

**ZETRON**

**Model 48-MAX  
Interconnected Repeater Panel  
Technical Manual**

**Part No. 025-9344E**

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



# Table of Contents

1. INTRODUCTION	
SYSTEM FEATURES.....	1-2
PROGRAMMING .....	1-3
Supervisor User.....	1-3
Enhanced Toll Restriction .....	1-3
Interconnect Hog Mode .....	1-4
Scheduled Telco Access .....	1-4
INTERCONNECT OPTIONS .....	1-4
Model 48-MAX, Basic .....	1-4
Model 48-MAX, Selcall .....	1-4
Model 48-MAX, Roamer.....	1-4
Call Detail Option.....	1-5
Voice Prompts Option.....	1-5
Dial Click Option.....	1-5
Kit Options.....	1-5
ABOUT THIS MANUAL .....	1-6
TYPOGRAPHICAL CONVENTIONS.....	1-6
2. SPECIFICATIONS	
PHYSICAL SPECIFICATIONS .....	2-1
DISPATCH CAPACITY .....	2-1
INTERCONNECT CAPACITY .....	2-1
ACCOUNTING SPECIFICATIONS .....	2-1
DECODER SPECIFICATIONS.....	2-2
SIGNALING SPECIFICATIONS .....	2-2
TELEPHONE INTERFACE SPECIFICATIONS.....	2-2
End-to-End.....	2-3
Local Phone .....	2-3
RADIO INTERFACE SPECIFICATIONS .....	2-3
ADDITIONAL SPECIFICATIONS.....	2-3
3. OPERATION	
INTERCONNECT OVERVIEW.....	3-1
TELCO ORIGINATED CALLS .....	3-2
Call Setup (Telco).....	3-2
Telephone-to-Mobile Calls.....	3-3
Telephone-to-Talkback Mobile Calls .....	3-3
Telephone-to-Tone-Only Pager Calls.....	3-4
Telephone-to-Tone-and-Voice Pager Calls .....	3-4
MOBILE ORIGINATED CALLS.....	3-4
Call Setup (Mobile) .....	3-5
Mobile-to-Telephone .....	3-5
Mobile-to-Mobile.....	3-6
ANI Mobile-Repeat .....	3-6

## Table of Contents (Continued)

DISCONNECT TONES .....	3-7
ENHANCED TOLL RESTRICTION .....	3-8
North American Plans .....	3-9
Universal Plan .....	3-11
General Features .....	3-11
PBX OPERATION .....	3-13
Internal Calls .....	3-13
External Calls .....	3-13
Hook Flash .....	3-14
Interconnect Hog Mode .....	3-14
Call Alert Beeps .....	3-14
Autodials .....	3-14
ACCESS AND DISCONNECT ANI's .....	3-16
Access ANI .....	3-16
Short Sign-on .....	3-16
ANI Sign-on .....	3-17
Steering Digits .....	3-17
Disconnect ANI .....	3-17
ANI Digit Timing .....	3-17
SCHEDULED TELCO ACCESS .....	3-18
PAGE FORWARD .....	3-18
AUXILIARY INPUT .....	3-18
AUXILIARY OUTPUT .....	3-18
REPEATER PANEL OPERATION .....	3-19
Tone Validation .....	3-19
Reserved Tone .....	3-19
Tone-in-Tail .....	3-19
Privacy .....	3-19
Courtesy Bip .....	3-19
Tail Bips .....	3-20
Transmit Hold Time .....	3-20
Morse ID .....	3-20
Hog Mode .....	3-20
TX Timeout .....	3-20
Stuck Mic ID .....	3-20
Carrier Squelch Repeat .....	3-20
DTMF Repeat .....	3-21
INTERCONNECT GATEWAY .....	3-21
How It Works .....	3-21
Call Setup .....	3-21
Call Clear Down .....	3-23
System Setup .....	3-23
Four Site Example .....	3-24
Operation .....	3-27

## Table of Contents (Continued)

### 4. PROGRAMMING

XON / XOFF PROTOCOL .....	4-2
SERIAL INTERFACE CONNECTIONS .....	4-2
TYPICAL CONNECTION TO A COMPUTER OR VIDEO TERMINAL .....	4-3
MODEL 48-MAX MENU STRUCTURE.....	4-4
PROGRAMMING CONVENTIONS.....	4-4
CONVENIENCE FEATURES .....	4-6
QUICK EXAMPLES.....	4-7
Interconnect Only .....	4-7
Dispatch Only .....	4-8
Interconnect and Dispatch .....	4-8
ACCESSING A MODEL 48-MAX BY MODEM.....	4-11
Terminal Emulation Mode Example.....	4-12
Using the Terminal in Microsoft Windows .....	4-13
DEVICE CONFIGURATION AND BILLING DATA .....	4-15
Billing File Formats .....	4-15
FILE TRANSFER ACCESS MODE.....	4-21
Script Files for ProComm Plus .....	4-23
DETAILED LISTING MENU .....	4-26
HOW TO PROGRAM ANI'S IN THE MODEL 48-MAX .....	4-28
Short Sign-on .....	4-29
Multi-Digit ANI.....	4-29
ANI Conflicts.....	4-29
SYSTEM EXAMPLES.....	4-30
Short Sign-on .....	4-30
Multi-digit ANI.....	4-35
Steering Digit Applications .....	4-38
Wild ANI .....	4-41

### 5. FEATURE SET REFERENCE

INTERCONNECT FUNCTIONS.....	5-2
Access ANI.....	5-2
Add/Delete/View Prefix .....	5-3
Airtime .....	5-4
ANI Mobile-repeat.....	5-5
Answer Type.....	5-6
Autocall User (Line 1, Line 2).....	5-7
Autodials - Autodials Mode.....	5-8
Busy Tone Disconnect - 2nd Dialtone Disconnect.....	5-10
Call Detail Logging .....	5-11
Call Limit Time - Extended Call Limit.....	5-13
Call Alert Beeps.....	5-14
Clear Airtime Records .....	5-15
Clear Call Detail Records .....	5-16
Cordless Telephone User .....	5-17

## Table of Contents (Continued)

Courtesy Tone.....	5-18
CTCSS/DCS Decode - CTCSS/DCS Encode.....	5-19
CTCSS/DCS Drop .....	5-20
DCS Decode (polarity) - DCS Encode (polarity) .....	5-21
Dialout Mode .....	5-22
Disconnect ANI .....	5-23
Dispatch Override .....	5-24
Display Statistics.....	5-25
DTMF On Time - DTMF Off Time.....	5-26
DTMF-t Collect Time .....	5-27
DTMF-t Reset Time.....	5-28
DTMF-t Reset Digit.....	5-29
DTMF Interdigit Time .....	5-30
Enabled .....	5-31
Equipment Type.....	5-32
Emergency Prefix.....	5-34
Fast ANI Access .....	5-35
Hookflash Mode.....	5-36
ID Call Sign - ID Interval - ID Speed .....	5-37
Interconnect Hog Mode - Interconnect Hog Time.....	5-38
Interconnect Privacy .....	5-39
Interconnect - Allowed Days / Restricted Days.....	5-40
Interconnect - Start Time / Stop Time .....	5-40
Keyup Delay .....	5-42
Line Select .....	5-43
Line Connection (Line 1, Line 2) .....	5-44
List Airtime Records.....	5-45
List Call Detail Records (SMDR).....	5-46
List Users .....	5-47
Log Errors in Call Detail Records .....	5-48
Loop Disconnect Time.....	5-49
Maximum Regenerated Digits - Minimum Regenerated Digits .....	5-50
Minimum Call Duration.....	5-51
Mobile Activity Time .....	5-52
Mobile Answer Time .....	5-53
Mobile Ringout.....	5-54
Mobile-to-Mobile.....	5-55
Mobile-to-Phone .....	5-56
Multiple Line Menu .....	5-57
Overdial (Line 1, Line 2, Local, Mobile-to-Mobile) .....	5-59
Overdial Prompt.....	5-60
Page Forward User.....	5-61
Pager Talk Time.....	5-62
PBX Outside Line Digit.....	5-63
PBX Extension Length .....	5-64

## Table of Contents (Continued)

Phone-to-Mobile .....	5-65
Priority Override .....	5-66
Program Access Code .....	5-67
PSTN Feature Code .....	5-68
Reset System Database / User Database to Factory Default .....	5-69
Rings Before Answer (Line 1, Line 2) .....	5-70
Ringouts Sent to Mobile .....	5-71
RS-232 Port Speed.....	5-72
Scheduled Telco Access .....	5-74
Selcall Capcode.....	5-75
Selcall Format .....	5-81
Set Date - Set Time .....	5-82
Site Name.....	5-83
Steering Digit Prompt .....	5-84
Supervisor User.....	5-85
System Memory Test .....	5-86
Toll Restrict Menu .....	5-87
Toll Restrict Plan .....	5-87
Toll Restrictions.....	5-88
Unerase Call Detail Records (SMDR).....	5-90
User Range.....	5-91
Video Mode .....	5-93
Voice Prompts.....	5-94
Wild ANI .....	5-96
REPEATER PANEL FUNCTIONS .....	5-97
Airtime .....	5-97
Carrier Squelch Repeat .....	5-98
Courtesy Bip - Tail Bips .....	5-99
DTMF Repeat .....	5-100
Decode .....	5-101
Encode.....	5-101
Enabled .....	5-102
Encode During TX Hold.....	5-103
Hog Mode .....	5-104
Hog Idle .....	5-104
Hog Limit.....	5-105
Hog Penalty.....	5-105
ID Rate .....	5-106
Initial TX Hold Time - TX Hold Time .....	5-107
List Users .....	5-108
Morse ID .....	5-109
Privacy .....	5-110
Reserved.....	5-111
Stuck Mic ID.....	5-112
TX Timeout.....	5-113

## Table of Contents (Continued)

User Range.....	5-114
6. INSTALLATION	
INSTALLATION WARNING .....	6-1
GENERAL.....	6-1
REQUIRED TEST EQUIPMENT.....	6-1
TYPICAL CONNECTIONS .....	6-2
INSTALLATION PROCEDURE.....	6-3
RESETTING TO FACTORY DEFAULTS .....	6-5
LOCAL TELEPHONE .....	6-5
TESTS AND ADJUSTMENTS.....	6-6
FINAL CHECKS BEFORE LEAVING THE SITE.....	6-11
OPTIONAL CONNECTIONS .....	6-11
RADIO-SPECIFIC CONNECTIONS .....	6-11
GE MASTR III Base/Repeater .....	6-12
GE MASTR II Base/Repeater.....	6-13
GE Exec II Base.....	6-14
ICOM IC-RP1510 Repeater.....	6-15
E.F. Johnson CR1010 Repeater .....	6-16
E.F. Johnson CR1010 Repeater (Alternate Hookup).....	6-17
E.F. Johnson Viking Universal Station.....	6-18
Kenwood TKR-720 / TKR-820 Repeater .....	6-19
Motorola GR300 Repeater (or Two GM300 Radios).....	6-20
Motorola MTR2000 Stations .....	6-21
Motorola MSF 5000 Analog Repeater.....	6-22
Motorola MSF 5000 Digital Repeater .....	6-23
Motorola MCR-100 / RADIUS R-100 .....	6-24
Tait T800 Series Repeater.....	6-25
Tait T300 Series Radio .....	6-26
IN CASE OF DIFFICULTY.....	6-27
MISCELLANEOUS SERVICE NOTES.....	6-27
Upgrading to a New Version of Software.....	6-28
Installing New EPROMs .....	6-29
Call Detail Option (950-9587) Installation.....	6-30
Voice Prompts Option (950-9588) Installation .....	6-31
Dial Click Option (950-9589) Installation.....	6-32

## Table of Contents (Continued)

### 7. REPAIR

MODEL 4X-MAX AUDIO BLOCK DIAGRAM (006-0075A) .....	7-2
MODEL 4X-MAX CONTROL BOARD (702-9710D) .....	7-3
Parts List .....	7-3
Schematic .....	7-8
Silkscreen .....	7-13
MODEL 4XB VOICE CARD (702-9236F) .....	7-14
Parts List .....	7-14
Schematic .....	7-15
Silkscreen .....	7-16
MODEL 4XB DIAL CLICK BOARD (702-9242E) .....	7-17
Parts List .....	7-17
Schematic .....	7-18
Silkscreen .....	7-19

### 8. QUICK REFERENCE

CTCSS TONES .....	8-1
DIGITAL SQUELCH CODES .....	8-2
DTMF-t SIGNALING .....	8-3
TWO-TONE SIGNALING .....	8-4
Two-Tone Timing .....	8-4
Two-Tone Tone Groups .....	8-5
Two-Tone Codeplans .....	8-6
FIVE-TONE SIGNALING .....	8-7
Five-Tone Groups/Timing .....	8-7
VOICE PROMPTS .....	8-8
DTMF COMMANDS .....	8-9
EXPERT COMMANDS .....	8-11
MODEL 48-MAX PROGRAMMING MENU TREE .....	8-13

CUSTOMER FEEDBACK FORMS

CHANGE INFORMATION

## List of Figures

Figure 4-1 Model 48-MAX Menu Structure.....	4-4
Figure 4-2 CCITT V.25 Answer Sequence.....	4-11
Figure 6-1 Typical Model 48-MAX Installation .....	6-2
Figure 6-2 Model 48-MAX Cable Connector Pin Numbers and Descriptions.....	6-3
Figure 6-3 Jumper JP31 Settings .....	6-4

## List of Tables

Table 3-1 User Programming for Interconnect Gateway.....	3-26
Table 3-2 Interconnect Gateway Call Progress .....	3-28
Table 4-1 Model 48-MAX DB-9 Pin-out .....	4-2
Table 4-2 Zetron Configuration.....	4-3
Table 4-3 AT Configuration .....	4-3
Table 4-4 Billing Data Record Fields .....	4-16
Table 4-5 File Transfer Access Mode Commands .....	4-22
Table 4-6 ANI User Listing Key .....	4-27
Table 5-1 User Equipment Types .....	5-32
Table 5-2. Toll Restrict Levels .....	5-88
Table 5-3. Toll Restrict Qualifiers.....	5-88
Table 5-4 Voice Prompt Messages .....	5-95

## **WARRANTY STATEMENT**

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

## **LIMITATION OF LIABILITY**

Zetron makes no representation with respect to the contents of this document and/or the contents, performance, and function of any accompanying software and specifically disclaims any warranties, expressed or implied, as to merchantability, fitness for purpose sold, description, or quality.

Further, Zetron reserves the right to revise this document or the accompanying software and to make changes in it from time to time without obligation to notify any person or organization of such revisions or changes.

