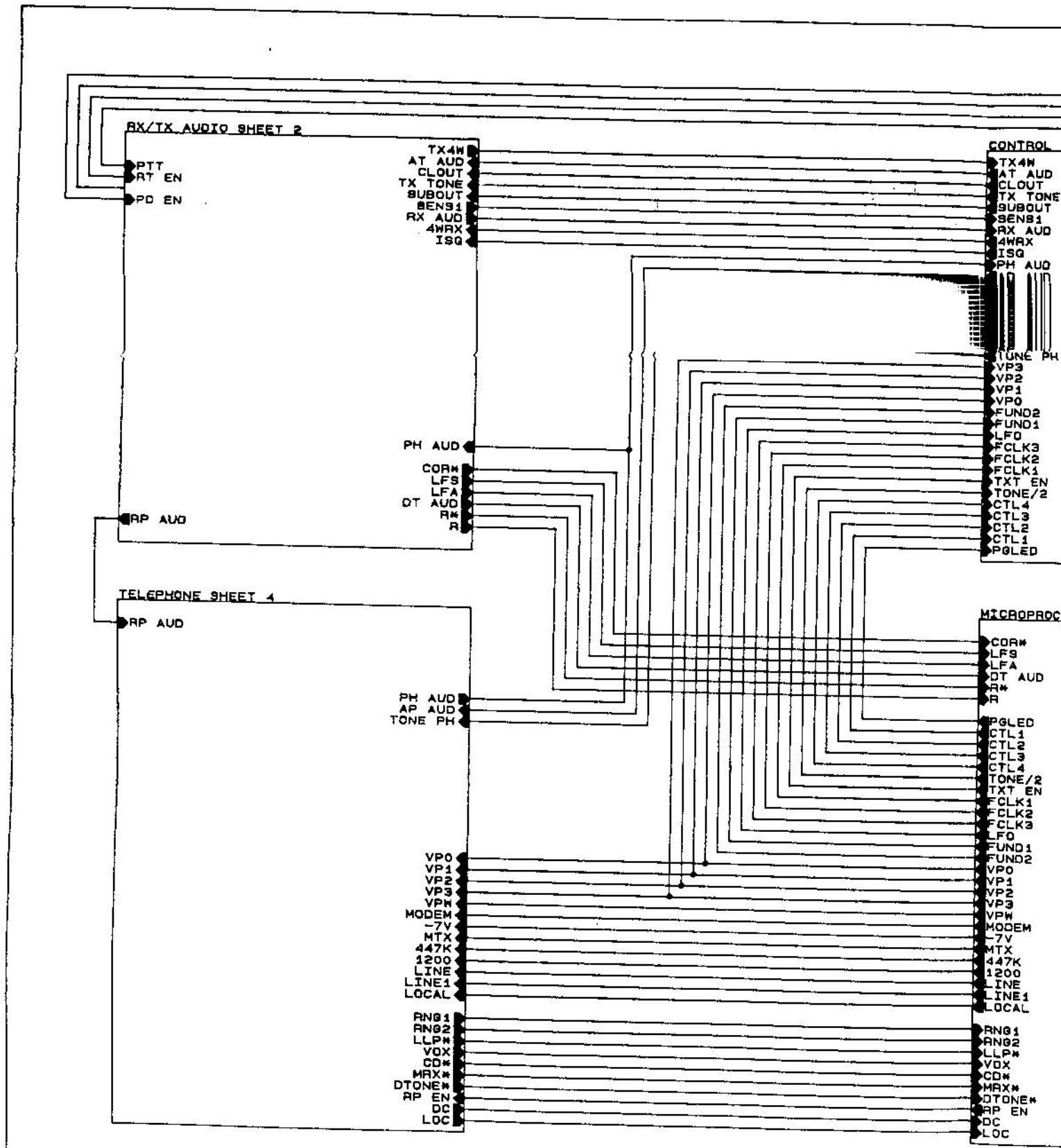
Item	Quantity	Reference	Part	Description	Mfg.Part No.
69	10	U20,U21,U22♯,U29,U31,U32, U33,U37,U38,U39,U40	316-0358	OP-AMP, DUAL	LM358N
70	1	U30	316-0567	PLL, TONE DECODER	LM567
71	1	VR1	316-7805	REGULATOR, +5V 1.5A	LM340T-5
72	1	U27	321-0202	DTMF DECODER	SSI-202P
73	0	U6^	321-6264	8K X 8 RAM 150ns	HM6264ALP-15
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
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	

MODEL 48B/CSA CONTROL BOARD PARTS LIST (702-9183-6D.1) cont'd

Item	Quantity	Reference	Part	Description	Mfg.Part No.
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	406-0001	1 OF 401-0108	
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	M4XB CONTROL BOARD	
135	2	XF1	416-3040	FUSE CLIPS	
136	10	XDS2-XDS11	417-0010	LED MOUNT R/A	

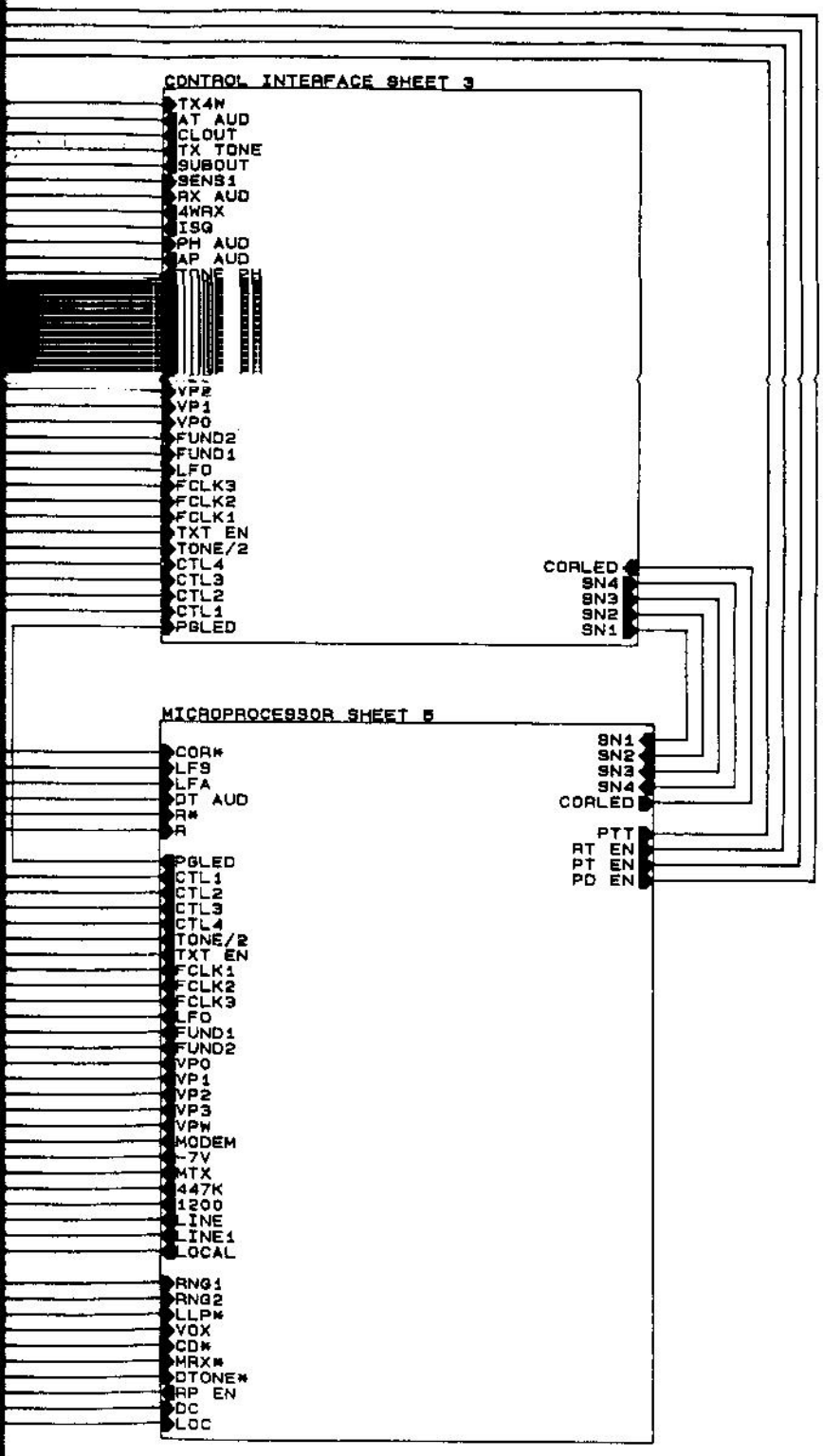
NOTES:

1. USE SPARE RESISTOR WIRE.
2. INSERT FROM CIRCUIT SIDE WITH LONG LEADS ON TOP SIDE. SOLDER COMPONENT SIDE. CUT LEADS CLOSE TO PLASTIC BASE.
3. AT AR4 (SOLDER SIDE) CUT WIPER TRACE, WIRE JUMPER TO OTHER LEG OF AR4.
4. CUT TRACE (COMPONENT SIDE) BETWEEN C85 AND R141. ON SOLDER SIDE WIRE JUMPER R141 TO C84 (GND)
5. ON COMPONENT SIDE CUT (2) TRACES - U23 PINS 43 AND 44, (CUT AT FEEDTHRU). ON SOLDER SIDE ADD JUMPER WIRES TO REVERSE.
6. ON SOLDER SIDE CUT TRACE BETWEEN Q4 (DRAIN) AND FEEDTHRU. ADD RX1 (ITEM 16) ACROSS CUT TRACE.
7. INSTALL CRX1 & CRX2 IN PARALLEL, ANODES OPPOSED, BETWEEN U29 PIN 5 AND END OF R114 NEAREST C35.
8. ON COMPONENT SIDE, JUMPER WIRE BETWEEN PINS 1 AND 3 OF U22.


RX/TX AUDIO SHEET 2
PTT
RT EN
PD EN
TX4W
AT AUD
CLOUT
TX TONE
SUBOUT
SENSI
RX AUD
4WRX
ISQ
PH AUD
COR*
LFS
LFA
DT AUD
R*
R
AP AUD
CONTROL
TX4W
AT AUD
CLOUT
TX TONE
SUBOUT
SENSI
RX AUD
4WRX
ISQ
PH AUD
TONE PH
VP3
VP2
VP1
VP0
FUND2
FUND1
LFO
FCLK3
FCLK2
FCLK1
TXT EN
TONE/2
CTL4
CTL3
CTL2
CTL1
PGLED
TELEPHONE SHEET 4
AP AUD
PH AUD
AP AUD
TONE PH
VP0
VP1
VP2
VP3
VPW
MODEM
-7V
MTX
447K
1200
LINE
LINE1
LOCAL
RNG1
RNG2
LLP*
VOX
CD*
MRX*
DTONE*
AP EN
DC
LOC
MICROPROC
COR*
LFS
LFA
DT AUD
R*
R
PGLED
CTL1
CTL2
CTL3
CTL4
TONE/2
TXT EN
FCLK1
FCLK2
FCLK3
LFO
FUND1
FUND2
VP0
VP1
VP2
VP3
VPW
MODEM
-7V
MTX
447K
1200
LINE
LINE1
LOCAL
RNG1
RNG2
LLP*
VOX
CD*
MRX*
DTONE*
AP EN
DC
LOC

REV. D SCHEMATIC (008-9183-6D) SHT 1/5

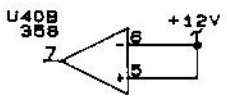
REV	DESCRIPTION	DRN	APV	DATE
B	RELEASE	DW		05-10-89
C	ECN 737	GH	[illegible]	07/25/89
D	ECN 1056	DW	[illegible]	7/30/90



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 ARS.

UNUSED PARTS:



LEGEND:

*	NOT INSTALLED
	OPTION (PER CUSTOMER ORDER)
	CUT TRACE
	JUMPER WIRE
- - - - -	INSTALLED ON HIGHER ASSY

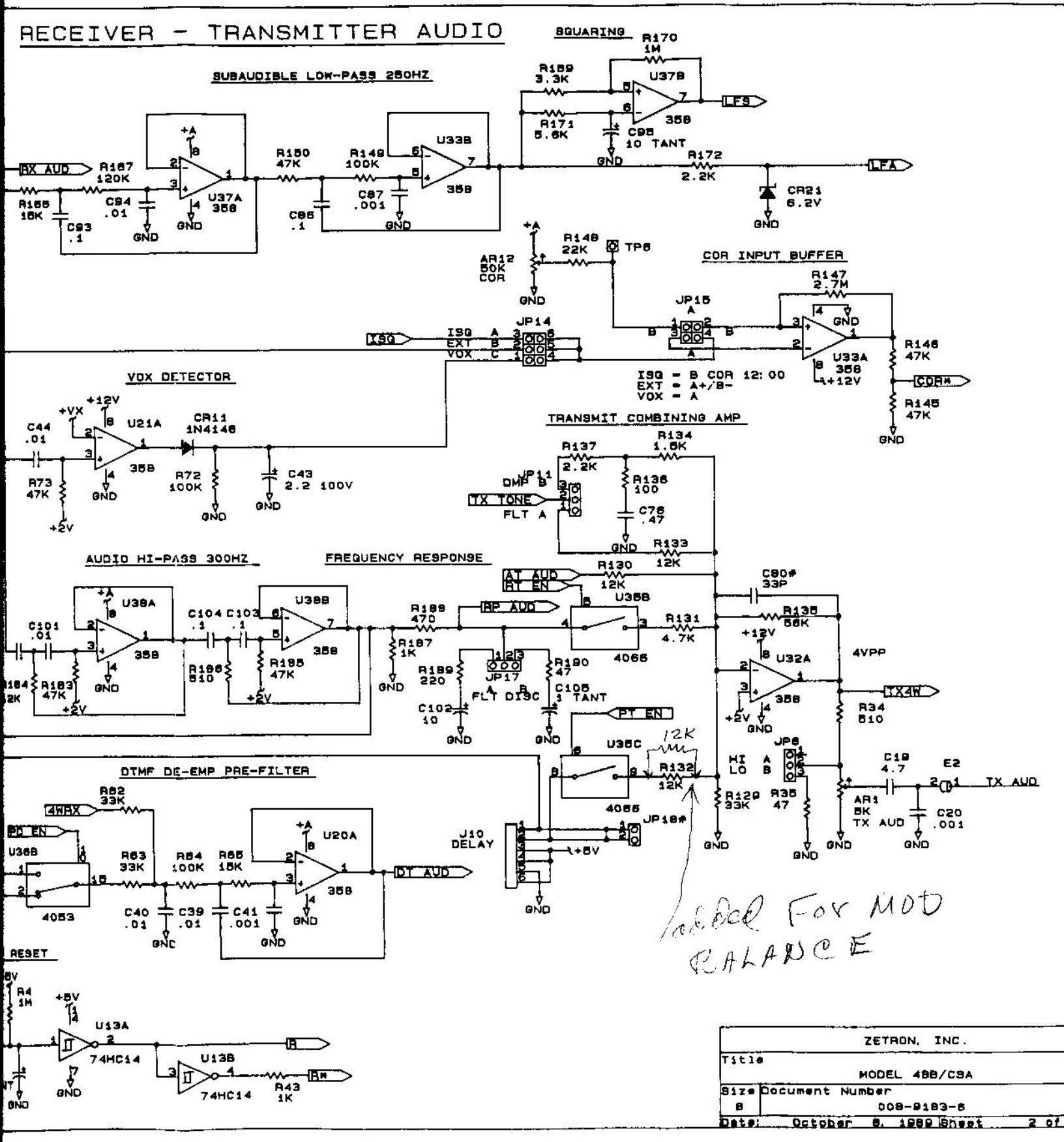
ZETRON, INC.
12338 134TH COURT N.E.
REDMOND, WASHINGTON, 98052-2433