This document and any accompanying software are provided “as is.” Zetron shall not under any circumstances be responsible for any indirect, special, incidental, or consequential damages or losses to the buyer or any third party arising out of or connected with the buyer’s purchase and use of Zetron’s products or services.

## **COPYRIGHT**

This publication is protected by copyright by Zetron, Inc. and all rights are reserved worldwide. This publication may not, in whole or in part, be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form without prior written consent from Zetron, Inc.

The software in this product is protected by copyright by Zetron, Inc. and remains the property of Zetron, Inc. Reproduction, duplication, or disclosure is not permitted without prior written consent of Zetron, Inc.

## **TRADEMARKS**

Zetron is a registered trademark of Zetron, Inc.

All other product names in this document are trademarks or registered trademarks of their respective owners.

## **FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS**

1. This device complies with Part 68 of the FCC rules. The FCC registration number of this device and the ringer equivalence number if requested, must be reported to the telephone company. The FCC registration number and the ringer equivalence number may be found on the label attached to the device.
2. The ringer equivalence number (REN) is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. The sum of ringer equivalence numbers for all devices connected to a single telephone line should not exceed five (5.0) for reliable operation. To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.
3. If this device causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify you as soon as possible. You will also be advised of your right to file a complaint with the FCC if you believe it is necessary.
4. The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of this equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.
5. This device must not be installed on coin-operated telephone lines or party lines.
6. Repair work on this device must be done by Zetron, Inc. or a Zetron authorized repair station. If this device is causing harm to the telephone network the telephone company may request that you disconnect the equipment until the problem is resolved.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

Changes or modifications not expressly approved by the manager of Zetron's compliance department can void the FCC authorization to operate this equipment.

## **INDUSTRY CANADA REGISTRATION**

**NOTICE:** The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). 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. 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 coordinated by a representative 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.

**NOTICE:** The **Ringer Equivalence Number** (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

## **CANADIAN EMC COMPLIANCE NOTICE**

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

## **AVIS CANADIEN**

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



## DECLARATION OF CONFORMITY



**Manufacturer Name and Address:**

Zetron, Inc.  
12034 134th CT. NE  
Redmond, WA 98052, USA

**European Union Representative:**

Zetron, Inc.  
28 Campbell Court,  
Campbell Road,  
Bramley, Basingstoke,  
Hants, RG26, UK

Declares that the Product: **Model 48 MAX Repeater Controller**

In Application of Council Directives: EU EMC Directive 89/336/EEC  
EU Low Voltage Directive 73/23/EEC

Compliance was demonstrated to the following specifications:

Radiated Emissions	CISPR 22: 1993, EN 55022 Class B
Conducted Emissions	CISPR 22: 1993, EN 55022 Class B
Electrostatic Discharge (ESD) Immunity	IEC 801-2:1992, EN 50082-1, 3KV CD, 8KV AD
Radiated RF Immunity	IEC 801-3:1984, EN 50082-1, 3V/m
Electrical Fast Transient Immunity	IEC 801-4:1988, EN 50082-1, 0.5 kV Signal Lines 1.0 kV Power Lines

Redmond, WA, USA  
March, 06

Robert E. Lawrence  
Compliance Manager



## 1. INTRODUCTION

SYSTEM FEATURES.....	1-2
PROGRAMMING .....	1-3
Supervisor User.....	1-3
Enhanced Toll Restriction .....	1-3
Interconnect Hog Mode .....	1-4
Scheduled Telco Access .....	1-4
INTERCONNECT OPTIONS .....	1-4
Model 48-MAX, Basic .....	1-4
Model 48-MAX, Selcall .....	1-4
Model 48-MAX, Roamer.....	1-4
Call Detail Option.....	1-5
Voice Prompts Option.....	1-5
Dial Click Option.....	1-5
Kit Options.....	1-5
ABOUT THIS MANUAL .....	1-6
TYPOGRAPHICAL CONVENTIONS .....	1-6

# 1. INTRODUCTION

Congratulations on your purchase of the Model 48-MAX Interconnected Repeater Panel, the latest, most powerful shared customer interconnect available from Zetron, Inc. It is designed for service providers who need the utmost in performance in order to compete effectively with cellular telephone systems, trunking operations and other threats to conventional mobile telephone service.

The Model 48-MAX can be equipped with previously unavailable capabilities, such as owner recordable voice prompts, interconnect hog mode and Wild ANI for inter-system roaming. These and other features ensure continued profitability and competitiveness for providers of conventional interconnect service.

In addition to its usefulness to service providers, the Model 48-MAX is also ideal for private, customer-owned systems that need a high degree of versatility and numerous convenience features.

For ease of configuration the Model 48-MAX is available in three versions: Basic, Selcall and Roamer.

As a telephone interconnect, the Model 48-MAX provides individualized telephone service for 99 (Basic or Selcall) or 750 (Roamer) different (DTMF ANI) customers. The telephone interconnect provides all of the features of a multi-user interconnect plus the ability to add CTCSS/DCS encoding and decoding per user. The Model 48-MAX provides the complete interface between a transmitter, receiver and telephone line.

The Selcall version adds selective calling capabilities to the Basic Model 48-MAX. This allows each mobile or handheld to be individually called by the telephone party or another mobile. Included formats: DTMF, DTMF-t, Two-tone and Five-tone.

The Roamer version increases the ANI capacity from 99 to 750 plus adds Wild ANI to the Selcall version.

As a repeater panel, the Model 48-MAX supports encoding and decoding of all 50 CTCSS tones and 104 DCS codes for dispatch. It also includes airtime tracking of all tones/codes, a Morse ID for each tone/code, and Zetron's unique hog mode timers to prevent "airtime hogs" from monopolizing the channel.

Accounting information is accumulated by the Model 48-MAX for later review or billing purposes. The airtime used by each customer is tracked in an "Hours:Minutes:Seconds" format. Airtime can be either accumulated (count up) or pre-pay (count down). Optional call detail information, or SMDR (Station Message Detail Record) data, may be printed and stored in the Model 48-MAX. Call detail includes date, time, mobile ID number, telephone number or mobile number dialed, call length, call completion status and originating mobile's ANI.

## Section 1. Introduction

The Model 48-MAX may be remotely controlled and programmed over the telephone, via the internal modem, or locally with a computer running terminal emulation software, or an ANSI compatible terminal. Local programming can be done without taking the Model 48-MAX off line or out of service. Installation (signal levels and adjustments) and turning users ON/OFF can be done using DTMF from the phone or over the air.

### **SYSTEM FEATURES**

#### **General**

- Programmable via RS-232, internal 1200/2400 baud modem
- Setup and user enable/disable via DTMF over the air or over the phone
- Database upload/download via PC using XMODEM protocol
- Billing information download via PC using XMODEM protocol

#### **Interconnect (system)**

- Two normal telephone lines (B1), plus local telephone port
- Half-duplex and full-duplex modes
- Selective calling via DTMF, DTMF-t, Two-tone, Five/Six-tone
- Mobile-to-telephone DTMF and dial pulse regeneration
- 99 autodial telephone numbers plus last number redial
- Repeat audio for mobile-to-mobile calls
- AGC for high quality telephone-to-mobile audio
- Morse ID; 1-9 characters in length, 10 - 25 wpm
- Call progress and mobile ringout tone generation
- Call limit, extended call limit and mobile activity timers
- Telco over dial can be a user number, ANI, or autocall
- Intelligent dialing modes and flexible toll restrict programming
- Supervisor user, can answer or disconnect any call
- Call Alert beeps; lets users on the channel know that a line is ringing
- Scheduled Telco Access; restricts access during peak usage

#### **Interconnect per user (up to 750 users)**

- 1 to 10 digit DTMF Access and Disconnect ANI's
- Equipment type; mobile, pager, tone+voice, talkback
- Selective calling; DTMF, DTMF-t, Two-tone, Five/Six-tone
- CTCSS/DCS encoding and decoding
- Call answer sequence; PTT, “\*”, Access ANI
- Toll restrict type; none, blap, 0+, local, auto, PBX inside
- Privacy; repeat audio, or half-privacy masking tone
- Access privileges; phone-to-mobile, mobile-to-phone, mobile-to-mobile, ANI repeat
- Airtime tracking per user; Accumulate or Prepay
- Call limit normal or extended
- Interconnect Hog mode; prevents back to back calls by same user

- Call Detail filter; Log all calls, toll only, log nothing or minimum call duration
- Autodial modes; 99 + redial, block of 10, forced autodial
- Roaming or Wild ANI support with exclusion
- Radio call forwarding

### **Repeater Panel**

- All 50 CTCSS tones and 104 DCS codes standard
- Cross tone/code encoding
- Privacy mode for lockout of other tones during repeater hang time
- Airtime tracking for all tones/codes; Accumulate or Prepay
- Morse ID programmable per tone/code
- Stuck mic identification
- Courtesy tone or tail bips
- Reserved tone mode
- Airtime hog penalty mode
- Transmit hold timer per tone/code

### **PROGRAMMING**

Programming is accomplished with a ANSI terminal or computer through the local serial port, or over either one of the Model 48-MAX's telephone lines using the internal 1200/2400 baud modem. The Model 48-MAX is not disabled or taken off line during programming (only one phone line can be in operation at a time). Programming is designed to be simple and intuitive.

### **Supervisor User**

The Supervisor User may answer or disconnect any calls on the system simply by using his or her ANI. The supervisor also has direct control over the auxiliary output via a steering digit. The Supervisor also has the ability to “barge in” on any call that uses the privacy tone. If the Supervisor's tone is decoded while the privacy tone is in use, the Model 48-MAX drops the privacy tone and switches to full-duplex. This allows the Supervisor to monitor the conversation for any unauthorized uses.

### **Enhanced Toll Restriction**

Toll restriction has been enhanced over previous interconnect products in the Model 48-MAX. Two dialing plans for North America and a Universal plan for areas outside of North America have been incorporated. With either of the North American plans, the Model 48-MAX knows when the dialing is complete from the syntax of the telephone number being dialed. This eliminates the need for time-out timers and termination digits. The Universal plan allows the system operator to tailor a toll restrict plan to fit the installation. It uses a table of prefixes to define allowed and restricted prefixes. Timers and termination digits are used with the Universal plan. More support for PBX installations has also been added. You can now connect Line 1 as an extension on the PBX and Line 2 directly to the PSTN. The Model 48-MAX monitors the dialed digits and

## Section 1. Introduction

can determine an inside call on the PBX from a PSTN call. Based on the call type, the Model 48-MAX knows how and when to enforce the toll restrict programming.

### **Interconnect Hog Mode**

With this mode enabled, everybody on the system has a chance to gain access to the Model 48-MAX. It prevents the last user from making back to back calls and blocking other customers from using the system. The last user is locked out for the duration of the Interconnect Hog time. This can be programmed from 1 to 250 seconds. This mode is enabled/disabled on a per ANI basis.

### **Scheduled Telco Access**

This feature is included in the Selcall and Roamer versions of the Model 48-MAX. It allows the system operator to restrict interconnect access based on time of day and day of the week. If you restrict interconnect access to normal business hours, 8:00 AM to 5:00 PM for Monday through Friday, you can prevent access to the interconnect on a per user (radio) basis during nonbusiness hours. This feature can also be useful in a system where dispatch and interconnect are mixed. You can disable access to interconnect during the morning hours (giving priority to dispatch) and still be able to offer interconnect during the afternoon and evening hours.

## **INTERCONNECT OPTIONS**

### **Model 48-MAX, Basic**

The Basic version of the Model 48-MAX (901-9410) is the standard or base model in the Model 48-MAX line. It comes with 154 user repeater panel, 99 user ANI database, CTCSS/DCS encode/decode, Airtime accumulation, 99 autodials, XMODEM upload/download, enhanced toll restriction.

### **Model 48-MAX, Selcall**

The Selcall version of the Model 48-MAX (901-9411) includes all of the features of the 99 user Model 48-MAX Basic plus selective calling and Scheduled Telco access. Selective calling formats included are DTMF, DTMF-t, Two-tone and Five/Six-tone. Scheduled Telco access adds the ability to limit interconnect access to off hours on a per ANI basis. This gives priority to dispatch traffic during peak usage.

### **Model 48-MAX, Roamer**

The Roamer version of the Model 48-MAX (901-9412) includes all of the features of the Model 48-MAX Selcall with a 750 user database plus Wild ANI. This provides the ability to support a much larger customer base. The ability to do wild card programming with exclusion, can provide a powerful way of supporting a large, roaming customer base among many system sites. When used with the Call Detail Option, the actual ANI that accessed the system is also recorded in the billing record.

### **Call Detail Option**

Any version of the Model 48-MAX may be equipped with the Call Detail Option (950-9587). This option adds the ability to record, store and print SMDR (Station Message Detail Record) information on interconnect calls. Each record includes the time and date of the call, duration, user number and ANI against whom the call is billed, telephone number dialed, and call completion status. The Model 48-MAX will also log errors such as invalid user number overdialed or toll restriction invoked on the telephone number dialed. The records stored internally in the Model 48-MAX may be retrieved with any XMODEM-capable communications software and written to an ASCII text file. To help maximize the value of data that is stored internally, this option allows you to control or filter out which records are stored, both at the user and system level. All calls are always logged out the local RS-232 port in real time. On a system with heavy use, this means downloading less often. The maximum number of records that can be stored is 4000.

### **Voice Prompts Option**

Any version of the Model 48-MAX may be equipped with the Voice Prompt Option (950-9588). This option has 9 voice messages that give call progress information to the caller. These include 2 Welcome/sign-on messages (one for Telco and one for Mobile to Mobile), invalid user ID, restricted user, unable to complete call, proceeding with the call, start talking prompt, channel busy, and channel ID. The system operator can record any or all of the messages that pertain to his system. Experienced users can bypass the messages by entering DTMF at anytime.

### **Dial Click Option**

Any version of the Model 48-MAX may be equipped with the Dial Click decode Option (950-9589). This allows support of older telephone systems that have a mix of DTMF and Dial Click dialing.

### **Kit Options**

These kits provide alternative interface hardware for those who require them to match their equipment.

- *Relay Kit (950-9752)* - Any version of the Model 48-MAX may be equipped with a Relay Kit Option. This kit provides relay contacts for PTT and Auxiliary output. Standard units have a FET to ground for these outputs.
- *600Ω Audio Kit (950-9759)* - Any version of the Model 48-MAX may be equipped with a 600 Ohm audio kit. This kit provides two 600 ohm audio transformers to provide a 600 ohm balanced interface to the transmitter and receiver. Standard units have single ended, unbalanced interface.