Title: MODEL 488/CBA

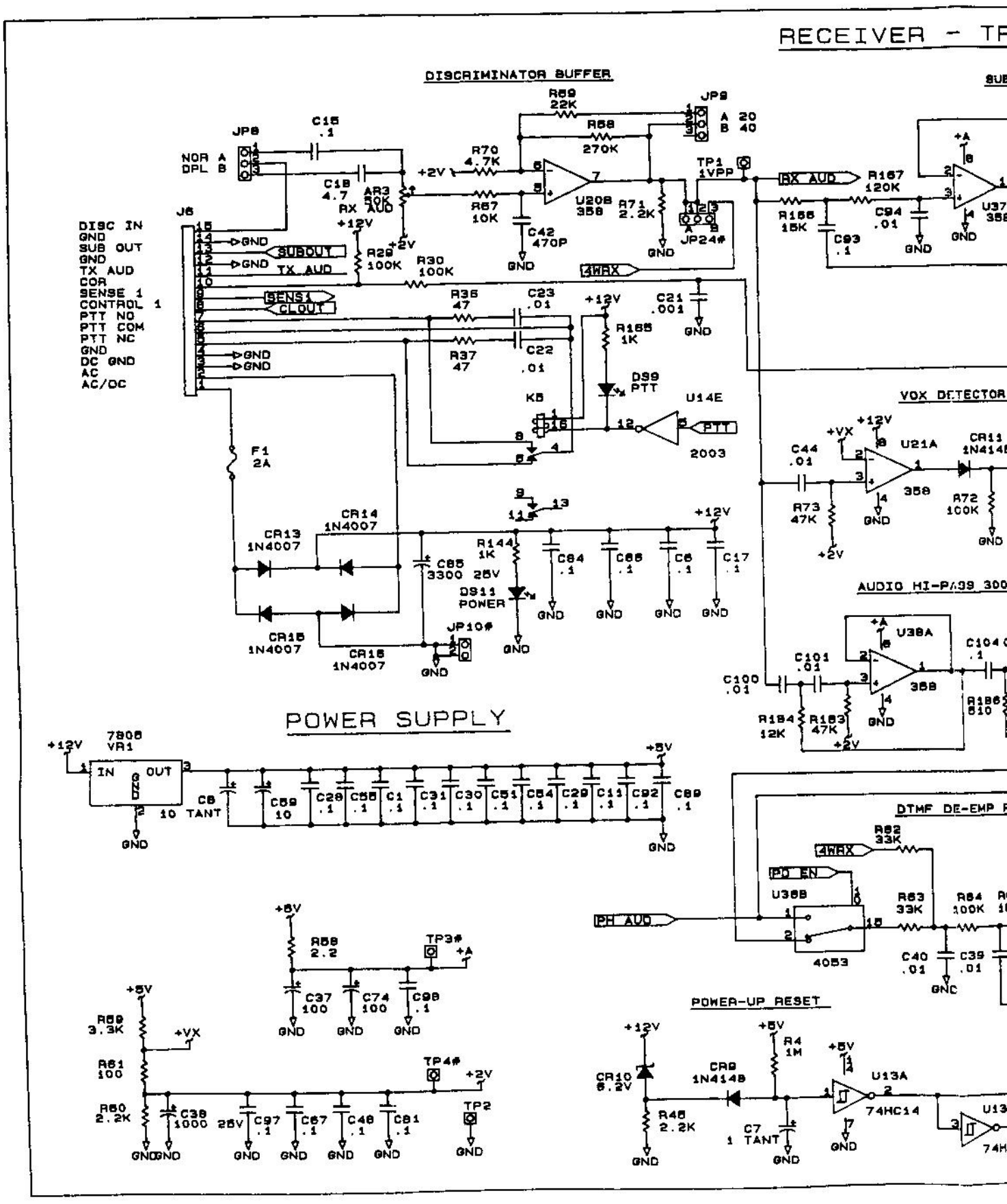
Size	Document Number	REV
B	008-9183-6	D

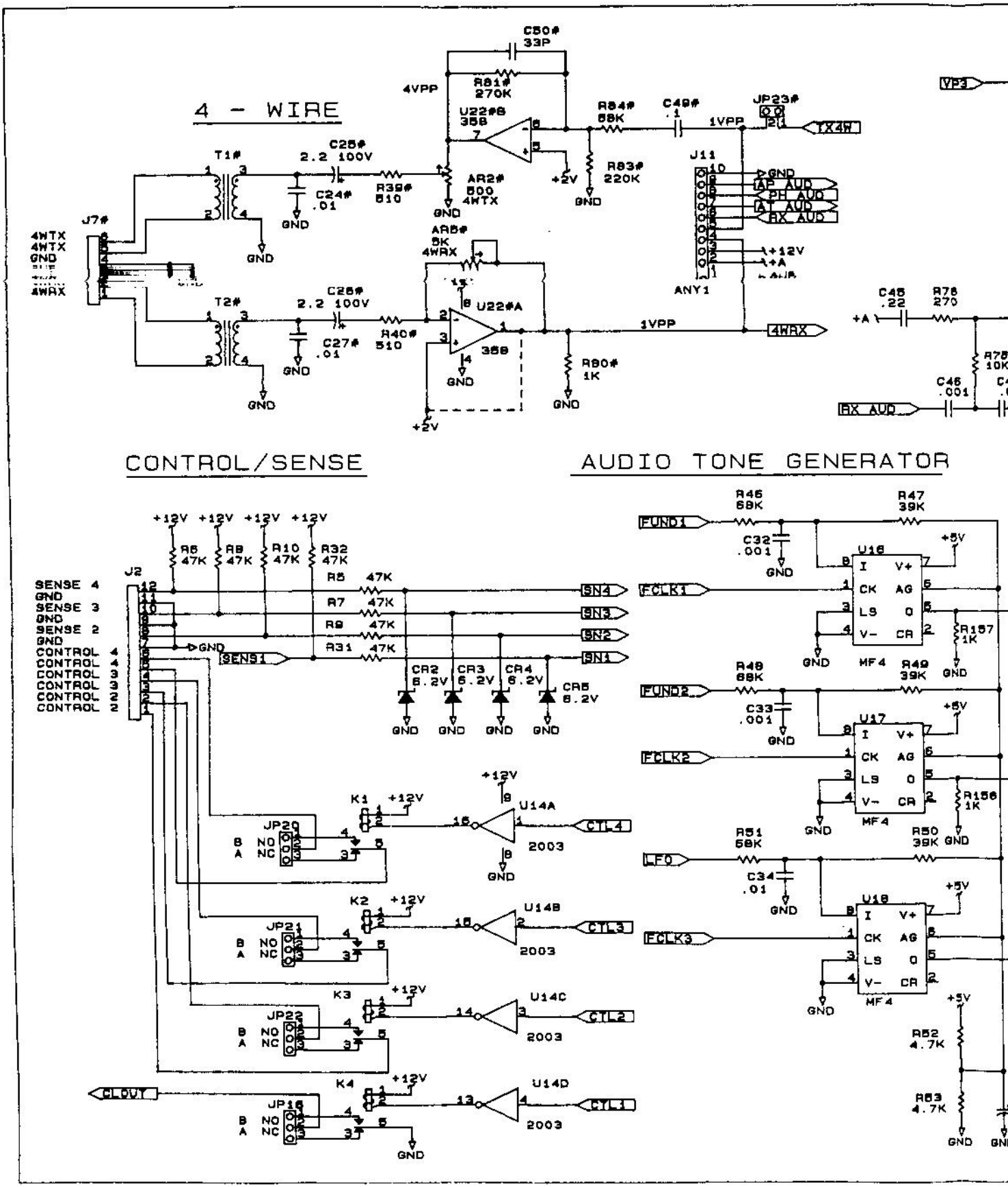
Date: October 6, 1989 Sheet 1 of 5

REV. D SCHEMATIC (008-9183-6D) SHT 2/5

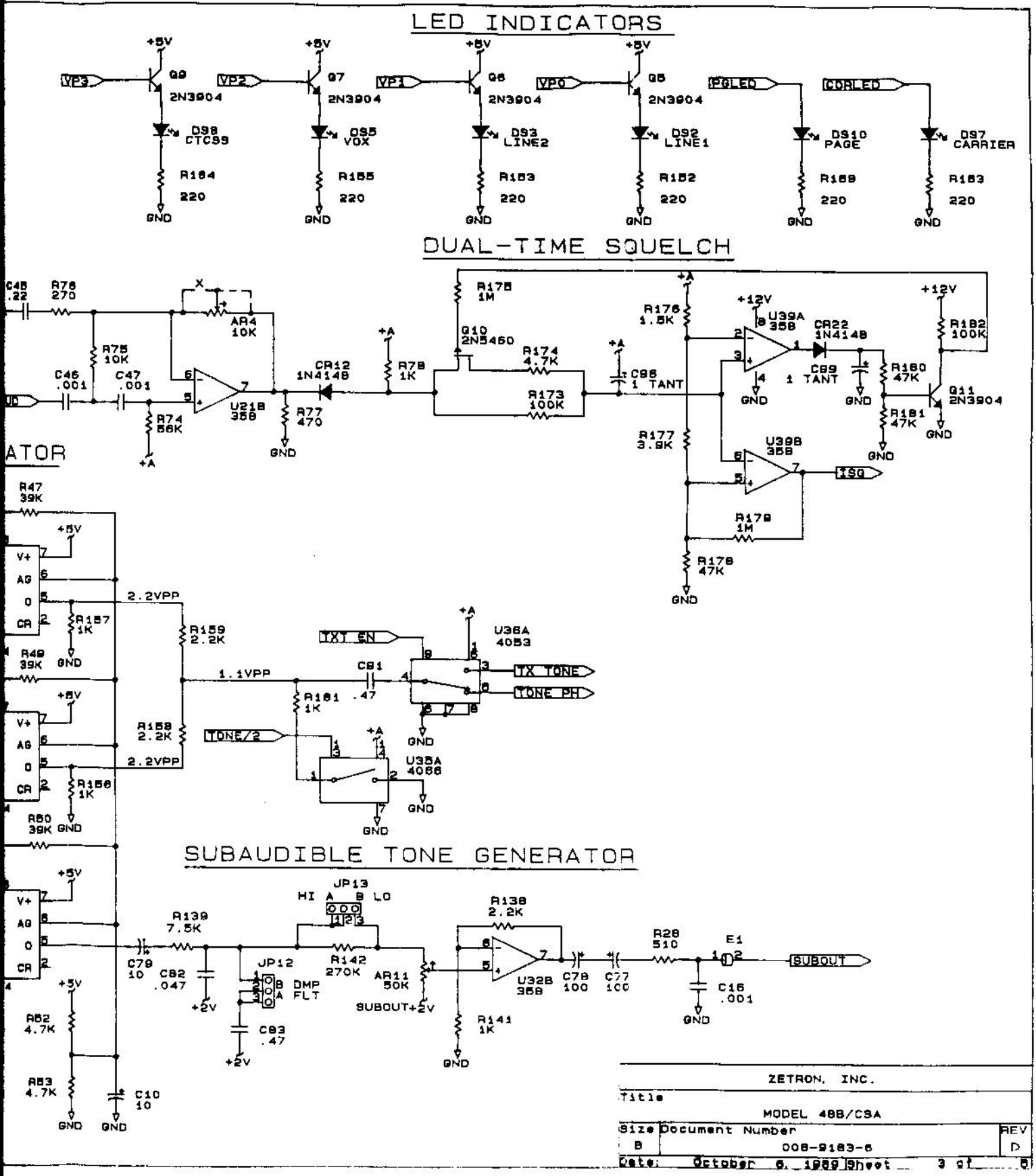


ZETRON, INC.	
Title	MODEL 488/C9A
Size B	Document Number 008-9183-6
Date: October 6, 1989	Sheet 2 of


RECEIVER - TR
DISCRIMINATOR BUFFER
SUB
VOX DETECTOR
AUDIO HI-P/99 300
POWER SUPPLY
DTMF DE-EMP
POWER-UP RESET
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
J6
JP8
NOR A
DPL B
JP9
A 20
B 40
C15 .1
C18 4.7
AR3 50K
RX AUD
R70 4.7K
R69 22K
R68 270K
R67 10K
C42 470P
U20B 358
R71 2.2K
TP1 1VPP
JP24#
R29 100K
R30 100K
SUBOUT
TX AUD
SENS1
CLOUT
4WRX
R36 47
R37 47
C23 .01
C22 .01
C21 .001
R185 1K
D99 PTT
K5
U14E
PTT
2003
F1 2A
CR13 1N4007
CR14 1N4007
CR15 1N4007
CR16 1N4007
C85 3300 25V
R144 1K
D911 POWER
JP10#
C84 .1
C86 .1
C6 .1
C17 .1
+12V
+5V
+2V
+VX
GND
7805
VR1
IN
OUT
C8 TANT 10
C59 10
C28 .1
C58 .1
C1 .1
C31 .1
C30 .1
C51 .1
C54 .1
C29 .1
C11 .1
C92 .1
C89 .1
R58 2.2
TP3#
C37 100
C74 100
C98 .1
R59 3.3K
R61 100
R60 2.2K
C38 1000 25V
C97 .1
C67 .1
C48 .1
C81 .1
TP4#
TP2
RX AUD
R167 120K
R166 15K
C94 .01
C93 .1
U37
358
U21A
C44 .01
R73 47K
R72 100K
CR11 1N414
U38A
C101 .01
C100 .01
R184 12K
R183 47K
C104
R186 810
R62 33K
PD EN
U38B
PH AUD
R63 33K
R64 100K
4053
C40 .01
C39 .01
CR10 6.2V
CR9 1N4148
R4 1M
R46 2.2K
C7 1 TANT
U13A
74HC14
U13
74H

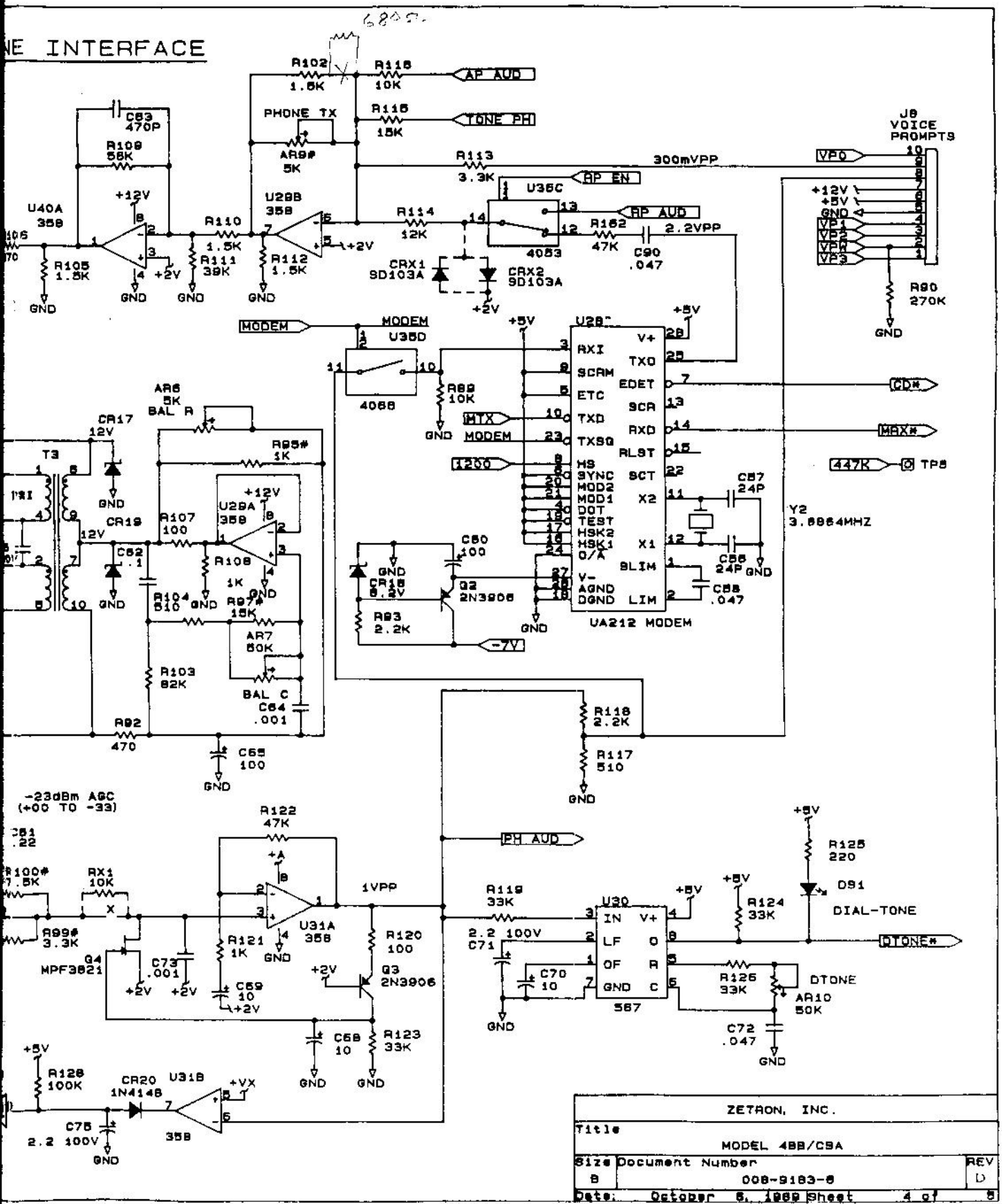

4 - WIRE
C50#
33P
R81#
270K
4VPP
U22#B
358
R84#
68K
C49#
.1
1VPP
JP23#
TX4W
VP3
T1#
C25#
2.2 100V
C24#
.01
R39#
510
AR2#
500
4WTX
+2V
R83#
220K
J11
GND
AP AUD
PH AUD
AT AUD
RX AUD
+12V
+A
ANY1
J7#
4WTX
4WTX
GND
4WRX
AR8#
5K
4WRX
T2#
C26#
2.2 100V
C27#
.01
R40#
510
U22#A
358
1VPP
4WRX
R80#
1K
C45
.22
R78
270
+A
C46
.001
RX AUD
CONTROL/SENSE
AUDIO TONE GENERATOR
+12V +12V +12V +12V
R6
47K
R8
47K
R10
47K
R32
47K
J2
SENSE 4
GND
SENSE 3
GND
SENSE 2
GND
CONTROL 4
CONTROL 4
CONTROL 3
CONTROL 3
CONTROL 2
CONTROL 2
R6 47K
R7 47K
R9 47K
R31 47K
SN4
SN3
SN2
SN1
SENS1
CR2
6.2V
CR3
6.2V
CR4
6.2V
CR5
6.2V
K1
K2
K3
K4
JP20
JP21
JP22
JP18
B NO
A NC
U14A
U14B
U14C
U14D
2003
CTL4
CTL3
CTL2
CTL1
CLOUT
R46
68K
R47
39K
FUND1
C32
.001
U16
FCLK1
MF4
R157
1K
R48
68K
R49
39K
FUND2
C33
.001
U17
FCLK2
R156
1K
R51
68K
R50
39K
LFO
C34
.01
U18
FCLK3
R52
4.7K
R53
4.7K