## Section 1. Introduction

### **ABOUT THIS MANUAL**

In this manual, it is assumed that all the options of the Model 48-MAX are installed. To help you install and operate the Model 48-MAX as quickly as possible, this manual includes the following sections:

- |           |   |
|-----------|---|
| Section 1 | This section is an introduction to the Model 48-MAX, its features and available options.  |
| Section 2 | This section is a list of the physical and operational specifications on the Model 48-MAX.  |
| Section 3 | This section describes the operation and features of the Model 48-MAX.  |
| Section 4 | This section includes programming conventions, computer interface and system examples. It also includes a thorough discussion on ANI's in the Model 48-MAX. |
| Section 5 | This is a reference section. It covers each programmable function, its range, and how to program it.  |
| Section 6 | This section contains the installation procedure. Also included in this section are radio-specific interface diagrams.                                      |
| Section 7 | This section contains schematics and other repair information.  |
| Section 8 | This section contains reference tables and DTMF programming information.  |

### **TYPOGRAPHICAL CONVENTIONS**

Programmable functions are in *italics*.



## 2. SPECIFICATIONS

PHYSICAL SPECIFICATIONS .....	2-1
DISPATCH CAPACITY .....	2-1
INTERCONNECT CAPACITY .....	2-1
ACCOUNTING SPECIFICATIONS .....	2-1
DECODER SPECIFICATIONS .....	2-2
SIGNALING SPECIFICATIONS .....	2-2
TELEPHONE INTERFACE SPECIFICATIONS .....	2-2
End-to-End .....	2-3
Local Phone .....	2-3
RADIO INTERFACE SPECIFICATIONS .....	2-3
ADDITIONAL SPECIFICATIONS .....	2-3

## 2. SPECIFICATIONS

### PHYSICAL SPECIFICATIONS

Power	10.5-16V DC 700 mA or 9 - 12V AC 11 watts
Temperature	0 to 65 degrees Celsius
Size	19" W x 7.25" D x 1.75" H. 19" rack-mount
Weight	4.0 pounds

### DISPATCH CAPACITY

CTCSS tones	50
DCS codes	104

### INTERCONNECT CAPACITY

DTMF ANI codes	Full random programming, all 16 tone pairs
ANI capacity	99 / 750
ANI length	1 to 10 digits per user
ANI speed	1 to 14 digits per second
Validation	Any of the 50 CTCSS or 104 DCS codes can be used

### ACCOUNTING SPECIFICATIONS

Interconnect	Airtime per ANI, Accumulate or Prepay 99:59:59 maximum in HH:MM:SS format
Dispatch	Airtime per Tone/Code, Accumulate or Prepay 99:59:59 maximum in HH:MM:SS format
Call detail option	Records detailed call information including number dialed, Time/Date stamp, duration and ANI
Capacity	4000 records stored internally
Filtering	Toll only, All or none per ANI, Errors on/off, minimum call duration
Logging	All calls logged on local RS-232 port

## Section 2. Specifications

### **DECODER SPECIFICATIONS**

Frequency range	67.0 Hz to 254.5 Hz
Number of tones	50
Number of digital codes	104
Sensitivity	< -3dB SINAD
Acquisition time	typically < 200 msec

### **SIGNALING SPECIFICATIONS**

Frequency range	10 to 3500 Hz
Frequency accuracy	0.1%
Frequency stability	0.005%
Distortion	2% nominal
Two-tone	Motorola/GE all tone groups, code plans, and capcodes.
DTMF	1 to 8 digits per subscriber
DTMF-t	1 to 8 digits per subscriber
Five/Six-tone	EIA, EEA, PZVEI, CCIR single or dual address
CTCSS	50 tones
DCS	104 codes

### **TELEPHONE INTERFACE SPECIFICATIONS**

Lines	Two end-to-end (B1) phone lines, one local phone port for connection to desk set.
Connector	RJ11-C modular jack.
Progress tones	Dial tone, ringing, double ring, busy.

**End-to-End**

Ringer equivalence	0.4B
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.
Call disconnect	Busy tone, 2nd dialtone, call limit timer, mobile activity timer, loss of loop current.

**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 SPECIFICATIONS**

PTT	FET pull to ground.
COR	Dual time constant noise detector or voltage change.
CTCSS/DCS output	-40 to +6 dBm. 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. 25K ohm input.
Channel busy	Closure input from secondary receiver COR.

**ADDITIONAL SPECIFICATIONS**

Modem	Autodetection of 1200 baud Bell 212, CCITT V.22 and 2400 baud CCITT V.22 bis.
Indicators	Line 1, Line 2, Local, VOX, DTMF, Carrier, Decode, Transmit, Aux, Power.
Switch	Connect.
Station ID	Morse code, fixed 1200hz frequency, programmable call sign (1 to 9 characters) and rate.

## Section 2. Specifications

Equipment types	Tone-Only pager, Tone-and-Voice pager, Talkback pager, Mobile.
Prompt tones	Progress tones, error tones and warning tones sent to phone or mobile.
Programming	Programmable via RS-232 with local terminal, or remotely over phone lines using internal modem. Installation and user enable/disable via DTMF.
Data retention	Battery backed typically 5 years with no power.
Real time clock	Battery backed typically 5 years with no power.
Secondary protection	On End-to-End telephone lines.
Auxiliary output	FET pull to ground.



### 3. OPERATION

INTERCONNECT OVERVIEW .....	3-1
TELCO ORIGINATED CALLS .....	3-2
Call Setup (Telco).....	3-2
Telephone-to-Mobile Calls .....	3-3
Telephone-to-Talkback Mobile Calls .....	3-3
Telephone-to-Tone-Only Pager Calls .....	3-4
Telephone-to-Tone-and-Voice Pager Calls .....	3-4
MOBILE ORIGINATED CALLS .....	3-4
Call Setup (Mobile) .....	3-5
Mobile-to-Telephone .....	3-5
Mobile-to-Mobile.....	3-6
ANI Mobile-Repeat .....	3-6
DISCONNECT TONES .....	3-7
ENHANCED TOLL RESTRICTION .....	3-8
North American Plans.....	3-9
Universal Plan.....	3-10
General Features .....	3-11
PBX OPERATION .....	3-13
Internal Calls.....	3-13
External Calls.....	3-13
Hook Flash.....	3-14
Interconnect Hog Mode .....	3-14
Call Alert Beeps.....	3-14
Autodials .....	3-14
ACCESS AND DISCONNECT ANI's .....	3-16
Access ANI .....	3-16
Short Sign-on .....	3-16
ANI Sign-on.....	3-17
Steering Digits .....	3-17
Disconnect ANI .....	3-17
ANI Digit Timing .....	3-17
SCHEDULED TELCO ACCESS.....	3-18
PAGE FORWARD .....	3-18
AUXILIARY INPUT.....	3-18
AUXILIARY OUTPUT.....	3-18

Continued ...

REPEATER PANEL OPERATION .....	3-19
Tone Validation .....	3-19
Reserved Tone .....	3-19
Tone-in-Tail .....	3-19
Privacy .....	3-19
Courtesy Bip .....	3-19
Tail Bips.....	3-20
Transmit Hold Time.....	3-20
Morse ID .....	3-20
Hog Mode .....	3-20
TX Timeout.....	3-20
Stuck Mic ID.....	3-20
Carrier Squelch Repeat .....	3-20
DTMF Repeat .....	3-21
INTERCONNECT GATEWAY.....	3-21
How It Works.....	3-21
Call Setup.....	3-21
Call Clear Down .....	3-23
System Setup.....	3-23
Four Site Example.....	3-24
Operation .....	3-27



### **3. OPERATION**

The Model 48-MAX Interconnected Repeater Panel does just as its name describes. It is a full-featured radio-telephone interconnect with an integrated full-featured repeater panel. It is designed for installation on full-duplex control stations or repeaters with half and full duplex mobile radios. The Selcall version adds the functions of both a dial access paging terminal and a mobile-to-mobile paging encoder, allowing a mix of equipment types in one system. The Roamer version increases the ANI database size from 99 to 750 plus adds Wild ANI capability to the Selcall version.

Half-duplex and full-duplex radio systems have different transmit and receive frequencies. A full-duplex system allows the mobile to transmit and receive at the same time using two antennas or a duplexer in the mobile and in the repeater. A half-duplex system is similar but half-duplex mobiles don't have duplexers, nor do they have the ability to receive and transmit at the same time. This is because in half-duplex mobiles, the receiver and transmitter both share common circuitry in an effort to reduce the cost of the radios. Typical use would be mobiles and/or bases talking through a repeater.

The Model 48-MAX provides complete audio path control between the PSTN or PBX and control station or repeater. It also provides repeat audio for tone/code validated repeater (dispatch) operation. In addition, the unit can be programmed to provide repeat audio in handling no-tone dispatch or require ANI validation (with or without tone/code validation) to access dispatch operations.

For interconnect operation, each radio (user) may be specified as either a full or half duplex radio. When operating full-duplex, the audio from the phone line is always output to the transmitter. When operating half-duplex with repeat audio enabled, the radio's audio is repeated whenever the radio is transmitting. If privacy is enabled, a masking tone is transmitted when the radio is transmitting.

This section describes the functional operation of the Model 48-MAX. A description of the interconnect features and functions is first, followed by the repeater panel features and functions. Programming is handled in Section 4.

#### **INTERCONNECT OVERVIEW**

The Model 48-MAX Interconnected Repeater Panel is a multiple user, radio-telephone interconnect. Radios or mobiles can place and receive telephone (PSTN or PBX) calls through the Model 48-MAX. These types of calls are "Phone-to-mobile" and "Mobile-to-phone" calls. Radios or mobiles can also place and receive calls to other radios or mobiles through the Model 48-MAX. These types of calls are "Mobile-to-mobile" calls. Radios or mobiles can gain validated repeater access through the Model 48-MAX. These types of calls are "ANI mobile repeat". To accomplish this requires that the Model 48-MAX have some way of identifying each radio or mobile wishing to place or receive calls through it. The

## Section 3. Operation

Model 48-MAX has two ways of doing this, User number or ANI (Automatic Number Identification).

User number is simply an index into the User database (1-99 or 1-750). This is most commonly used as the radio ID number for phone-to-mobile and mobile-to-mobile calls. This keeps the over dial reasonably simple (2 or 3 digits) for the person calling in.

ANI numbers are used by radios or mobiles in gaining access to the Model 48-MAX from the radio channel. These can be a single DTMF digit (short sign-on) or a DTMF sequence up to 10 digits in length.

All interconnect calls, regardless of type, have three basic states:

### **Call setup, Conversation mode, Disconnect.**

**Call setup** is the sequence of events required to establish a call. On phone-to-mobile calls, this involves answering an incoming call, taking in a radio ID (user number or ANI), signaling the requested radio or mobile, and the called radio or mobile answering. On mobile- originated calls, this involves the radio or mobile sending its ANI, taking in a phone number or radio ID (User number or ANI), dialing a phone number or signaling the requested radio or mobile, and the called party (phone or radio) answering.

**Conversation mode** is the goal of interconnect, to allow the exchange of information between the parties. Various conversation timers are started which will ensure shutdown if the radio or mobile goes away. Various decoders that look for conditions to initiate a disconnect are also enabled.

**Disconnect** is the sequence of events required to shut down or terminate a call. This is the process where the Model 48-MAX returns to a state where it can process another call. Disconnect can be initiated by a DTMF sequence sent by the radio or mobile (Disconnect ANI), or the phone party (“#” or “#0”). Disconnect can be initiated by expiration of the call limit timer or mobile activity timer. Disconnect can be initiated by detection of second dialtone, busy signal or loss of loop current.

## **TELCO ORIGINATED CALLS**

Telco or telephone originated calls are those which are initiated by someone calling into the Model 48-MAX from the telephone side (dialing the telephone number to which the Model 48-MAX is connected). The destination or called party is someone on the radio channel in the Model 48-MAX's database. This can be a mobile, handheld transceiver, tone-only pager, tone and voice pager, Talkback pager.

### **Call Setup (Telco)**

To place a telco originated call, the caller must first dial the telephone number of the Model 48-MAX. After the specified *Rings before answer* have elapsed, it will answer the line and prompt the caller to over dial a number. This will be either a prompt tone (800Hz beep or Dial

tone) or a “welcome” voice prompt (prompt #1). The caller then overdials the number (user number or *Access ANI*) of the user (radio) they wish to contact. The Model 48-MAX then evaluates the number overdialed, if it finds an enabled user (radio), the Model 48-MAX responds with a “thank you” voice prompt (prompt #3), keys the transmitter and sends any required selective calling sequence (paging tones), followed by ringing tones to the mobile and the telephone caller. If the user (radio) is not enabled, error beeps or the “invalid user” voice prompt (prompt #4) will be sent to the telephone caller, and the call is disconnected. If the time restriction (Scheduled telco access) is not met for interconnect, the “interconnect not available at this time” voice prompt (prompt #8) is sent to the telephone, and the call request is terminated. The caller has 2 times the programmed *DTMF interdigit time* to enter the first overdialed digit. After the first digit, the specified *DTMF interdigit time* is the maximum time between digits. If no digits are overdialed, and an *Autocall user* has been programmed for that line, the Model 48-MAX will automatically call that user (radio). If not enough digits are dialed, the Model 48-MAX will error the caller off and disconnect the call.

### Telephone-to-Mobile Calls

The caller first gains access to the Model 48-MAX (see the previous subsection, “Call Setup (Telco)”). A valid user number or ANI has been entered, the Model 48-MAX has keyed the transmitter, sent any required selective calling sequence (paging tones) and is now sending ringing tones both to the mobile and the telephone caller. The mobile must answer the call as specified by *Answer type* for that user (radio) before the *Mobile answer time* expires or the call will be disconnected. The Model 48-MAX will ring on the channel, and to the telephone for the specified *Ringouts sent to mobile*. If the mobile does not answer, the “your call cannot be processed at this time” voice prompt (prompt #4) is sent to the telco and the call is disconnected. Once the mobile has answered, the conversation timer has been initialized with *Call limit time* for that user (radio). If enabled, the mobile activity timer has been initialized. Each time the mobile keys up, the *Mobile activity time* is used to reset the timer. If at any time the mobile activity timer expires, the call is disconnected. Single warning beeps are sent every 3 seconds starting 12 seconds before the mobile activity timer expires. The conversation timer may not be reset since this controls the length of the call. Double warning beeps are sent every 3 seconds starting 15 seconds before the call is disconnected. To terminate the call, the calling (phone) party enters “#0” or a long “#”, or the mobile must enter its *Disconnect ANI*.

### Telephone-to-Talkback Mobile Calls

The caller first gains access to the Model 48-MAX (see “Call Setup (Telco)” earlier in this section). A valid user number or ANI has been entered, the Model 48-MAX has keyed the transmitter, any required selective calling sequence (paging tones) will now be sent, the caller will hear one ring while the paging tones are being sent. The Model 48-MAX will then send the “speak your message at the prompt” voice prompt (prompt #6) followed by a “go ahead” prompt to the caller. Once the prompt is heard, the audio path between the phone line and the transmitter is opened and caller's voice is transmitted over the radio channel. The Talkback mobile must answer as specified by *Answer type* for that user (radio), within the specified *Mobile answer time*. If the mobile does not answer, the “your call cannot be processed at this time” voice prompt (prompt #4) is sent to the telco and the call is

## Section 3. Operation

disconnected. Once the mobile answers, the call proceeds exactly the same as equipment type “Mobile”.

### **Application note:**

If a selective calling sequence is not required (no paging tones programmed), a single ring on the channel will be sent instead.

### **Telephone-to-Tone-Only Pager Calls**

The caller first gains access to the Model 48-MAX (see “Call Setup (Telco)” earlier in this section). A valid user number or ANI has been entered, the Model 48-MAX has keyed the transmitter, any required selective calling sequence (paging tones) will now be sent, the caller will hear one ring while the paging tones are being sent. The caller will next hear a series of tones imitating the pagers alert tones. The call is then disconnected automatically.

### **Telephone-to-Tone-and-Voice Pager Calls**

The caller first gains access to the Model 48-MAX (see “Call Setup (Telco)” earlier in this section). A valid user number or ANI has been entered, the Model 48-MAX has keyed the transmitter, any required selective calling sequence (paging tones) will now be sent, the caller will hear one ring while the paging tones are being sent. The Model 48-MAX will then send the “speak your message at the beep” voice prompt (prompt #6) followed by a “go ahead” prompt to the caller. Once the prompt is heard, the caller may begin speaking, and the message is transmitted over the air. The message may be up to the *Pager talk time* in length or until VOX detection drops for 3 seconds. When the talk time has expired, the Model 48-MAX sends two “stop” beeps to the caller and disconnects the call.

### **Application note:**

If a selective calling sequence is not required (no paging tones programmed), a single ring on the channel will be sent instead.

## **MOBILE ORIGINATED CALLS**

Mobile originated calls are those which are initiated by a radio or mobile on the receive frequency or channel to which the Model 48-MAX is connected. To initiate a call from the radio channel, the mobile must be capable of encoding DTMF. The Model 48-MAX identifies the originating mobile by using its *Access ANI* (Automatic Number Identification). In the Model 48-MAX, this is a DTMF sequence, 1 to 10 digits in length, using any of the 16 DTMF tone pairs. There is an *Access ANI* for each user (radio) in the database.

Users (radios) may be allowed to make outgoing telephone calls, mobile-to-mobile calls, or mobile-repeat (dispatch) calls. If a mobile is only allowed to use one of these privileges, the user simply keys the radio and enters his *Access ANI* to gain access to the Model 48-MAX. If

the mobile is allowed access to more than one of these privileges, a steering digit must be appended to the end of the ANI. The steering digits are as follows:

- 5 = access code for mobile repeat (dispatch) mode
- 7 = mobile to mobile, Talkback, pager or Tone and Voice pager
- 8 = mobile to telephone (line 2)
- \* or 9 = mobile to telephone (line 1 or default line)

### Call Setup (Mobile)

To place a mobile originated call, the radio or mobile must first identify itself to the Model 48-MAX. This is done by transmitting its *Access ANI* along with any sub-audible tone/code required. The Model 48-MAX validates an ANI in three ways: 1) finds a match in the user database, 2) verifies the decoded tone/code matches the ANI found in the user database, and 3) verifies that the complete ANI was captured within the minimum time requirement, typically 1 digit per second (5 digits per second if *Fast ANI access* is enabled). If the Model 48-MAX finds a valid ANI, but it is not enabled, the Model 48-MAX ignores the ANI. If the time restriction (Scheduled telco access) is not met for interconnect, the “interconnect not available at this time” voice prompt (prompt #9) is sent to the mobile, and the call request is terminated.

For users (radios) that are allowed access to only a single privilege, no steering digit is required.

For users (radios) that are allowed access to multiple privileges, the Model 48-MAX will keyup and send the *Steering digit prompt* (dialtone or 800 Hz beep), indicating “Please enter your steering digit now”. The Model 48-MAX allows up to 5 seconds for the mobile to enter a steering digit.

The Model 48-MAX verifies that the steering digit received is a valid request for the originating user (radio). If the steering digit is not valid, the Model 48-MAX will keyup and send an error tone to the mobile and terminate the call request.

Note that the Model 48-MAX is capable of buffering the digits from the radio. This means a radio could send a 10 digit ANI + steering digit + 10 digit phone number in a single transmission. The Model 48-MAX will process the string just as if the radio unkeys in between the ANI and phone number.

### Mobile-to-Telephone

The mobile first gains access to the Model 48-MAX (see the previous subsection, “Call Setup (Mobile)”). The Model 48-MAX takes the indicated phone line off-hook and opens the audio path from phone to transmitter. The mobile now hears dialtone (from the local CO) and can start dialing a telephone number. The mobile has twice the programmed *DTMF interdigit time* to dial the first digit. After the first digit, the specified *DTMF interdigit time* is used as the maximum time between digits. The digits taken in from the mobile are regenerated as specified by *Dialout mode* into the phone line by the Model 48-MAX. The telephone number is monitored (while it is dialed) by the toll restrict routines. If the number dialed is toll

## Section 3. Operation

restricted, the call attempt is terminated and error tones are sent to the mobile. Once into the conversation mode (finished dialing the phone number), the Model 48-MAX is no longer regenerating DTMF. The audio from receiver to telephone is enabled, the conversation timer has been initialized with *Call limit time* for that user (radio). If enabled, the mobile activity timer has been initialized. Each time the mobile keys up, the *Mobile activity time* is used to reset this timer. If at any time the mobile activity timer expires, the call is disconnected. Single warning beeps are sent every 3 seconds starting 12 seconds before the mobile activity timer expires. The conversation timer may not be reset since this controls the length of the call. Double warning beeps are sent every 3 seconds starting 15 seconds before the call is disconnected. To terminate the call, the called (phone) party enters “#0” or a long “#”, or the mobile must enter its *Disconnect ANI*.

### **Mobile-to-Mobile**

The mobile first gains access to the Model 48-MAX (see “Call Setup (Mobile)” earlier in this section). The Model 48-MAX will prompt the caller to overdial a number. This will be either a prompt tone (Dial tone or 800 Hz beep) or a voice prompt (prompt #2). The caller then overdials the number (user number or *Access ANI*) of the user (radio) they wish to contact. The call then progresses exactly as though the originating mobile is a telephone caller, including any voice prompts (see “Telephone-to-Mobile Calls” on page 3-3). Note that ringouts on the channel for mobile-to-mobile calls differ in cadence from telephone-to-mobile calls. A telephone-to-mobile call sends ringing in 2 seconds on / 4 seconds off bursts. A mobile-to-mobile call sends ringing in 2 seconds on / 2 seconds off bursts. This way the mobile being called can tell by the ring cadence if the caller is another mobile or is land based. If both the originating mobile and destination or called mobile use sub-audible signaling, the originating mobile's tone/code is encoded during dialtone and overdial. Once the Model 48-MAX starts ringouts, the destination or called mobile's tone/code is encoded for the duration of the ringing. Once the destination mobile answers, the Model 48-MAX will perform tone/code translation between the originating and destination mobiles.

### **ANI Mobile-Repeat**

The mobile first gains access to the Model 48-MAX (see “Call Setup (Mobile)” earlier in this section). The Model 48-MAX will transmit a short beep indicating that the mobile has obtained access to the repeater. The *Mobile activity* timer and *Call limit time* take effect here and the call progresses until the mobile sends a disconnect sequence or one of the timers expire.

## DISCONNECT TONES

In all cases, when the call is terminated, disconnect beeps are sent to both the telephone and mobile. The disconnect beeps are different depending on the method or reason that disconnect was initiated. Most of the time, 5 short 50 millisecond beeps will be heard indicating normal disconnect. This happens when either the mobile disconnected the call, or one of the timers expired (either call limit or mobile activity). When the telephone party disconnects the call with a “#” or “#0”, a long dual tone will be sent to the telephone and mobile. If the call is terminated by the Model 48-MAX because it detects a busy signal or second dial tone, 3 fast busy tones are sent to the mobile. These diagnostic tones allow the user to determine the source of the disconnection.

<b>Event</b>	<b>Tone sequence</b>
Phone party disconnects call	Long dual tone
Mobile disconnects call	Five fast beeps
Mobile activity timer expires	Five fast beeps
Call limit timer expires	Five fast beeps
Busy tone terminates call	Three fast busy tones
Second dialtone terminates call	Three fast busy tones
Toll or time restriction	Three high/low error tones
Priority override	High/Low alert

When a call is terminated with three high/low error tones, a single digit error code in Morse follows. This is to further diagnose why the call was terminated.

<b>Error</b>	<b>Code</b>
Invalid steering digit	1
Time restriction	2
Toll restriction	3
Invalid user ID	4

### **Application note:**

If the three high/low error tones are heard following the normal disconnect tones (5 fast beeps), the Call detail records are at 80% capacity or greater. This is an indication that the Call detail records should be downloaded to prevent loss of data.

## Section 3. Operation

### ENHANCED TOLL RESTRICTION

The Model 48-MAX incorporates toll restrictions at two levels, system wide and on a per user (radio) basis. At the system level, the rules by which the dialed digits are monitored is set. At the user (radio) level, the degree to which those restrictions apply to a specific user is set. You should become familiar with how toll calls are determined by the phone company in the area where the interconnect will be installed. You will need this knowledge to help you determine what method of toll restriction best fits your needs.

At the system level there are three different *Toll restriction* plans supported, (“NA Original”, “NA Standard” and “Universal”). The first two (“NA Original” and “NA Standard”) directly support dialing plans as defined in North America. A third plan (“Universal”) is designed to support installations outside of North America, or where additional customization is desired. Each plan provides a set of rules used in determining the types of calls a mobile can place.

In addition to the defined toll restriction plans, two *Emergency Prefix* numbers and three *Toll free prefix* numbers can be defined. These special numbers allow calls (911 or 1800) to be placed regardless of the degree of restriction for that user (radio). Support for PBX connections, by making a distinction between inside and outside calls (toll restricts apply to outside calls only) is also provided.

The two North American plans (“NA Original” and “NA Standard”) are similar in function but differ in implementation. Both monitor the digits as they are dialed by the mobile, looking for 1+ and 0+ toll calls, 7 digit toll calls (non 1+) and 10 digit local calls. Based on the digits received from the mobile, the 48-MAX knows how many digits are required to place the phone call, and when to enable mobile to phone audio. This eliminates the need for timers or termination digits at the end of dialing.

The “Universal” plan allows the system operator to define or customize the toll restriction rules to fit the local dialing plan. It works by using two user defined tables of prefixes. Each table can have up to 10 entries. Each entry can be 2 to 4 digits long and include wild cards (“\*”) anywhere. The digits are monitored as they are dialed by the mobile. Once it receives the minimum required digits, it then scans the tables for a matching prefix (just like a wild ANI search). The call is then either allowed or disallowed based on the result of the search. Minimum (default = 4) and Maximum (default = 15) number of regenerated digits also defined. Timers and/or termination digit (“\*”) is used in determining when to terminate regenerated dialing and enable mobile to phone audio.

At the user (radio) level, *Toll restrict type* has 8 degrees or types of restriction. Four are common to all plans and four are plan specific. “None thru”, “None blap”, “AutoDial” and “PBX inside” are common to all plans. The “thru” and “blap” qualifiers indicate if DTMF is passed through after dropping out of regeneration. “AutoDial” disables all manual dialing, “PBX inside” limits calls to internal only with thru enabled. Under North American plans, “0+” and “Local” allow calling card calls and/or local call only. Under the Universal plan, “Tb1A” restricts calls to the Allow table and “Tb1B” restricts calls in the Restrict table.

### North American Plans

Phone systems in most areas of North America follow a specific format for a telephone number. A 3 digit Area code followed by a 3 digit CO code followed by a 4 digit extension number. The area code defines a region or area. A CO code is the local Central Office to which your phone line is connected. The extension number is your specific line or telephone from the local CO.

The first dialing plans established in North America made a distinction between local CO codes (Central Office) and Area Codes. As a number was dialed the decoding circuits could then route the call based on the first 3 numbers. Based on the 2nd digit, you could distinguish between a local CO code and an Area Code. Local CO Codes and Area Codes were not interchangeable for this to work. This also limits the total number of unique telephone numbers. As regions of North America run out of unique telephone numbers and equipment upgrades take place, a switch to interchangeable or New CO Codes is possible. It also means that any 1+ or 0+ number requires 10 digits to follow. The Model 48-MAX supports both dialing plans.

#### NA Original

This plan follows an older dialing plan used by phone companies without interchangeable CO (central office) codes. Area codes have the format N 0/1 X and CO codes have the format N N X where:

$$\begin{aligned} N &= 2 - 9 \\ X &= 0 - 9 \end{aligned}$$

Area codes will always have a 0 or 1 as the second digit and a CO code will not. Under “NA Original”, area codes and CO codes are not interchangeable. This means that any 1+ or 0+ type of call can be followed by either 7 digits or 10 digits. In areas where it DOES NOT require an area code to place a 1+ or 0+ call, “NA Original” should be used.

#### NA Standard

This plan follows a newer dialing plan used by phone companies with interchangeable CO (central office) codes. Most areas of North America now follow this format. Area codes and CO code have the format N X X where:

$$\begin{aligned} N &= 2 - 9 \\ X &= 0 - 9 \end{aligned}$$

Area codes and CO codes are no longer required to have the same distinction as they do under plan 1. Under “NA Standard”, area code and CO codes are interchangeable. All 1+ and 0+ calls would be followed by 10 digits. In areas where it REQUIRES an area code to place a 1+ or 0+ call, “NA Standard” should be used.

#### Prefix Table

The North American plans support use of a *Prefix table*. In some areas, the local phone companies have two levels of toll calls. Ones that require a 1+ or 0+ and Local Zone calls

## Section 3. Operation

that do not. To restrict or block Local Zone calls, a *Prefix table* can be built using any of the 999 possible prefixes. The table can be set up as either “Restricted” or “Allowed” prefixes. If a mobile places a call that is not a 1+ or 0+ call, it checks to see if the prefix is in the table. The table is enforced if the user (radio) *Toll restrict type* is anything other than None.