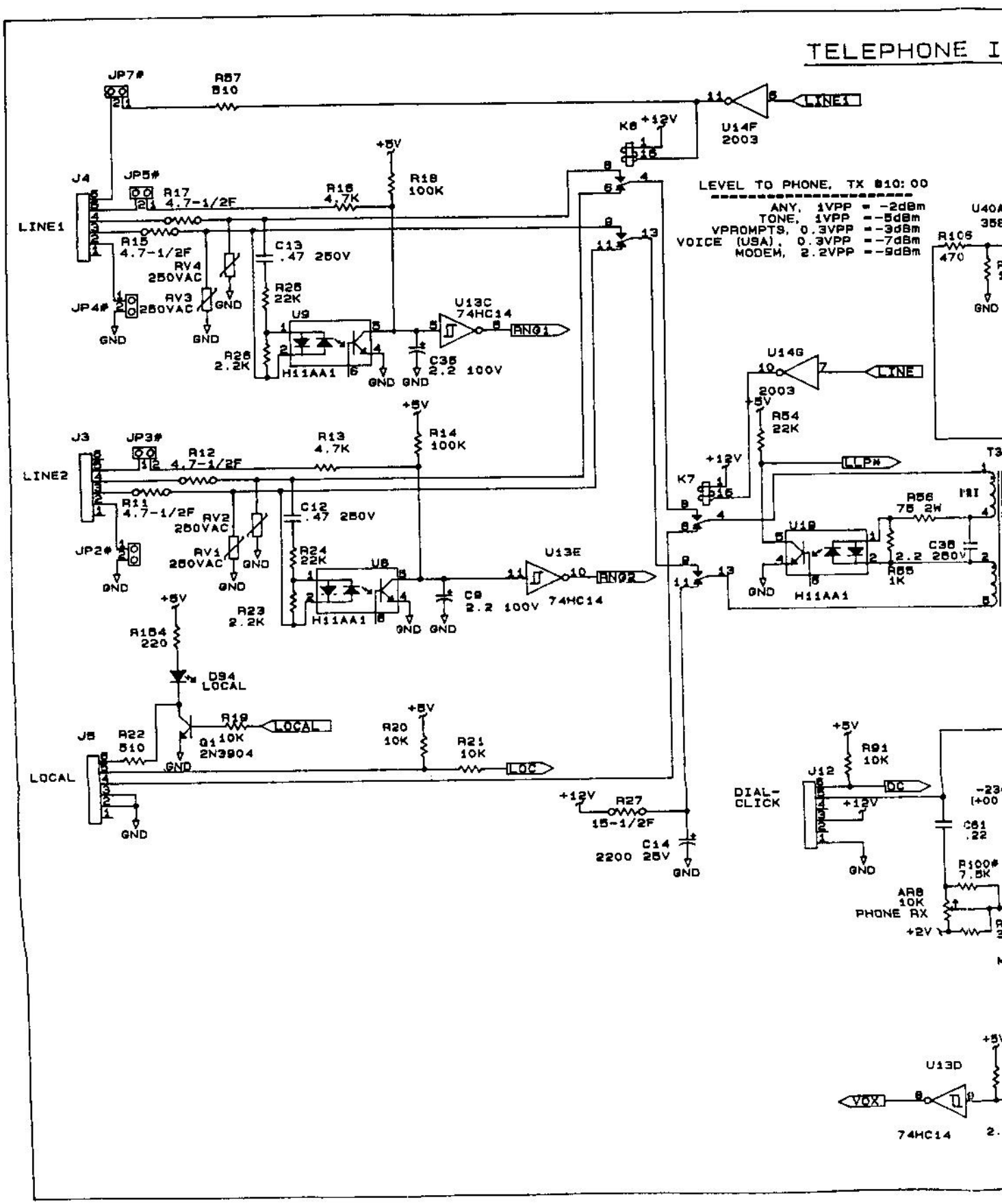
REV. D SCHEMATIC (008-9183-6D) SHT 3/5

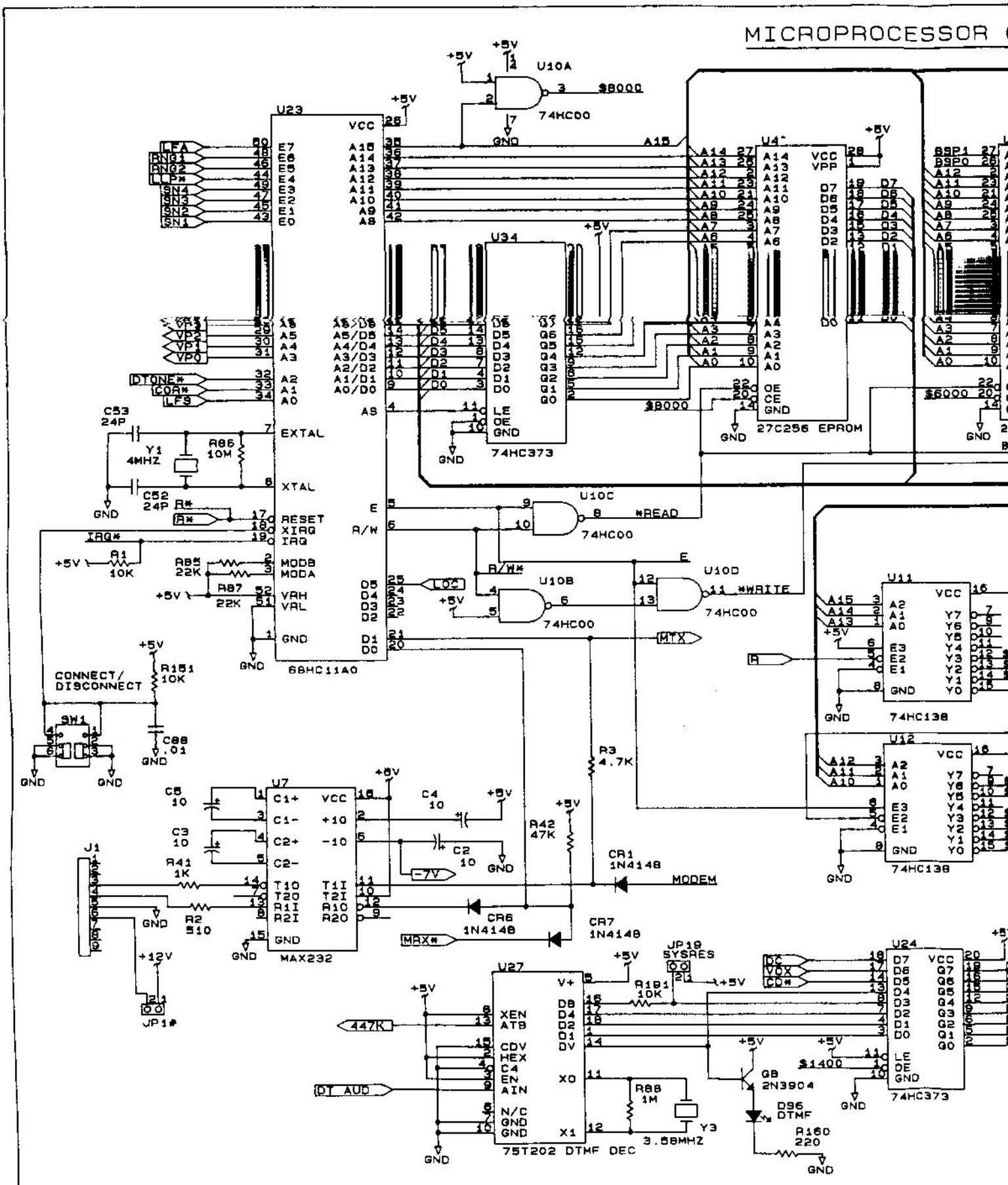


ZETRON, INC.		
Title: MODEL 48B/CSA		
Size: B	Document Number: 008-9183-6	REV: D
Date: October 6, 1989	Sheet 3 of 5	