### Ten Digit Local Calls

As more area codes are put into use throughout North America, some local calls now require an area code ahead of the phone number. A 1+ or 0+ is not required to place these calls. To support these types of calls, four *Local area code* prefixes can be defined. If a mobile places a call that does not begin with a 1+ or 0+, these prefixes are scanned for a match on the first three digits. If a match is found, then 10 digits are required for the phone number and it is considered a local call.

### 0+ Calls

A 0+ call is a toll call where the billing is directed to a third party. The most common method works by dialing a calling card number when prompted after the completion of the phone number. The typical number of calling card digits is 14 (default). Once a 0+ call has been started, the phone number (8 or 11 digits) plus the calling card number (14 digits) must be dialed BEFORE the call can proceed. Once the phone number has been dialed, the mobile has 20 seconds to start dialing the calling card number. To prevent someone from monitoring the calling card number dialed, no beeps or DTMF is regenerated over the channel. Once the first digit of the number has been entered, the normal *DTMF time out* takes affect for interdigit timing. This allows for the 48-MAX to have a way out if the mobile goes away during dialing. To terminate early (less than 14 digits) the entry of calling card digits, enter a DTMF “\*” any time after the phone number has been dialed.

### Provider ID Codes

With the proliferation of local and long distance service providers in North America, the need to select a specific provider can arise. The ability to dial a Provider Identity Code or PIC code ahead of a number is supported. The format of a PIC code is as follows:

10nnn  
101nnn  
Where N = 2-9

For instance to get AT&T you would dial 10288 (10ATT) + 0 + the phone number. PIC codes are regenerated as they are dialed and not considered part of the phone number. The 48-MAX does not care what phone number is dialed after a PIC code, but does enforce the programmed toll restriction. Note that PIC codes are not included in the SMDR record, only the phone number dialed.

### Universal Plan

The “Universal” toll restrict plan or mode is designed to allow the system operator to define a toll restrict plan to meet local requirements. It uses two prefix tables (up to 10 entries each) to define a filter or plan. As digits are dialed, the 48-MAX will scan the entries in the table

for a match against the dialed digits. One table is defined as “Allowed” (TblA) and the other as “Restricted” (TblB). Each user (radio) whom you wish to restrict dialing can be assigned which table (TblA or TblB) is to be scanned when dialing. Entries in the table can be 2 - 4 digits in length. Valid digits are 0 - 9. Wild card or don't care digits can also be defined using the “\*” character, anywhere in the string.

Two other parameters are used with the “Universal” plan. *Minimum regenerated digits* and *Maximum regenerated digits*. These two values set the range for how many digits the mobile may be required or allowed to dial. The number of digits required for the 48-MAX to evaluate the prefix table is based on the setting of *Minimum regenerated digits*. If set to less than 4, then scan is started using *Minimum regenerated digits* and continues until greater than 4 digits have been dialed. The digits will always be evaluated when 3 and 4 digits have been dialed.

If the minimum number of digits is not met, the call will always be terminated as toll restricted. If the Maximum number of digits is exceeded, regeneration is terminated. If the users Toll restrict type is None, mobile to phone audio is enabled, otherwise the call will be disallowed.

Dial in termination (when the 48-MAX stops regenerating digits and enables the mobile to phone audio path) is determined using timers and/or a termination digit (“\*”). If no DTMF digits are received from the mobile for the programmed *DTMF interdigit time*, and the minimum number of regenerated digits has been met, the 48-MAX will drop out of regeneration and enable the mobile to phone audio.

### **General Features**

Functions which are common to all toll restrict plans include, Emergency prefixes, Toll free prefixes and PSTN feature code.

### **Emergency Prefix**

The Model 48-MAX supports two user defined *Emergency Prefix* codes. An emergency prefix is a 3 digit prefix that is used to access emergency services. The two default prefixes are “911” and “311”. These can be disabled by clearing the prefix string in programming. When decoded by the 48-MAX, dial in is immediately terminated and mobile to phone audio is enabled. The *Call limit* and *Mobile activity* timers are disabled. These prefixes are always allowed for any level of user toll restriction which allows manual dialing.

### **Toll Free Prefix**

The Model 48-MAX supports three user defined *Toll free Prefix* codes. A toll free prefix is a 4 digit prefix that will always be considered a local call. The default prefixes are “1800” and “1888”. These can be disabled by clearing the prefix string in programming. These prefixes are always allowed for any level of user toll restriction which allows manual dialing.

## Section 3. Operation

### **PSTN Feature Code**

When the phone line is first taken off hook for a mobile to phone call, the Model 48-MAX can send a pre-defined string of DTMF before any other digits are dialed by the mobile. This is typically used to disable Call waiting or Caller ID function. The PSTN Feature Code string can be up to nine digits long using any valid DTMF digit including pauses “,”. This string can be disabled by clearing the string in programming (default). This string will be dialed after the first digit is received from the mobile before any other digits are dialed. The string will always be sent, but only once at the beginning of the call.

## **PBX OPERATION**

Operating an interconnect that is installed on a PBX has a different set of requirements than one installed on a conventional PSTN connection. The Model 48-MAX provides some PBX specific programming to meet these needs. Based on programming and what the mobile dials, the 48-MAX can distinguish between an internal or an external call or a direct PSTN connection. Each of the two end-to-end lines can be configured as a PSTN connection or a PBX extension. This allows the toll restrict programming to be applied only to calls dialed outside of the PBX.

### **Internal Calls**

The 48-MAX provides a way to determine if the mobile is placing an internal call or trying to go to an outside line. When a mobile has accessed a phone line configured as PBX, the first digit dialed by the mobile is scanned against *PBX outside line digit* for a match. If no match is found, the call is flagged as a PBX internal call. If a match is found then it is flagged as an PSTN type and all programmed toll restrictions apply starting with the second dialed digit. Up to 4 digits may be entered as *PBX Outside line digit* (default = 9). For internal calls, the 48-MAX will regenerate digits equal to *PBX Extension length* (default = 3). PBX inside calls are considered local calls for all users. All DTMF is passed through (digit blapping is disabled). Hook flash is valid for all users who have this enabled (no toll restrict qualifier like on PSTN calls). Hook flash on internal calls does not go into regeneration.

### **External Calls**

When a mobile dials the first digit and it is used to select an outside line, the 48-MAX flags the call as a PSTN call. The first or leading digit (used to select the outside line) is now ignored as if it was never dialed. As additional digits are dialed, they are monitored according to the current toll restrict programming for that user. External calls though a PBX extension line follow all the same rules as a call on a direct PSTN connection.

## Section 3. Operation

### Hook Flash

The Model 48-MAX can support the mobile in performing a hook flash on the current line once in the conversation mode. One of the more typical installations where hook flash is used is on PBX installations. This is enabled on a per user basis. On PSTN calls a user's *Toll restrict type* must be set to "None" for access to Hook flash. On PBX internal calls, a user's *Toll restrict type* can be set to anything except "AutoD" for access to Hook flash. It is initiated by the mobile entering a DTMF "\*" while in conversation mode. The Model 48-MAX will then "break" or "flash" the current line for 600 milliseconds. What happens next is based on whether the call is an internal PBX call or a PSTN call.

On PSTN calls the Model 48-MAX will temporarily enable DTMF regeneration. While in temporary regenerate, all digits decoded from the mobile will be regenerated (0-9,A-D,#). Once a hook flash has been performed, the mobile has 2 times the programmed *DTMF interdigit time* to dial the first digit. This is used to stay in regeneration. After the first digit, the specified *DTMF interdigit time* is used as the maximum interdigit time. Allowing the interdigit time to expire or a DTMF "\*" will turn off the regeneration at any time. If disconnect on second dial tone is enabled (default), the Model 48-MAX will ignore dial tone from the telco line after a hook flash.

On internal PBX calls only a hook flash is performed and the Model 48-MAX returns to conversation mode. Since all DTMF is passed though from the mobile, there is no need to stay in regeneration.

### Interconnect Hog Mode

Occasionally some customers will make back to back calls once they gain access (place a call then place another call upon completion of the first). This prevents anyone else from using the interconnect for several minutes, and in effect defeats the call limit timers. When enabled for these users, the *Interconnect Hog mode* can help equalize access for all customers on the system. The last user who signed on to the interconnect is restricted from using it for the *Interconnect Hog time*. This allows another user to gain access to the interconnect and prevents the back to back type calls. This is can be enabled/disable on a per user basis.

### Call Alert Beeps

This feature allows mobiles currently involved in a interconnect call to know that one of the telco lines is ringing (Line 1 or Line 2). When enabled, the Model 48-MAX will send a tone over the channel for each incoming ring detected. The mobile then has a chance to terminate the call in progress and allow the ringing line to be answered.

### Autodials

The Model 48-MAX provides a large (99 number) autodial table. Each autodial can be up to 16 characters long. Valid digits that will be dialed are "0 - 9, \*, #". The "," character will insert a delay (2.5 seconds default) in the dialing string. Text can be included in the string. Some examples of this are "1(425) 820-6363" = "14258206363" and "820-6363 ZETRON".

Individual users (radios) can have access to all 99, 10, or only one based on the setting of *Autodial mode*. This is a two digit number. The first number indicates which block of 10 autodials that user (radio) has access to. The second number indicates which autodial(s) in that block of 10 that user (radio) has access to. If *Autodial mode* = 00, then “\*01” to “\*99” will access any autodial programmed in the table. “\*00” will access the last number redial buffer also. If *Autodial mode* = 20, then “\*0” through “\*9” will access autodial numbers 20 through 29. If *Autodial mode* = 21, then that user is forced to autodial 21 and cannot manually dial a telephone number, regardless of his toll restrict type.

Autodials can also be used for toll restrictions in the Model 48-MAX. When a user (radio) has *Toll restrict type* set to “AutoD,” that user can only access telephone numbers in the autodial table. You would typically set *Autodial mode* to a block of numbers. Trying to access an empty autodial is not allowed for all users whose *Toll restrict type* is not set for “None” or “Blap”.

When a user (radio) has *Toll restrict type* set for “None” or “Blap”, accessing an empty autodial drops directly into conversation mode. Accessing an empty autodial with any other *Toll restrict type* is considered toll restricted and the call attempt is terminated.

## Section 3. Operation

### **ACCESS AND DISCONNECT ANI's**

Before a radio (user) may sign on to the Model 48-MAX, an *Access ANI* (Automatic Number Identification) code must be assigned to the user. This code provides access to the interconnect. Without it, a user cannot make or receive calls. Default ANI's are "\*" for *Access ANI* and "#" for *Disconnect ANI*.

ANI's in the Model 48-MAX are fully and independently programmable. Each ANI can be up to 10 digits in length. Each ANI can be made up using any of the 16 DTMF tone pairs. Two types of sign-on are possible, Short sign-on (single digit ANI) and ANI sign-on (multi-digit ANI). Short sign-on is typically for a single function ("\*" for telco access on Line 1). ANI sign-on is typically used with steering digits ("ANI+\*" for telco access on Line 1). Wild ANI with exclusion is supported in the Roamer version. When enabled, the DTMF "A" is used as a wild card. Due to the very powerful features of how ANI's can be put to work in a system, some care and planning **MUST** be done up front to avoid potential conflicts. Please see "How to Program ANI's in the Model 48-MAX" in Section 4, for a detailed discussion of ANI's including examples.

#### **Access ANI**

Sign-on in the Model 48-MAX consists of the user's *Access ANI* code followed by a steering digit (if more than one privilege is enabled). Once a valid first digit has been received, the remaining digits must be received within the set timing requirements. If *Fast ANI access* is disabled (default), digits must be at least one digit per second. If *Fast ANI access* is enabled, digits must be at least five digits per second. The Model 48-MAX also tone/code validates the incoming ANI. If the timing requirements are violated or a NO MATCH returned from the ANI decoder, the ANI decoder is turned off for 2 seconds or until COR is dropped. This is to prevent decoding of an embedded ANI in a string by someone trying to gain unauthorized access to the interconnect.

Please note that to prevent ANI's from being repeated out over the channel during dispatch, repeat audio is muted after the first digit of a valid ANI.

#### **Short Sign-on**

Short sign-on can be a very convenient way to access the Model 48-MAX. Any user programmed with a single digit *Access ANI* is considered Short sign-on. Any valid ANI digit (0 - 9, A - D, \*, #) can be used for short sign-on. Typically, a short sign-on user is setup with only one privilege (removing the need for a steering digit). The default privilege for short sign-on is Mobile-to-Phone on Line 1 only (this is done automatically when a short sign-on for *Access ANI* is programmed). A short sign-on ANI has a minimum digit duration requirement of 500 milliseconds to be considered valid. Short sign-on is also tone/code validated. Short sign-on uses a 1 second validation timer. Before the Model 48-MAX validates a short sign-on, this timer must expire or COR and/or tone/code validation must drop with no other digit being decoded.

### **ANI Sign-on**

ANI sign-on is used in systems where Airtime billing and Call Detail records are used. It also provides greater security in preventing unauthorized access to the system. Any user programmed with a multi-digit *Access ANI* (2 or more digits) is considered an ANI sign-on user. In larger systems with many users requiring access to different privileges, this provides a way to identify each user on the system. Typically ANI sign-on is used with a trailing steering digit to select a privilege. If only one privilege is enabled, then a steering digit is not required. All multi-digit ANI's are checked for conflicts during programming. There is no minimum "on" time requirement for multi-digit ANI's.

### **Steering Digits**

If a user has more than one privilege enabled (Mobile-to-Phone, Mobile-to-Mobile, or ANI Mobile-Repeat) and/or has selectable line privileges, a trailing steering digit is required. This differs from earlier Zetron interconnects in that the steering digit could be leading or trailing. The purpose of the steering digit is to let the interconnect know which privilege the user wishes to use. If it is desired to not use steering digits, a user could have the steering digit be part of the *Access ANI*. This works by entering the user multiple times in the database. One for each privilege or function granted.

Trailing steering digits recognized by the Model 48-MAX:

- 5 = access code for mobile repeat (dispatch) mode
- 7 = mobile to mobile, pager, Talkback, or Tone and Voice pager
- 8 = mobile to telephone (line 2)
- \* or 9 = mobile to telephone (line 1 or default line)

### **Disconnect ANI**

Before a user can sign off using a mobile or portable, a *Disconnect ANI* (Automatic Number Identification) code must be assigned to the user. This code provides the mobile or portable with a way to terminate the call in progress. Without it, the interconnect must rely on timeout timers to terminate a call. The *Disconnect ANI* gives the mobile or portable "control" over the interconnect at all times.

Once a valid *Access ANI* has been identified, that user's *Disconnect ANI* is put into the disconnect table. The interconnect now knows who has signed on, and how they are required to sign off.

### **ANI Digit Timing**

Single digit ANI's have a minimum on time requirement of 500 milliseconds to be considered valid. This includes Short sign-on from the radio channel and single digit *Disconnect ANI*.