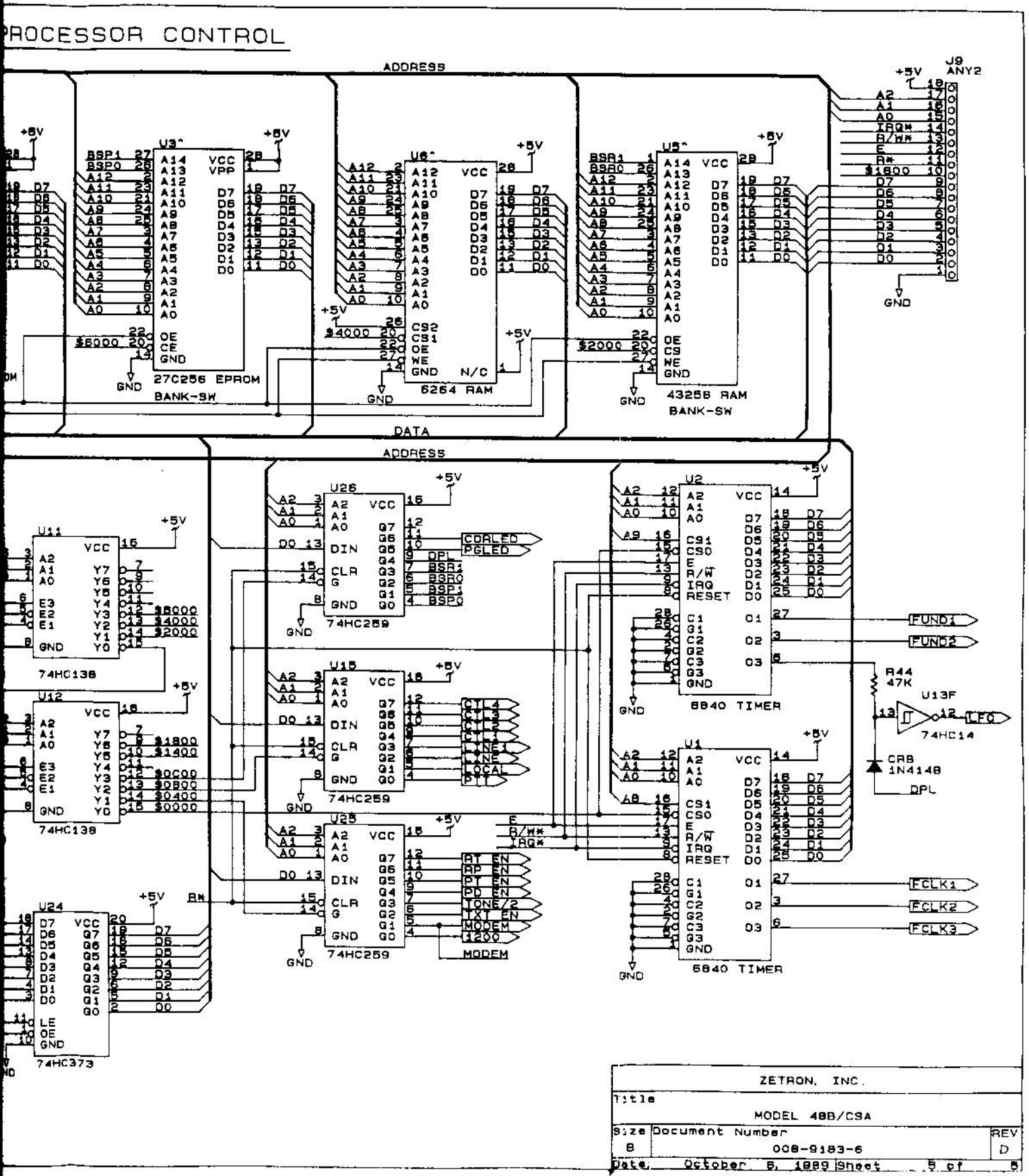
REV. D SCHEMATIC (008-9183-6D) SHT 4/5



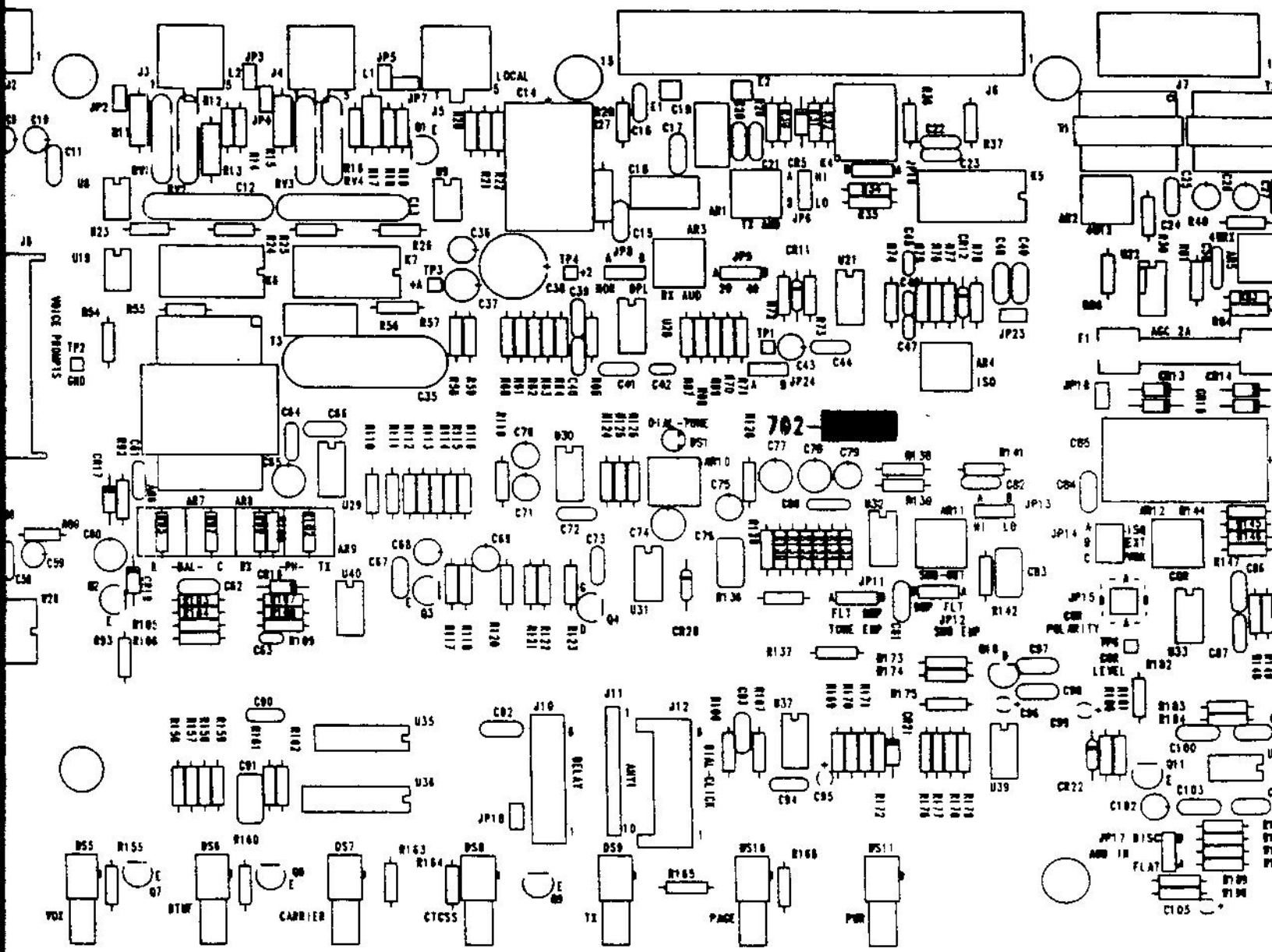

TELEPHONE I
JP7#
R57
510
LINE1
U14F
2003
K6
+12V
+5V
J4
JP5#
R17
4.7-1/2F
R16
4.7K
R18
100K
LINE1
R15
4.7-1/2F
RV4
250VAC
RV3
250VAC
JP4#
GND
C13
.47 250V
R26
22K
U9
U13C
74HC14
ANG1
R28
2.2K
H11AA1
C35
2.2 100V
LEVEL TO PHONE, TX 810:00
ANY, 1VPP = -2dBm
TONE, 1VPP = -5dBm
VPROMPTS, 0.3VPP = -3dBm
VOICE (USA), 0.3VPP = -7dBm
MODEM, 2.2VPP = -9dBm
R105
470
U14G
LINE
2003
R54
22K
LLPW
K7
R56
75 2W
U10
C38
2.2 250V
R55
1K
H11AA1
J3
JP3#
R12
4.7-1/2F
R13
4.7K
R14
100K
LINE2
R11
4.7-1/2F
RV2
250VAC
RV1
250VAC
JP2#
C12
.47 250V
R24
22K
U8
U13E
ANG2
R23
2.2K
H11AA1
C9
2.2 100V
74HC14
R104
220
D94
LOCAL
J5
R22
510
Q1
2N3904
R19
10K
LOCAL
R20
10K
R21
10K
LOC
LOCAL
R27
15-1/2F
C14
2200 25V
J12
R91
10K
DC
DIAL-
CLICK
C61
.22
R100#
7.5K
AR8
10K
PHONE RX
+2V
U13D
VOX
74HC14

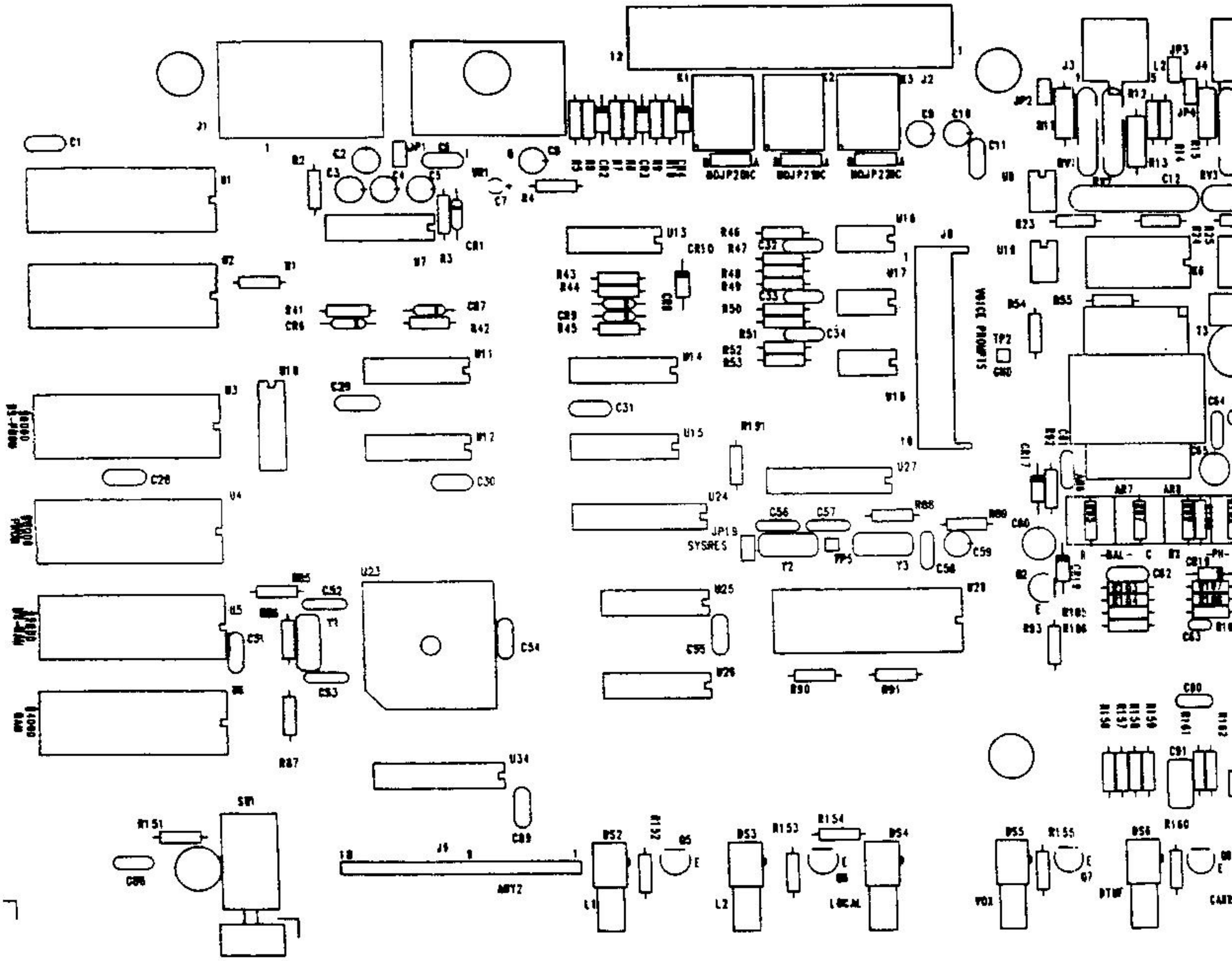

MICROPROCESSOR
U23
68HC11A0
U10A
74HC00
$8000
U34
74HC373
U4
27C256 EPROM
$6000
U10C
*READ
U10B
U10D
*WRITE
74HC00
U11
74HC138
U12
74HC138
U7
MAX232
U27
75T202 DTMF DEC
U24
74HC373
JP19
SYSRES
JP1#
CONNECT/
DISCONNECT
SW1
MODEM
MTX
LOZ
DT_AUD
Y1
4MHZ
Y3
3.58MHZ
Q8
2N3904
D96
DTMF
R160
220
R3
4.7K
R42
47K
R181
10K
R88
1M
R86
10M
R87
22K
R85
22K
R1
10K
R151
10K
R41
1K
R2
510
C53
24P
C52
24P
C88
.01
C5
10
C4
10
C3
10
C2
10
CR1
1N4148
CR6
1N4148
CR7
1N4148
+5V
+12V
-7V
GND