Multi-digit ANI sequences have no minimum on time requirements. *Access ANI* and *Disconnect ANI* sequences look at the setting of *Fast ANI access*. The average speed of the

## Section 3. Operation

decoded ANI must be 5 digit per second or greater when enabled and 1 digit per second or greater when disabled.

### **SCHEDULED TELCO ACCESS**

This feature is included in the Selcall and Roamer versions of the Model 48-MAX. It allows the system operator to give priority to different user groups based on time of day and day of the week. If you restrict interconnect access to normal business hours, 8:00 AM to 5:00 PM for Monday through Friday, you can prevent access to the interconnect on a per user (radio) basis during non-business hours. This feature can also be useful in a system where dispatch and interconnect are mixed. You can disable interconnect during the morning hours (giving priority to dispatch) and still be able to offer interconnect after hours.

### **PAGE FORWARD**

Each interconnect user can have his unanswered calls forwarded to a second user in the database. When a call comes in for a particular user (radio), the Model 48-MAX tries to reach him. If the called mobile does not answer, and he has a *Page forward user* programmed, the Model 48-MAX will try to call that user (radio) next. An example of how to use this feature would be, say a customer has a mobile radio in his truck and a handheld transceiver that he carries. The mobile would be his primary user (radio) in the database. The handheld is his secondary user (radio) in the database. His two users are cross-referenced in the database via the Page forward user. This means that if he can receive calls on either radio (mobile or handheld). This feature will only forward once.

### **AUXILIARY INPUT**

The Model 48-MAX has one active low input that can be configured for either transmit “Channel busy” or “Site status”. This input is internally pulled high. If set for “Channel busy”, the Model 48-MAX will not key the transmitter with the input held active or low. With a secondary receiver monitoring the transmit channel, a relay output can feed this input to meet FCC Part 90 requirements. If set for “Site status”, the Model 48-MAX will issue a 1500Hz tone just prior to unkeying the transmitter with the input held active or low. This could be used to indicate if the site is on battery power or main power. Just keyup on a valid tone and get an instant status check. The current status of this input is always available via a DTMF programming inquiry command. See “DTMF Programming” in Section 8 for details.

### **AUXILIARY OUTPUT**

The Model 48-MAX has one open drain output (FET to ground). This output can be set via two methods: 1) DTMF programming or, 2) Supervisor user access. See “DTMF Programming” in Section 8. For Supervisor access, an additional steering digit has been added, “6”. When the Supervisor user's access ANI is received followed by a steering digit of 6, the Model 48-MAX will keyup and send a high or low tone, indicating current setting of the auxiliary output (high = active, low = inactive). A “\*1” will set it active and return a high tone, a “\*0” will set it inactive and return a low tone. The Model 48-MAX then drops off the

channel. The auxiliary output will remember its current setting even after a power failure. It keeps the current setting in battery-backed RAM.

### **REPEATER PANEL OPERATION**

The Model 48-MAX supports all 50 CTCSS tones and 104 commonly used DCS codes. When a valid (enabled) tone/code is decoded, the Model 48-MAX will key the transmitter, encode the programmed tone/code and process the audio between the receiver and transmitter.

#### **Tone Validation**

Each tone/code may be selectively enabled or disabled. Anytime one of the 154 tones/codes is decoded, it is also tracking airtime (default is to accumulate), regardless of whether it has been enabled or not. This provides the system operator with co-channel loading information as to which tones/codes are currently being used. Any valid (enabled) tone or code can have any other tone or code programmed for encoding. This allows “cross-tone” encoding between tone and/or digital codes.

#### **Reserved Tone**

The Model 48-MAX has the ability to “reserve” a tone or code. If a tone/code is “reserved”, the transmitter will be keyed, and a fast “busy” signal will be transmitted. This prevents that tone or code from being used on the channel.

#### **Tone-in-Tail**

The Model 48-MAX has the ability to continue to encode the current tone/code for the duration of the transmit hold time. This can be enabled or disabled on a per tone/code basis. A typical use for this feature is in systems that use “channel busy lockout” in the mobiles. When enabled, the mobiles radio will remain unscquelched while the transmitter is keyed. This allows the mobiles involved in the conversation to continue keying and unkeying. It also prevents other mobiles from barging in on the channel.

#### **Privacy**

When this function is enabled, the Model 48-MAX will not allow another tone/code to access the repeater during the transmit hold time. This prevents other mobiles from “grabbing” the repeater during momentary pauses in a conversation. If privacy is enabled, it is desirable to enable tone-in-tail as well. This lets other mobiles know that the channel is busy. This feature can be enabled or disabled on a per tone/code basis.

#### **Courtesy Bip**

This function, when enabled for a tone/code, will issue a prompt or beep out the transmitter whenever the mobile unkeys. This is a 1200 Hz tone for a duration of 50 milliseconds.

## Section 3. Operation

### Tail Bips

This function, when enabled (system wide) changes the Courtesy Bip from a single bip when the mobile initially unkeys, to a bip once every second during the transmit hold time.

### Transmit Hold Time

The Model 48-MAX has a separate transmit hold time for each tone/code. There is also a separate transmit hold time for the initial keyup of a validated tone/code. The first keyup of a validated (enabled) tone/code uses *Initial TX hold time* for the transmit hold time. All subsequent keyups (until the transmit hold time expires and the Model 48-MAX unkeys) of the validated tone uses the *TX hold time* for the decoded tone/code.

### Morse ID

Each tone/code may be assigned an eight-character Morse code ID. This will be automatically sent (during the transmit hold time) when a mobile keys up after the an interval timer has expired. The *ID rate* sets the interval for all tone/code ID's. The ID is transmitted at a reduced level so that voice communications can occur while the ID is being sent. If an ID is not specified for a tone/code, one will not be sent.

### Hog Mode

The tone panel operation has a Hog mode to prevent “airtime hogs” from monopolizing the channel. Each tone/code can have the Hog mode enabled or disabled. When enabled, the mobile can have uninterrupted access to the repeater up to the *Hog limit* time. Once this timer has expired for a user, he is denied access to the repeater for the *Hog penalty* time. A user can prevent going into the penalty stage by unkeying and allowing the repeater to remain idle for the *Hog idle* time. This gives another mobile on the channel a chance to have access to the repeater. Each time the *Hog idle* timer expires, it resets the *Hog limit* timer for that tone/code.

### TX Timeout

To prevent a stuck microphone from keeping the transmitter continuously keyed, the TX timeout timer provides a maximum amount of time that the Model 48-MAX will keep PTT keyed.

### Stuck Mic ID

In case of transmitter timeout, you can enable the Stuck mic ID feature. When enabled, the Model 48-MAX will keyup and send the offending tone/code number, in DTMF, once every 15 seconds for the duration of the error.

### Carrier Squelch Repeat

The Model 48-MAX can act as a carrier squelch repeater panel. Upon seeing carrier, the Model 48-MAX will key the transmitter and allow repeat audio. If a sub-audible tone/code is detected, it will revert to the programming for the detected sub-audible tone/code. This

allows the Model 48-MAX to be installed where there is a need to support dispatch for both carrier and tone squelch radios.

### **DTMF Repeat**

At default, the Model 48-MAX mutes repeat audio upon decoding a valid first digit of an ANI. When enabled, DTMF Repeat prevents any DTMF from muting the repeat audio during tone dispatch operation.

### **INTERCONNECT GATEWAY**

Interconnect Gateway is a new feature that has been added to the Model 48-MAX in software Version 1.21 as part of the 154 User Option (D25). This feature allows two distant coverage areas to be linked together through the PSTN using a pair of Model 48-MAX's. A typical application is to link together a dispatch user group that is in two different locations. This makes it ideal for installation into existing systems, increasing the range of communications possible without the need for expensive upgrades of existing radios. Call setup can be as simple as just keying the radio (no DTMF originate) or using short sign-on (single digit ANI) for selecting the site you wish to link with.

### **How It Works**

The local topography does not lend itself to good overall coverage from a single site. Multiple sites have been set up to establish overlapping coverage areas. As mobile units move from one coverage area to another, they are only able establish communications with other units who are currently in the same coverage area. Interconnect Gateway solves this problem. It allows mobile units to directly contact other coverage areas by linking the two sites together through the PSTN.

A mobile in area 52 wants to establish contact with other mobiles in his user group, who are currently in area 51. Initiating a call to area 51 in can be accomplished one of two ways, using short sign-on with his normal dispatch tone or temporarily switch to a second tone to initiate the call. A mobile-to-phone call, using forced autodial, to the Model 48-MAX in area 51 is the result. When the Model 48-MAX in area 51 (destination site) answers the incoming call, the Model 48-MAX in area 52 (originating site) responds by over dialing a user number. This then setups up a phone-to-mobile call in area 51 from the Model 48-MAX in area 52. Mobiles in the called user group will hear ringing and can just key up to answer (PTT to answer). We have now established a link between two units of the same dispatch group on two different sites through the PSTN. Call clear down can be either DTMF or time-out. If either Model 48-MAX shuts the call down, it will send a disconnect code to the Model 48-MAX at the other site.

### **Call Setup**

There are two ways to initiate an Interconnect Gateway call: 1) sub-audible alone and 2) DTMF + sub-audible. Both have advantages and disadvantages. Using sub-audible alone requires a multi-channel radio but not DTMF, using channel (sub-audible) selection to initiate calls. If more than two sites are involved, using sub-audible alone can get quite

## Section 3. Operation

complicated in a hurry. Using DTMF + sub-audible requires a DTMF capable multi-channel radio. When more than two sites are involved, this method is the most straight forward in terms of operation from a user stand point and in flexibility of programming.

Once an interconnect gateway call has been setup (phone line off hook and digits being dialed), the operation is the same regardless of which method was used to setup the call.

### **Subaudible Only**

To initiate a call using this method requires the Model 48-MAX to receive 3-plus seconds of an enabled tone/code with Interconnect Gateway enabled. In a two site installation, a four channel radio would be required. Channels 1 and 3 are the normal dispatch channel for the two sites. Channels 2 and 4 would be used to initiate a Gateway call to the other site. To initiate a gateway call, switch to channel 2 and key up for 3-plus seconds and then unkey. The Model 48-MAX will respond by taking a phone line off-hook, and executing a forced autodial. The originating mobile will hear the beeps (from dialing) and switch back to channel 1 (normal dispatch channel). Now all mobiles in the user group will be able to hear the call as it progresses.

When the Model 48-MAX receives 3-plus seconds of an enabled tone/code, it looks to see if that tone/code also has Interconnect Gateway enabled. If Gateway has been enabled, the Model 48-MAX switches from repeater panel operation to interconnect operation. It takes the user number of gateway enabled tone/code (from the repeater panel user database) and executes a mobile originated interconnect call as if that user (from the interconnect user database) has signed-on with DTMF. You could also think of this as no-DTMF originated interconnect. If tone 103.5Hz in the repeater panel user database (user 14) is enabled for Gateway, then when 103.5Hz has been received for greater than 3 seconds, the Model 48-MAX will execute the programming for user 14 in the interconnect user database.

The need to switch channels to place an Interconnect Gateway call is based on using sub-audible to select the functions instead of DTMF. The channel used to initiate the Gateway call uses a different decode tone/code (encode in the radio) but will typically use the same encode tone/code (decode in the radio) as the normal dispatch channel for call setup. When the call switches over from repeater panel to interconnect, the same encode/decode used for dispatch is used. This allows other radios in the user group to monitor/participate in the call. It also provides a way for the originating mobile to hear the progression the call (dialing the phone number) before switching back to the normal dispatch channel.

### **Short Sign-on + Subaudible**

To initiate a call using this method requires a single DTMF digit for greater than 500 mSec with sub-audible tone/code. The interconnect user equipment type must also be set to MobileLink. This method has two advantages over the subaudible only: first no changing of channels on the radio is required to setup a call and second the site selection (in a multi site setup) can be based on a single number and remain consistent throughout out the system for all user groups.

A four channel DTMF equipped radio can now support four different sites or coverage areas. Each user group has a single tone/code used for dispatch operation. Each site is assigned a digit which is used for site selection as a short sign-on digit. To contact other mobiles in your user group on site 3 from any of the other sites, simply key up and send a DTMF 3 for greater than 500mSec and unkey. The Model 48-MAX will see a valid mobile originate access, see that the equipment type is set for MobileLink and perform a gateway call to site 3. Since short sign-on uses sub-audible to validate the DTMF digit, all user groups can use the same digit to select the site. The subaudible used to separate user groups during dispatch also is used to distinguish them for short sign-on.

### **Call Clear Down**

Once the call has been established, it is just like any other interconnect call, various control timers are running and programmed disconnect sequences are now valid. Clear down of the call can be initiated by any of the normal methods, expiration of the Call limit or Mobile activity timers, detection of 2nd dial tone or 6 cycles of busy tone or reception of mobile or telco disconnect codes. Since two Model 48-MAX's are now handling the call, either one is capable of initiating call clear down, and will send the telco disconnect code to the other.

The destination or called Model 48-MAX handles the call just like any other phone originated interconnect call. The originating or calling Model 48-MAX handles the mobile activity timer differently based on how the call was setup. If the Interconnect Gateway function of the repeater panel user database was used, then the mobile activity reset value is 2 times the transmit hold time for the originating tone/code. If short sign-on is used, then the normal mobile activity timer is used. If no DTMF is available to the mobiles, then a shorter time out period would be desired.

### **System Setup**

Multi-channel capability is required of the radios used in these systems, the question then becomes are they DTMF capable. When using sub-audible for site selection, the number of channels required goes up exponentially with sites. A simple two site system requires 4 channel radios, a three site system requires 9 channel radios. When using the short sign-on method of site selection, the number of channels required is equal to the number of sites supported. For a simple two site system, using sub-audible for site selection can work quite well. Three or more sites really need DTMF to help simplify the operation, both for the system operator and the users.

In a typical system, you want incoming calls (those from other sites) to be received on the regular dispatch channel. This allows all radios in the receiving user group to hear the incoming call and be able to answer. You may also find that programming the equipment type to Talkback for incoming calls, allows the originating mobile to “voice hail” out on the destination system, thus operating more like a dispatch call.

In a typical system you will have more than one user group on it. For each user group, you will need an interconnect user for each site you wish to support. One for receiving incoming calls (phone to mobile), plus one for each of the other sites (mobile to phone). The user programming for originating a gateway call is specific to both the function and site. This

## Section 3. Operation

prevents you from using the same interconnect user for more than one site and also from receiving incoming phone to mobile calls.

Once a system has been designed, a single Model 48-MAX can be programmed with all the required system and user data. This can then be downloaded and then uploaded or cloned into the other Model 48-MAX's on the system.

### **Four Site Example**

This example has four sites to be linked together using the Interconnect Gateway feature of the Model 48-MAX. We will be using Short sign-on with sub-audible validation for site selection. The field units required to support this system are multi-channel( at least 4 channel), DTMF capable radios. Each site is on a different RF channel. User groups are separated by sub-audible tone/code. Short sign-on allows all user groups on the system to select or access the four sites in the same way.

First we need to assign a single digit to be used for site selection for each of our sites. Since we have four sites, we have numbered them 1 - 4. The site selection digit becomes the Short sign-on digit or Access ANI used to access or select a particular site from any other site in the system.

Next we need to assign a block of user numbers (from the interconnect user database) for each user group on the system. We will give each user group a block of ten user numbers. We will only be using five in our example, but this does make keeping track of user groups in the programming a bit easier. We will use the block of users from 50 - 59 for our example user group. We need one user for inbound calls (phone to mobile) and four users for outbound calls (mobile-to-phone). User 50 will be inbound and 51 - 54 will be outbound. The advantage here is we can program all Model 48-MAX's the same. The site specific issue is which of one of the outbound users is disabled at each site.

The last item we need is it pick autodial numbers for our four sites. The number of autodials needed is equal to the number of sites, regardless of the number of user groups on the system. Since we are using the forced autodial function, pick numbers that end in one through four. We will use autodials 21 through 24 for our four sites.

### **How to Program It**

We will now step through the programming of a Model 48-MAX for one of the four sites in our example system, clone it to the other three units and perform the site specific adjustments to the programming.

Before doing any programming, reset the database to factory default for all three databases (System, Interconnect User and Repeater Panel User). This is done in the Diagnostic menu, items 2 and 3. This is important on the first unit we will be programming as the other three will be cloned from the first. Any unknowns in the first unit will also be in the other three.

### **System programming**

Interconnect gateway uses FastNET commands to establish a gateway call. This must be enabled on each line used by Interconnect Gateway. This is in the Interconnect - Telco Specific menu.

Autodials must be programmed for each of the 4 sites. Autodial 21 holds the phone number for the Model 48-MAX at site 1, Autodial 24 holds the phone number for site 4. If it is always a toll call or always a local call from any one site to any other, then autodials won't be a site specific item.

### **Repeater Panel programming**

The only thing that needs to be programmed in the repeater panel initially is to enable the tones/code to be used for normal dispatch by the user groups on the system.

In our example system we have D026 as the sub-audible tone/code used by our user group. This is user 53 in the Repeater Panel User Database. We need to enable that code.

### **Interconnect User programming**

Several items and multiple users need to be programmed in the Interconnect user database. On some items we can use the block programming functions to help speed the process along.

First item, since we are using short sign-on, you will want to disable User 1, who defaults to short sign-on with 67.0Hz sub-audible.

### Section 3. Operation

Table 3. **OPERATION-1** gives an overview of the block of users in our example user group. It shows the required programming changes from default.

*Table 3. OPERATION-1 User Programming for Interconnect Gateway*

User #	ANI	Answer	Sub-audible	P-to-M	M-to-P	Autodial	Equipment	PageFwd
50	*	PTT	D026	Yes	No	00	Talkback	None
51	1	*	D026	No	Yes	21	MobileLink	50
52	2	*	D026	No	Yes	22	MobileLink	50
53	3	*	D026	No	Yes	23	MobileLink	50
54	4	*	D026	No	Yes	24	MobileLink	50

Since we are programming a block of users, we can use that function to set some of the items. Set the range for 50 - 54, set sub-audible encode/decode and User enable for all in range. Set answer type, calling privileges (phone-to-mobile, mobile-to-phone), equipment type, Page forward, prompting for each user.

Change User range to user 51 and begin programming the user specific type items, like Access ANI and Autodial Mode. Use the “N” key to advance to the next user and repeat the process through user 54.

To add more user groups, just pick another block of users and program them the same as above with two exceptions; 1) change the sub-audible for the specific user group. 2) Change the Page Forward user to match the inbound (phone to mobile) user number for that user group. The inbound user has None for Page Forward user.

#### **Site Specific changes**

Once we have the first unit programmed, we can then download the programming to disk (System database, Interconnect User database and Repeater Panel database). Now we can upload that programming into the three other Model 48-MAX's in the system. Once this has been accomplished we can go back into each unit and make the few required site specific changes to the programming.

In the System database and Repeater Panel User database, the only required changes relate to the Station ID and User ID.

In the Interconnect User database we need to disable the user who would call the site itself rather than another site. At site 1 this would be User 51, at site 2 this would be User 52. While leaving these users enabled will not prevent the system from working, it would prevent a call being placed that will only fail.

The only real site specific item is to disable the user used to call that site from the others. While this call will always fail, disabling it prevents users from thinking that the system is not working.

### Operation

Now that we have programmed and installed our system, we need to put it to use. We will walk through the steps of placing a call, describing the various stages as the call progresses. Table 3. *OPERATION-2* contains the events of a typical call, showing the flow as it progresses.

For a mobile on Site 1 to call Site 3, just key the radio and sends a long DTMF 3 and then unkey. He can now hear the progression of the phone call through the PSTN. He will hear the phone number being dialed, followed by the ringback tones from the Central office as the Model 48-MAX at Site 3 receives ringing voltage. When the Model 48-MAX at Site 3 answers the line, it will send a FastNET answer sequence followed by the normal answer prompt. The Model 48-MAX on Site 1 will hear the FastNET answer sequence and respond by over dialing a three digit user number. This is the Page Forward User in the user programming. Following our example user group this would be User 50. The Model 48-MAX at Site 3 now keys the transmitter and issues a single ringout on the channel (at site 3). The mobile on Site 1 hears a single ringback followed by the go ahead prompt (short low/high/low prompt) indicating that the audio path from Site 1 to Site 3 has been opened. The mobile on Site 1 can now key up and do a voice hail to the other radios in his user group on Site 3. Any radio in his user group on Site 3 can answer back by just keying their radio, just like any other dispatch call.

### Section 3. Operation

*Table 3. OPERATION-2 Interconnect Gateway Call Progress*

<b>Mobile in Site 1 Area</b>	<b>48-MAX on Site 1</b>	<b>48-MAX on Site 3</b>	<b>Mobile in Site 3 Area</b>
Key radio and send long DTMF 3 and unkey	Validate Short sign-on of User #53		
	Take phone line off hook and execute autodial 23		
Hear phone call being placed through PSTN	Audio path from Phone to Mobile is opened	Ring voltage is detected on Line 1 input	
Hear ringing from CO as Site 3 is called		Answer ringing line, issue a FastNET answer sequence	
Hear answer and over dial of User #	Receive FastNET answer, over dial Page Forward #	Validate over dial of User #50. Key TX and ring once	
Hear ring followed by Go Ahead prompt from Site 3		Issue Go Ahead prompt to phone line and open audio	Radio unquelsches and ringing is heard
Key radio and voice hail	Audio path is opened		Hear audio from Site 1
Unkey radio and monitor	Audio path is reversed		Key radio and answer back
Hear audio from Site 3		Audio path is opened	
		Audio path is reversed	Unkey radio and monitor
Key radio and send long DTMF # to disconnect	Validate disconnect sequence from mobile		
	Send FastNET hang-up to Site 3 controller	Receive FastNET hang-up	
Hear normal disconnect (5 fast beeps)	Call is complete	Send telco side disconnect tones to mobile	Hear telco disconnect (long dual tone)

Once the call is in process the timers and disconnect conditions that are running are the same as for any interconnect call. mobile activity, call limit, detection of 2nd dialtone, loss of loop current or any valid disconnect code. Either radio can initiate a shut down which will clear the other side down using FastNET commands again. Since the radios are DTMF equipped there would be no reason to not have them clear the call down using a disconnect ANI (default is a long DTMF #).



## 4. PROGRAMMING

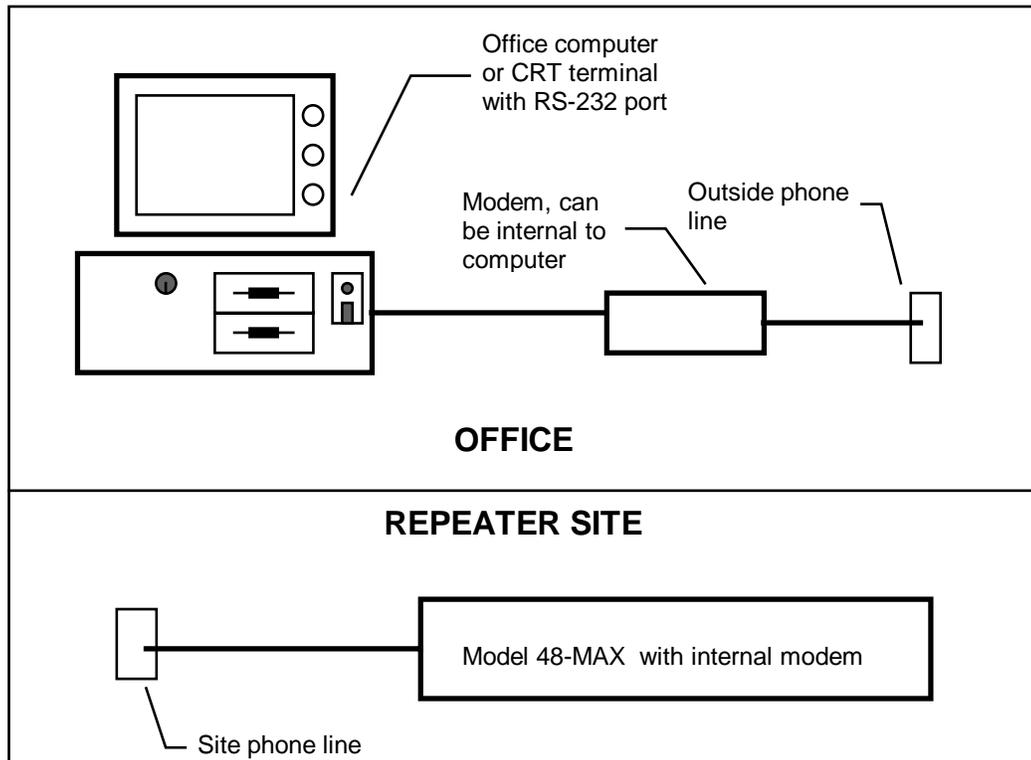
XON / XOFF PROTOCOL .....	4-2
SERIAL INTERFACE CONNECTIONS .....	4-2
TYPICAL CONNECTION TO A COMPUTER OR VIDEO TERMINAL .....	4-3
MODEL 48-MAX MENU STRUCTURE.....	4-4
PROGRAMMING CONVENTIONS.....	4-4
CONVENIENCE FEATURES .....	4-6
QUICK EXAMPLES.....	4-6
Interconnect Only .....	4-7
Dispatch Only .....	4-8
Interconnect and Dispatch .....	4-8
ACCESSING A MODEL 48-MAX BY MODEM.....	4-11
Terminal Emulation Mode Example.....	4-12
Using the Terminal in Microsoft Windows .....	4-13
DEVICE CONFIGURATION AND BILLING DATA .....	4-15
Billing File Formats .....	4-15
FILE TRANSFER ACCESS MODE.....	4-21
Script Files for ProComm Plus .....	4-23
DETAILED LISTING MENU .....	4-26
HOW TO PROGRAM ANI'S IN THE MODEL 48-MAX .....	4-28
Short Sign-on .....	4-29
Multi-Digit ANI.....	4-29
ANI Conflicts.....	4-29
SYSTEM EXAMPLES.....	4-30
Short Sign-on .....	4-30
Multi-digit ANI.....	4-34
Steering Digit Applications .....	4-38
Wild ANI .....	4-41

## 4. PROGRAMMING

Programming the Model 48-MAX is designed to be straight forward and user friendly. All programming is done with menu driven prompts, in plain English. You may find that you don't even need the manual! You can connect to a Model 48-MAX for programming either locally through the RS-232 port or remotely using the internal modem. All system and user programming is done with a terminal or computer running terminal emulation software. The terminal or computer software must be capable of supporting ANSI terminal codes or VT102. The Model 48-MAX uses ANSI escape sequences for cursor and screen control.

The local RS-232 port is valuable for initial test and adjustment, as well as general purpose programming and monitoring. The Model 48-MAX is a "program while operate" device. You can do programming and device upload / download without taking the unit out of service. When using the internal modem, the phone line is also in use, but dispatch activity is unaffected.

The Model 48-MAX may be connected directly to an RS-232 terminal or computer when the equipment is co-located. When this is not possible, the Model 48-MAX's internal modem may be used.



## Section 4. Programming

### XON / XOFF PROTOCOL

The Model 48-MAX follows “XOFF/XON” protocol. This sequence prevents data from flowing too rapidly for the display device (printer/terminal) or host to assimilate. If the Model 48-MAX receives an “XOFF” code (Control S), the data output will pause until an “XON” code (Control Q) is received or 20 seconds expire.

### SERIAL INTERFACE CONNECTIONS

The local serial I/O port on the Model 48-MAX is compatible with RS-232C signals and uses an asynchronous ASCII serial communications protocol. Only three wires need to be connected from your terminal to the serial I/O connector on the Model 48-MAX: Tx data, Rx data and Ground. Set the terminal for 8 bits per character, no parity bit, and 1 stop bit (see the reference manual for the terminal you are using). Set the terminal type or mode to ANSI or VT102. The Model 48-MAX defaults to 4800 baud. If nothing happens, try reversing pins 2 and 3 at the connector on your terminal/computer.

#### CAUTION:

The 9 pin RS-232 connector on the Model 48-MAX has two different pin out configurations. JP1 and JP2 must BOTH be in position A for Zetron or position B for AT. Default configuration = A (Zetron).

*Table 4. PROGRAMMING-1 Model 48-MAX DB-9 Pin-out*

<b>JP1, JP2 = ZETRON INTERNAL CIRCUITRY</b>	<b>PIN</b>	<b>JP1, JP2 = AT INTERNAL CIRCUITRY</b>
NC	1	NC
NC	2	Tx data (transmit data)
Tx data (transmit data)	3	Rx data (receive data)
Rx data (receive data)	4	jumper to pin 6
Ground	5	Ground
jumper to pin 4	6	jumper to pin 4
jumper to pin 8	7	jumper to pin 8
jumper to pin 7	8	jumper to pin 7
NC	9	NC

The 9 pin RS-232 connector on the Model 48-MAX can be configured two ways. In the default configuration (JP1 and JP2 = A) provides compatibility with previous Zetron products (M38,M39,M45,M48).