REV. D SCHEMATIC (008-9183-6D) SHT 5/5



MODEL 488 REPEATER MANAGER SILKSCREEN (702-9183-6D.1)





J1
J2
J3
J4
J8
J9
U1
U2
U3
U4
U5
U6
U7
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U23
U24
U25
U26
U27
U28
U34
C1
C2
C3
C4
C5
C7
C9
C10
C11
C12
C28
C29
C30
C31
C32
C33
C34
C51
C52
C53
C54
C56
C57
C58
C59
C60
C62
C63
C80
C89
C91
C95
CR1
CR5
CR6
CR10
R1
R2
R3
R4
R12
R13
R23
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
R54
R55
R65
R66
R67
R68
R69
R90
R91
R93
R151
R152
R153
R154
R155
R160
R191
K1
K2
K3
JP1
JP2
JP3
JP19
SYSRES
TP2
GND
TP5
Y1
Y2
Y3
T3
VR1
SW1
DS2
DS3
DS4
DS5
DS6
Q5
Q6
Q7
L1
L2
LOCAL
VOX
DTMF
VOICE PROMPTS
-BAL-

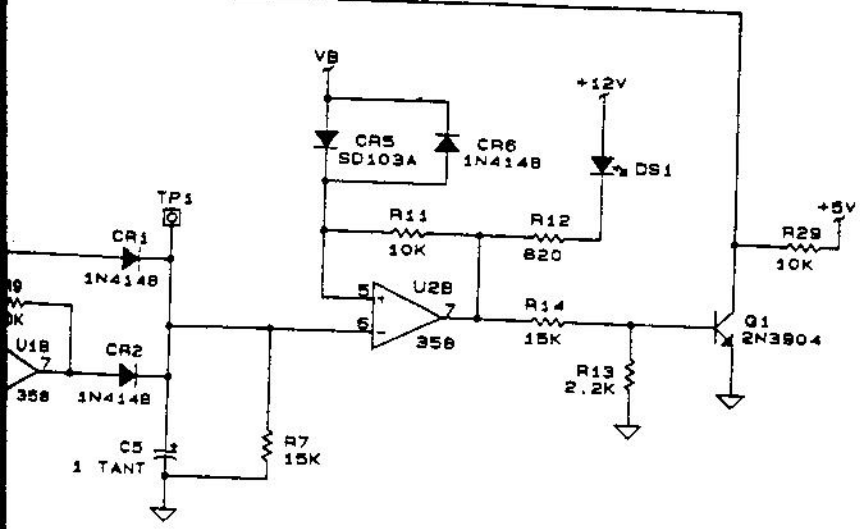
MODEL 4XB DIAL CLICK PARTS LIST (702-9242E)

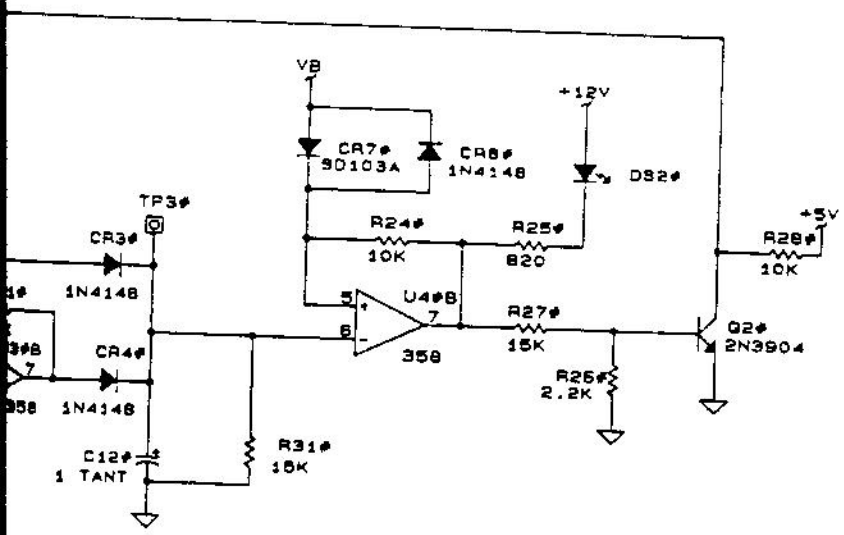
/ = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY
+ = OPTION (INSTALLED PER CUSTOMER ORDER)

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 25W +50%-10% AXIAL ALUMINUM ELECTROLYTIC	TLB1E220M
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 PLUSH WITH BASE.

REV	DESCRIPTION	DN	APD	DATE
D	ECN 817	GH		
E	ECN 864	GH	DCV	4-30-90





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.

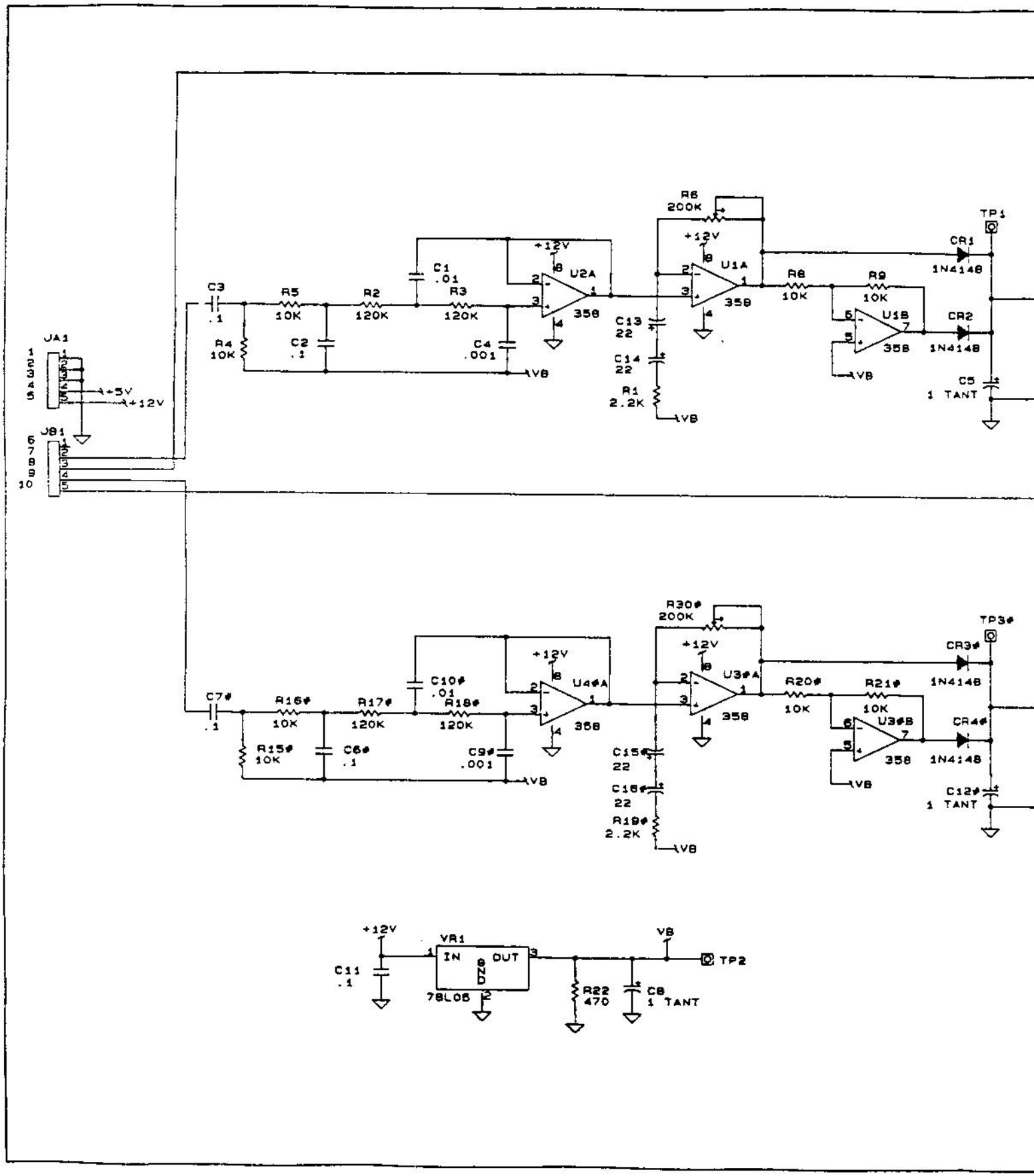
ZETRON, INC.
12338 134th COURT N.E.
REDMOND, WA 98052-2433

Title: M4XB DIAL CLICK

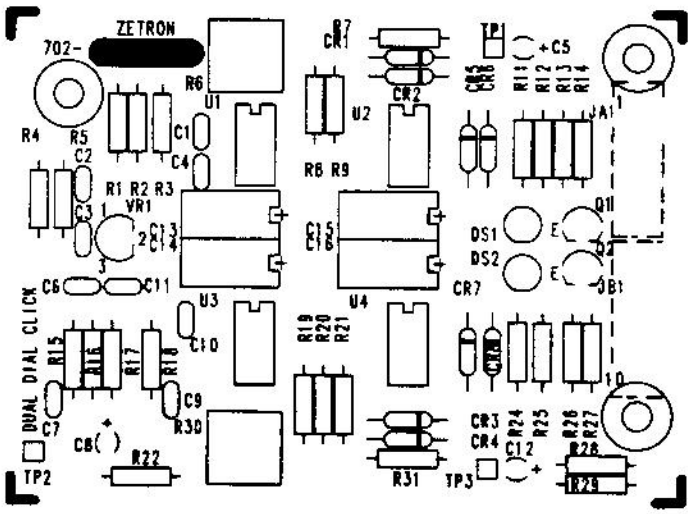
Size	Document Number	REV
B	006-0242	E

Date: April 30, 1990 Sheet 1 of 1

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



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



9. CONNECTIONS AND JUMPERS

INTRODUCTION

This section includes the connections to the Model 48'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 REPEATER MANAGER 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 REPEATER MANAGER 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 REPEATER MANAGER 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 Repeater Manager. 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 Repeater Manager. 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 Repeater Manager, 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

DEFAULT JUMPER SETTINGS

JUMPER	SET	FUNCTION	OPTIONS
JP- 1	out	RS-232 Power	In= +12 Volts to J1 Pin 6
2	out	Phone line jumpers	In= L2 pin 2= ground
3	out	" " "	In= L2 pin 5= ring detector
4	out	" " "	In= L1 pin 2= ground
5	out	" " "	In= L1 pin 5= ring detector
6	A	Tx Audio Hi/Lo	A= Hi B= Lo
7	out	L1 Answer OUT	In= L1 pin 6→ground=answered
8	A	Rx Tone NOR/DPL	A=CTCSS only B=CTCSS/CDCSS(DPL)
9	A	Rx Audio Gain	A= 20 dB B= 40 dB
10		Supply Ground	Etched--Do not cut
JP-11	A	Tx Tone Filter	A= Flat B= De-emphasized
12	A	Tx Subaud Filter	A= Flat B= De-emphasized
13	A	Tx Subaud Hi/Lo	A= Hi B= Lo
14	A	COR Mode	A= Internal Squelch B= Externally Supplied COR C= Voice operated (VOX)
15	A	COR Polarity	A= Active Lo B=Active Hi
16			
17	A	Tx Audio Filter	A= Flat B=De-emphasized
18		Delay	Etched
19	out	System Reset	In =Clears all system memory on power-up

A. APPENDIX

Model 48B Customer Option Sheet

Model Number: 48B CSA

Software Revision: 6.7

Zetron Order Number: 39195

Serial Number: 1562-062

Options installed have [X]

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

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

If you have service problems or need information about your Zetron unit, call Zetron at (206) 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.

USING THE DT TERMINAL EMULATOR

An IBM PC (or compatible) may be used to program the Repeater Manager. The computer must contain an RS-232 serial interface in order to function as a "dumb terminal". The only connections required between the Model 48 and the computer running "DT" are: Ground, Tx-data, and Rx-data (as described in "Computer or CRT Connections," section 7). The baud rate is defaulted to 1200 baud from the factory when programming with a modem. If you want to change it back to 300 baud you can change the modem baud rate in the system miscellaneous menu, run modem at 300 baud. Set to Yes for 300 baud. If needed you can change the baud rate with DTMF commands.

Zetron offers a terminal emulator program that enables the computer to communicate with the Model 48. The program is named DT.COM and is provided on floppy diskette. If the disk with the program is in drive A:, "DT" is run by typing DT and pressing the RETURN or ENTER key. The program begins and displays the title and communication settings (Figure A1). Pressing a function key (F1-F7) will change the corresponding setting. Pressing the function key F10, will exit the program. Pressing the Home key will clear the screen and begin serial communications. Any key you type is then sent to the Model 48 and back to the PC to be displayed. Characters sent from the Model 48 are displayed. Pressing the RETURN key will "bring up" or display the Model 48 "Top Level" menu. To end communications and return to the "DT settings" screen, press the Home key again. The DT program only communicates with COM1:.

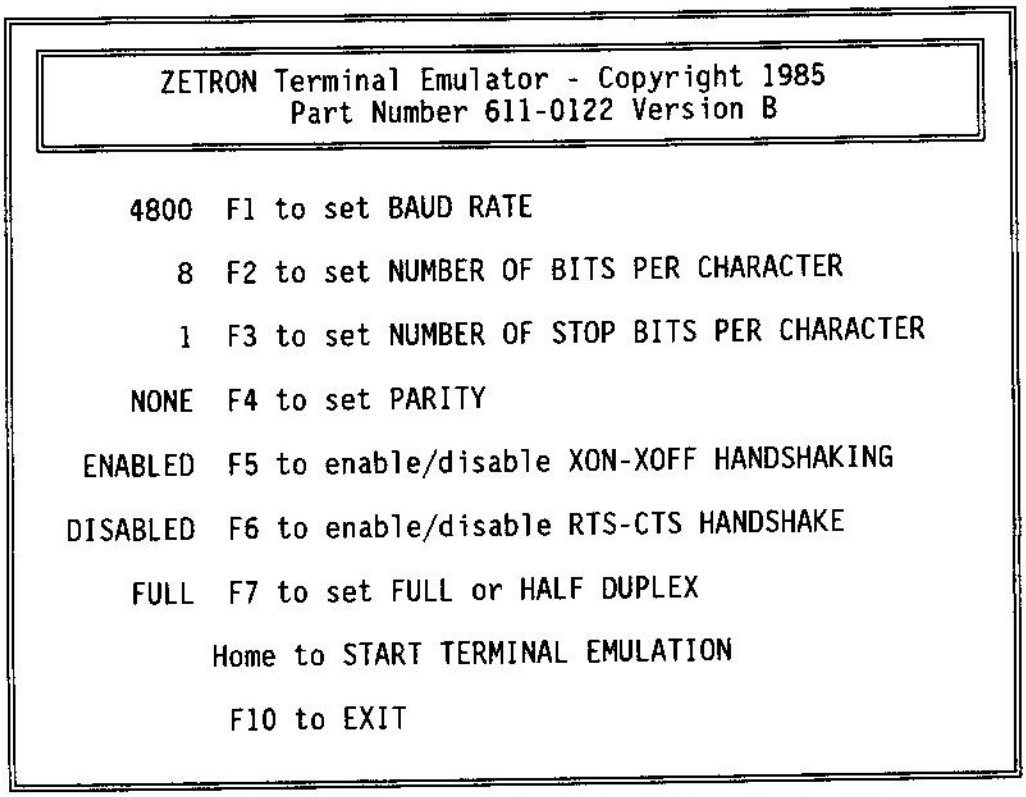


FIGURE A1: "DT" communication settings screen

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 M48 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 M48 and your CRT/Computer.

2. Check that data is coming out of the M48, pin 12 of U46, and pin 3 of J3. The data will come out each time you hit the reset button on the M48.

3. The TX data output of the M48 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 48	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: 77ile 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 48 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 48 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. Model 48 phone line (hybrid) balance poor.
      c. Be sure RS-232 cable is disconnected from Model 100.
      d. 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

P4.18 (NE PAS UTILISER) SI DCS

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 48 decodes and encodes, note that the Model 48 only decodes 22 codes for dispatch operation. When entering an encode number in the digital dispatch user menu, just enter the number of the code you wish to decode. In the user specific menu the digital number is preceded by the letter 'D' when entering an encode or decode code. When entering an encode code in the tone dispatch user menu the leading 'D' is required. 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 48 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 M48 returns dial tone; 2=No-Answer/Ring-out, the M48 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.

DTMF PROGRAMMING REFERENCE

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 *)	
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)
113	!SAC		DIAL CLICK	
DISPATCH				
58	!SHH	0-250	REPEATER HOLD TIME (30)	X100(MS)
16	!SHS	2-30	CTCSS HOLD TIME (8)	X100(MS)
57	!SHT	1-10	REPEATER TIME-OUT TIME (3)	(MIN)
124	!SHI	1-25	HOG MODE IDLE TIME (5)	(SEC)
125	!SHL	1-99	HOG MODE LIMIT TIME (5)	(MIN)
126	!SHP	1-250	HOG MODE PENALTY TIME (30)	X10(SEC)
127	!SHR	1-99	DISPATCH I.D. RATE (15)	(MIN)
*56	!SHD	0-1	TONE REQUIRED FOR DISPATCH (1)	(0=NO,1=YES)
63	!SHC	0-1	DISPATCH COURTESY TONE (1)	(0=NO,1=YES)
129	!SHM	0-1	STUCK MIC I.D. ENABLE (0)	(0=NO,1=YES)
132	!SHX	0-1	INVERT DIGITAL TX (0)	(0=NO,1=YES)
139	!SHO	0-1	INVERT DIGITAL RX (0)	(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	RTX SIGNALING ENABLE (0)	(0=OFF,1=ON)
65	!SPT	5-25	TALK TIME (5)	(SEC)
20	!SPV	0-50	VOX HOLD TIME (7)	X100(MS)
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)
172	!SIS	1-10	STATION I.D.	(CHARS)
AUTODIALS				
163	!SD1	0-16	AUTODIAL NUMBER 1	(DIGITS)
:	!SDn	0-16	AUTODIAL NUMBERS 2-8	(DIGITS)
171	!SD9	0-16	AUTODIAL NUMBER 9	(DIGITS)

DTMF PROGRAMMING REFERENCE (cont'd)

DTMF	MENU	RANGE	DESCRIPTION	
TOLL RESTRICTS				
71	!SV1	1-20	MAX TOLL DIGITS SET 1 (15)	
173	!SV2	1-4	TOLL RESTRICT SET 1 FIRST DIGITS	(DIGITS)
174	!SV3	1-4	TOLL RESTRICT SET 1 SECOND DIGITS	(DIGITS)
72	!SV4	1-20	MAX TOLL DIGITS SET 1 (15)	
175	!SV5	1-4	TOLL RESTRICT SET 2 FIRST DIGITS	(DIGITS)
176	!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	0-25	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)
**114	!STB	0-1	BROKEN RING FOR BUSY (0)	(0=OFF,1=ON)
MISCELLANEOUS				
*101	!SMD	1-10	COURTESY TONE DURATION (3)	X25(MS)
15	!SMF	35-250	COURTESY TONE FREQUENCY (54)	X10(HZ)
180	!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)
141	!SME	0-1	DID DELAYED BILLING (0)	(0=NO,1=YES)

DTMF PROGRAMMING REFERENCE (cont'd)

DTMF	MENU	RANGE	DESCRIPTION	
USER TONE DISPATCH				
119	!UTU	1-38	TONE DISPATCH USER NUMBER	
21	!UTE	0-1	DISPATCH USER ENABLE (0)	(0=NO,1=YES)
22	!UTR	0-1	DISPATCH USER RESERVE (0)	(0=NO,1=YES)
118	!UTX	1-143	DISPATCH USER TX TONE/CODE (0=NONE, 1-38=CTCSS, 40-143=DIGITAL)	
23	!UTT	0-1	DISPATCH USER TONE IN TAIL (0)	(0=NO,1=YES)
24	!UTV	0-1	DISPATCH USER PRIVACY (0)	(0=NO,1=YES)
25	!UTO	0-1	DISPATCH USER COURTESY TONE (0)	(0=NO,1=YES)
128	!UTH	0-1	DISPATCH USER HOG ENABLE (0)	(0=NO,1=YES)
181	!UTM	1-8	DISPATCH USER MORSE I.D.	(CHARS)
USER DIGITAL DISPATCH				
135	!UDU	1-22	DIGITAL DISPATCH USER NUMBER	
134	!UDC	0-104	DIGITAL DISPATCH USER RX CODE	
USER SPECIFIC				
30	!USU	1-99(325)	USER NUMBER	
82	!USE	0-1	USER ENABLE (0)	(0=NO,1=YES)
160	!USA	1-8	USER ANI STRING	(DIGITS)
41	!USF	0-6	PAGE FORMAT (0) (0=NONE, 1=ADTMF, 2=BDTMF, 3=2805, 4=2T, 5=5/6T, 6=GMARC)	
161	!USP	VAR	USER PAGING CODE	
53	!USX	0-143	USER TONE/CODE TX	
130	!USR	0-143	USER TONE/CODE RX (0=NONE, 1-38=CTCSS, 40-143=DIGITAL)	
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	!UAH	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)	

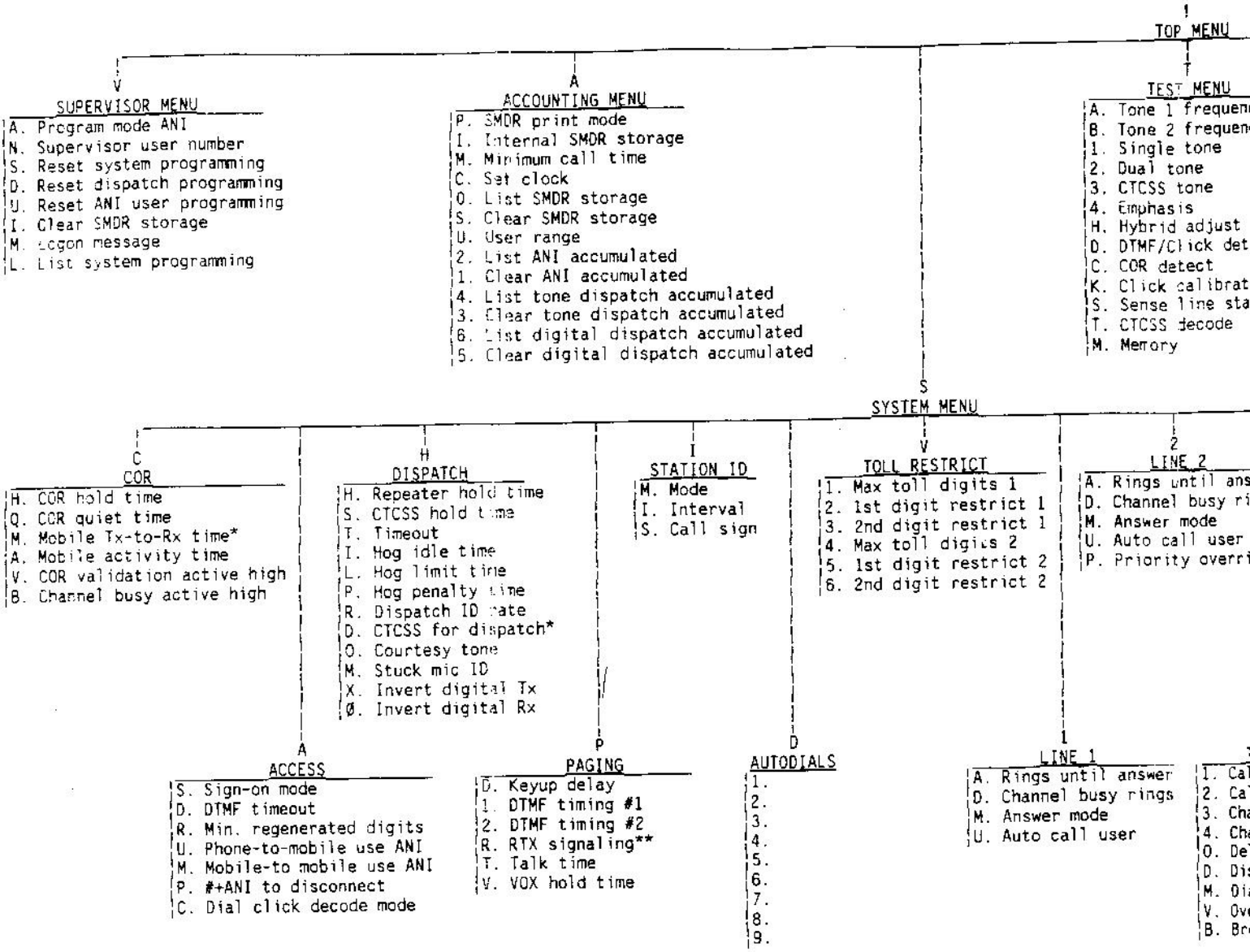
NOTE: FOR ALL OTHER DIGITAL DISPATCH USER PROGRAMMING USE THE DTMF COMMANDS SHOWN UNDER TONE DISPATCH

DTMF PROGRAMMING REFERENCE (cont'd)

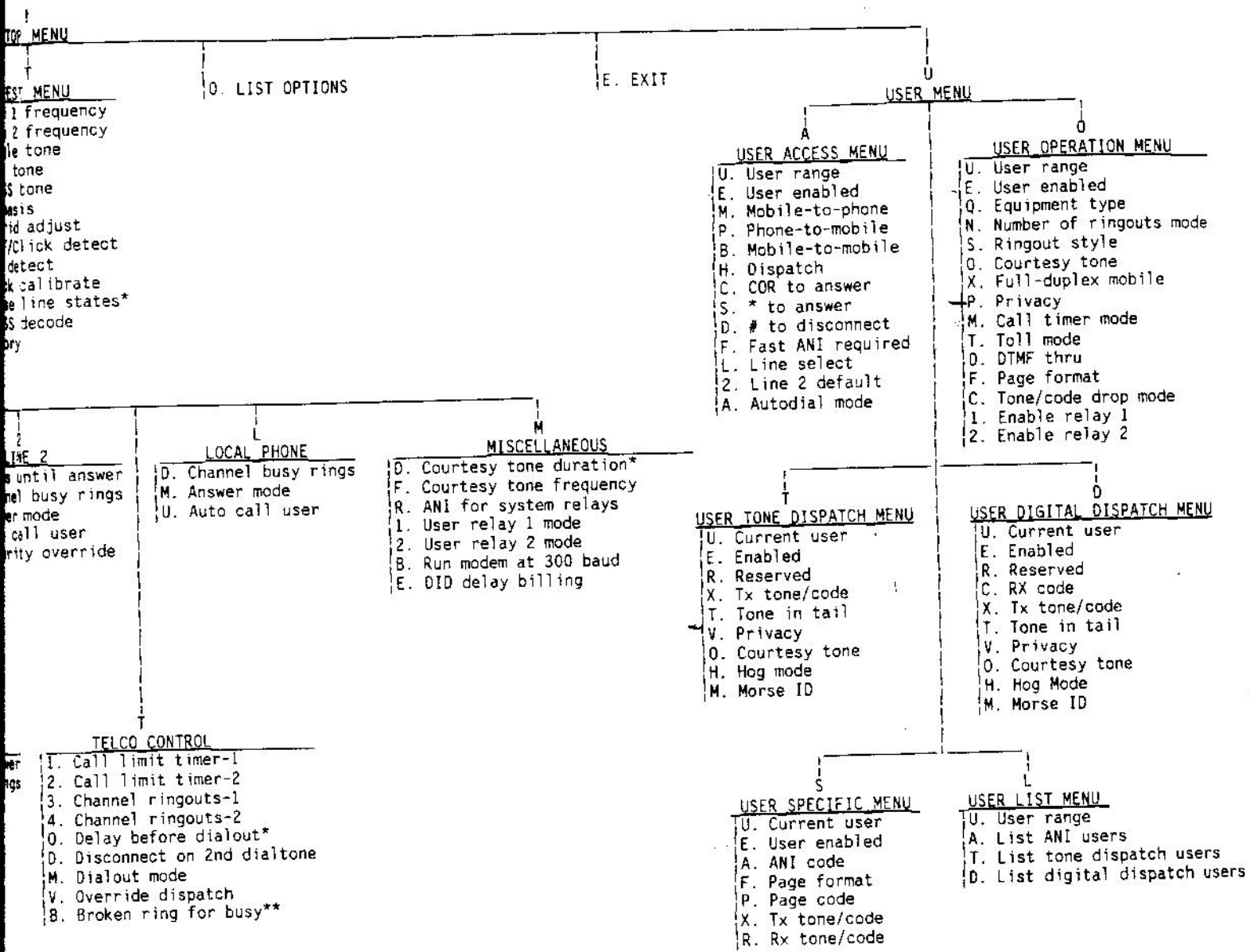
DTMF	MENU	RANGE	DESCRIPTION
USER OPERATION			
66	!UOQ	0-4	USER EQUIPMENT TYPE (0) (0=MOB,1=T/B,2=T+V,3=TO, 4=DIRECT)
39	!UON	1-2	USER CHANNEL RINGOUTS
40	!UOS	0-7	USER RINGOUT STYLE
14	!UOO	0-1	USER COURTESY TONE (1) (0=NO,1=YES)
81	!UOX	0-1	USER FULL DUPLEX MOBILE (0) (0=NO,1=YES)
31	!UOP	0-1	USER PRIVACY (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)
SUPERVISOR			
177	!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	35-100	TONE #1 FREQUENCY X10(HZ)
103	!TB	35-100	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	0-38	CTCSS TONE OUT (0) (0=TONE OFF,1-38=TX TONE)
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	0-1	SMDR OUTPUT TO PRINTER (1) (0=NO,1=YES)
89	!AI	0-1	INTERNAL SMDR STORAGE (1) (0=NO,1=YES)
90	!AM	1-180	MINIMUM CALL TIME (1) (SEC)
178	!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)
0*0#	EXIT PROGRAMMING		

*does not apply to software version 6.3 and later
**applies only to software version 6.3 and later

MODEL 48 MENU PROGRAMMING STRUCTURE



*does not apply to software version 6.3 and later
**applies only to software version 6.3 and later


TOP MENU
O. LIST OPTIONS
E. EXIT
U
USER MENU
A
USER ACCESS MENU
U. User range
E. User enabled
M. Mobile-to-phone
P. Phone-to-mobile
B. Mobile-to-mobile
H. Dispatch
C. COR to answer
S. * to answer
D. # to disconnect
F. Fast ANI required
L. Line select
2. Line 2 default
A. Autodial mode
O
USER OPERATION MENU
U. User range
E. User enabled
Q. Equipment type
N. Number of ringouts mode
S. Ringout style
O. Courtesy tone
X. Full-duplex mobile
P. Privacy
M. Call timer mode
T. Toll mode
D. DTMF thru
F. Page format
C. Tone/code drop mode
1. Enable relay 1
2. Enable relay 2
L
LOCAL PHONE
D. Channel busy rings
M. Answer mode
U. Auto call user
M
MISCELLANEOUS
O. Courtesy tone duration*
F. Courtesy tone frequency
R. ANI for system relays
1. User relay 1 mode
2. User relay 2 mode
B. Run modem at 300 baud
E. DID delay billing
T
USER TONE DISPATCH MENU
U. Current user
E. Enabled
R. Reserved
X. Tx tone/code
T. Tone in tail
V. Privacy
O. Courtesy tone
H. Hog mode
M. Morse ID
D
USER DIGITAL DISPATCH MENU
U. Current user
E. Enabled
R. Reserved
C. RX code
X. Tx tone/code
T. Tone in tail
V. Privacy
O. Courtesy tone
H. Hog Mode
M. Morse ID
T
TELCO CONTROL
1. Call limit timer-1
2. Call limit timer-2
3. Channel ringouts-1
4. Channel ringouts-2
O. Delay before dialout*
D. Disconnect on 2nd dialtone
M. Dialout mode
V. Override dispatch
B. Broken ring for busy**
S
USER SPECIFIC MENU
U. Current user
E. User enabled
A. ANI code
F. Page format
P. Page code
X. Tx tone/code
R. Rx tone/code
L
USER LIST MENU
U. User range
A. List ANI users
T. List tone dispatch users
D. List digital dispatch users