The alternate configuration (JP1 and JP2 = B) provides compatibility with standard “AT” DB9 connection by providing the null modem termination. This works with a standard DB9 extension cable.

**TYPICAL CONNECTION TO A COMPUTER OR VIDEO TERMINAL***Table 4. PROGRAMMING-2 Zetron Configuration*

<b>M48-MAX DB-9 PIN</b>	<b>FUNCTION</b>	<b>CONNECTION</b>	<b>TERMINAL PC DB-25</b>	<b>TERMINAL AT DB-9</b>
3	Tx data	To terminal "Rx data"	3	2
4	Rx data	From terminal "Tx data"	2	3
5	Ground	Ground	7	5
n/a	No connect	RTS, jumper to CTS	4 ←	7 ←
n/a	No connect	CTS, jumper to RTS	5 ←	8 ←
n/a	No connect	DSR, jumper to DTR	6 ←	6 ←
n/a	No connect	DTR, jumper to DSR	20 ←	4 ←

The following pre-wired cables for popular computers and terminals are available from Zetron supporting the Zetron configuration.

<b>Part #</b>	<b>Description</b>
709-7027	RS-232 interface cable, DB-25P (terminal compatible)
709-7030	RS-232 interface cable, DB-25S (PC compatible)
709-7144	RS-232 interface cable, DB-9S (AT compatible)

*Table 4. PROGRAMMING-3 AT Configuration*

<b>M48-MAX DB-9 PIN</b>	<b>FUNCTION</b>	<b>CONNECTION</b>	<b>TERMINAL PC DB-25</b>	<b>TERMINAL AT DB-9</b>
2	Tx data	To terminal "Rx data"	3	2
3	Rx data	From terminal "Tx data"	2	3
5	Ground	Ground	7	5
7 ←	jumper to 8	RTS, jumper to CTS	4	7
8 ←	jumper to 7	CTS, jumper to RTS	5	8
6 ←	jumper to 4	DSR, jumper to DTR	6	6
4 ←	jumper to 6	DTR, jumper to DSR	20	4

### MODEL 48-MAX MENU STRUCTURE

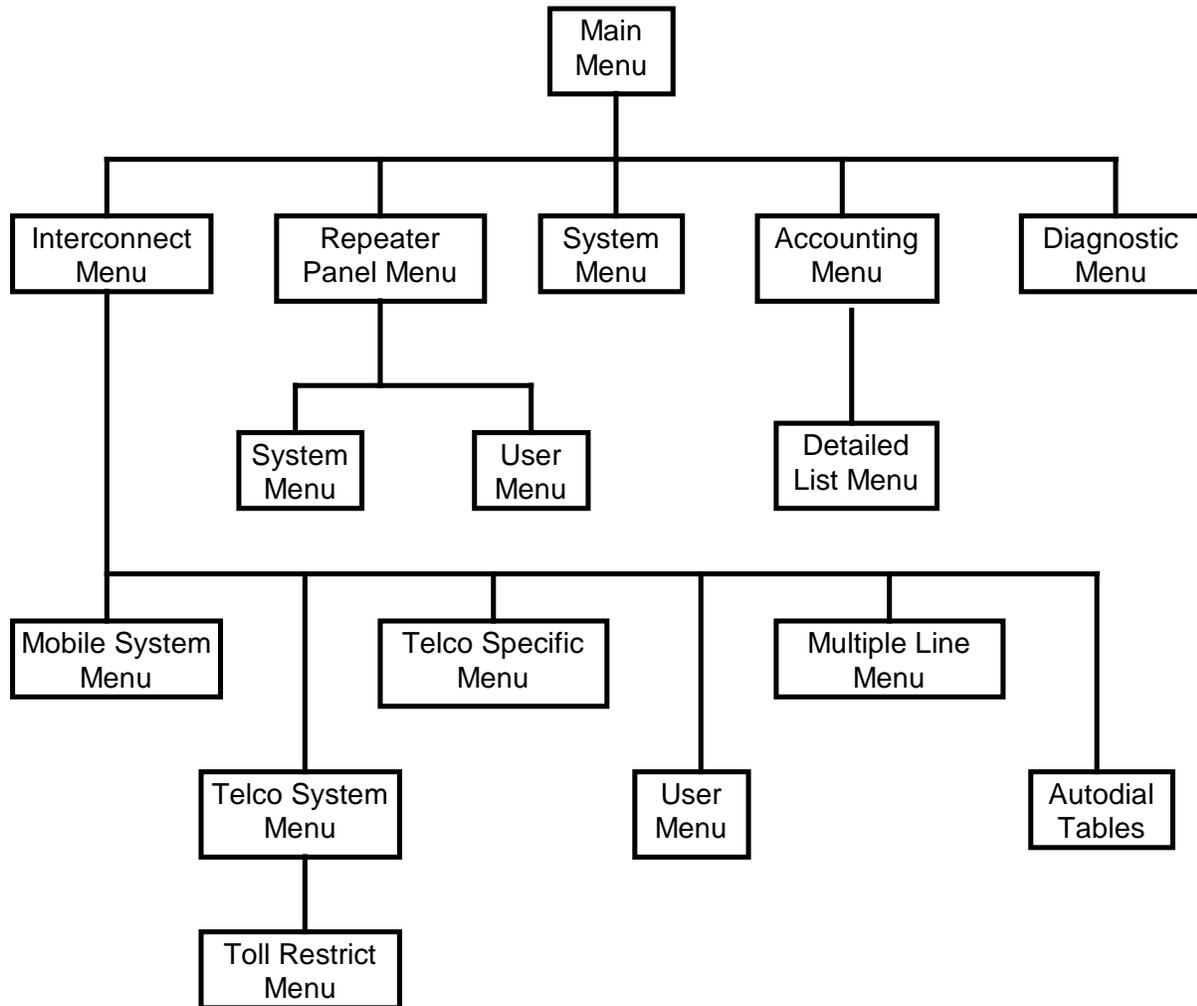


Figure 4. PROGRAMMING-1 Model 48-MAX Menu Structure

The Model 48-MAX incorporates 16 individual programming menus or screens into a structured menu system. Each menu contains groups of parameters that functionally relate to each other. Some of the menus are sub-grouped together to emphasize the functional relationship between the menus. To enter the program mode, press ENTER. The prompt “ENTER PASSWORD ===>” will be displayed. Enter the program access code (default is 12048) and press ENTER.

### PROGRAMMING CONVENTIONS

The Model 48-MAX has 16 menus or screens for programming and system maintenance. Programming activities include the system and user databases. Maintenance activities include up/down load device configuration, down load billing data, system monitoring, plus setup and adjustments.

Selecting an item in a menu is done by typing the associated number and pressing ENTER. If the number is out of range or invalid, an error beep will be sent and the line cleared. You can edit the line by using the backspace key. The Model 48-MAX does not evaluate the number until you press ENTER. To leave a menu and return to the previous menu, press the ESCAPE key (often labeled "ESC").

At any time, you can get back to the Main Menu by repeatedly pressing the ESCAPE key. To prevent accidental exiting during modem programming, selecting the exit command is required from the Main Menu.

Each menu has related commands in it. For example, the System Menu has all of the commands associated with the system as a whole, while the Interconnect Menu contains additional menus for specific areas of interconnect operation.

Each menu or screen remains displayed in its entirety while you are working with it. Each time you change an item, it is immediately updated on the screen. This gives you an up to date view of all the data on the screen at once. An example would be when programming a user. All the programmable items for that user is displayed on a single screen. You can see at a glance all the current program settings for that user. This makes for less errors or confusion due to the lack of displayed information.

There are 3 ways of entering data/parameters in the Model 48-MAX. The first is numerical data, (timing value or user number) this is entered as a decimal number. The second is string data, (ANI's, Autodials, or Selcall codes) this is entered in alpha-numeric strings. The third type is via scrolling or toggling among (state, type or mode) options for that parameter.

Numerical data is displayed in the units of measure for that data. When changing numerical data, you enter data using the same units of measure.

A valid data range for that data will be displayed. The Model 48-MAX will "BEEP" if the data entered is out of range. Pressing ENTER without entering any data will not change the current value. The data on the screen will be updated immediately once you have pressed ENTER.

When programming string data (ANI, pager codes), not all characters may be valid. Any invalid characters simply won't be recognized when entered. Once the maximum valid characters have been entered, no more will be accepted. Pressing ENTER without entering any data will not change the current value. The data on the screen will be updated immediately once you have pressed ENTER. String type data can be cleared by typing a " " (the space bar) and pressing ENTER.

When programming by scrolling (by pressing the space bar) through the (state, type or mode) selection for a particular item, the selection will be displayed in plain English (something descriptive for that item). You can accept the currently displayed selection by pressing ENTER. If you go past the selection you desired, just go around again (keep pressing any key) until the selection comes around again.

## Section 4. Programming

This should make the programming much more intuitive. Once familiar with the Model 48-MAX's operation, the manual may not be required to program the Model 48-MAX.

When programming the Model 48-MAX with a modem, loss of carrier will force the Model 48-MAX to exit the programming mode and return to the normal operating mode.

### **CONVENIENCE FEATURES**

As an aid to programming a Model 48-MAX, some convenience features have been added. Most apply to programming of Users (which can be tedious).

#### **Interconnect users:**

You can block program many items in the User menu. Set the starting and stopping user number with User range. When an item is selected for programming, you will be prompted to program all or one at a time for the range selected.

You can advance to the next sequential user by typing "N" (for next) followed by ENTER. You can go to the previous user by typing "P" (for previous) followed by ENTER.

You can search for a specific ANI in the user database. Select User range. When prompted for the starting user, just press ENTER. You will then be prompted for an ANI to search for. If found, it will bring up that user in the menu. This can be useful for trying out Wild ANI!

#### **Repeater Panel users:**

You can block program many items in the User menu. Set the starting and stopping user number with User range. When an item is selected for programming, you will be prompted to program all or one at a time for the range selected.

You can advance to the next sequential user by typing "N" (for next) followed by ENTER. You can go to the previous user by typing "P" (for previous) followed by ENTER.

#### **CTCSS/DCS programming:**

CTCSS tones are entered in Hz. Just enter the first 3 digits of the tone. The Model 48-MAX will figure out the rest. See "CTCSS Tones" in Section 8.

DCS codes are entered directly by prefacing the octal code with "D". See "Digital Squelch Codes" in Section 8.

To clear a CTCSS/DCS value, simply enter 0 for the tone/code.

### **QUICK EXAMPLES**

Here are three quick examples of programming "Users" in order to demonstrate some basic functions of the Model 48-MAX. A "User" may be defined as an individual radio operator who gains access to the radio system by transmitting the appropriate DTMF codes, either manually, or by using codes preprogrammed into particular radios' ANI encoders. We will

set up one user (radio) for interconnect only (Mobile-to-phone, Phone-to-mobile) using short sign-on, one user (radio) for dispatch only (repeater operation) and one user (radio) for both interconnect and dispatch operation using multi-digit ANI.

Before starting these examples, go to the Diagnostic menu and reset the System database (item 2) and User databases (item 3) to factory default.

Items that have been changed **are in bold** in the example menus.

### Interconnect Only

Our interconnect only user has three items changed from default: *Enabled* is set to “Yes”, *CTCSS/DCS decode* and *CTCSS/DCS encode* are both set to “100.0” Hz. Notice also that this is User 1; Short sign-on users should be placed in the low end of the database.

```

                                INTERCONNECT USER MENU

1 - User range: 1                16 - CTCSS/DCS drop: No
2 - Enabled: Yes                17 - Call limit time: 03 mins
3 - Access ANI: *                18 - Call detail logging: All
4 - Answer type: *                19 - Toll restrictions: Blap
5 - Disconnect ANI: #            20 - Interconnect privacy: Repeat
6 - Equipment type: Mobile        21 - Scheduled telco access: Disabled
7 - Mobile-to-phone: Enabled      22 - Courtesy tone: Disabled
8 - Phone-to-mobile: Enabled      23 - Mobile ringout: High warble
9 - Mobile-to-mobile: Disabled    24 - Page forward user: None
10 - ANI Mobile-repeat: Disabled  25 - Autodial mode: 00
11 - Line select: L1 Only         26 - Hookflash mode: Disabled
12 - Selcall format: None        27 - Mobile activity timer: Enabled
13 - Selcall capcode:            28 - Interconnect hog mode: Disabled
14 - CTCSS/DCS decode: 100.0    29 - List users (in user range)
15 - CTCSS/DCS encode: 100.0  30 - Airtime - Accumulate: 00:00:00

<ESC> to exit
Select a command:

```

This user is now set up for Short sign-on; Mobile-to-phone on Line 1. Program a DTMF equipped radio for the proper transmit and receive frequencies that correspond to the repeater that the Model 48-MAX is installed on. Set the CTCSS encode and decode for 100.0 Hz.

Key up and send a DTMF “\*” for greater than 500mSec. Unkey. Model 48-MAX will key the transmitter and seize line 1. You should hear dial tone from the Central Office. Dial a 7 digit local telephone number. You should now be in conversation mode. Key up and send a DTMF “#” for greater than 500mSec. Model 48-MAX will send 5 short disconnect beeps and drop the transmitter.

Call into the Model 48-MAX, when the line is answered the *Overdial prompt tone* will be issued (default is an 800 Hz beep tone); overdial 01 (001 for Roamer), the Model 48-MAX will key the transmitter and start sending ringing tones and encoding 100.0 Hz. Key up and

## Section 4. Programming

send a DTMF “\*” for greater than 500mSec to answer. You should now be in conversation mode. Key up and send a DTMF “#” for greater than 500mSec. The Model 48-MAX will send 5 short disconnect beeps and drop the transmitter.

### Dispatch Only

Our dispatch only user has only one item changed from default, *Enabled* is set to “Yes”.

REPEATER PANEL USER MENU	
1 - User range: 20	8 - Courtesy bip: Disabled
2 - <b>Enabled: Yes</b>	9 - Hog mode: Disabled
3 - Decode: 127.3	10 - DTMF Repeat: Disabled
4 - Encode: 127.3	11 - Morse ID:
5 - Reserved: Disabled	12 - Tx hold time: 2000 msec
6 - Privacy: Disabled	13 - List users (in user range)
7 - Encode during TX hold: No	14 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

Set User range to 20 for CTCSS tone 127.3 Hz. Set Enabled to Yes

This enables CTCSS tone 127.3 Hz for dispatch operation. Program a radio for the proper transmit and receive frequencies that correspond to the repeater that the Model 48-MAX is installed on. Set the CTCSS encode and decode for 127.3 Hz.

Key up and the Model 48-MAX will key the transmitter, open the repeat audio path and encode 127.3 Hz. Unkey the radio, the Model 48-MAX will stop encoding 127.3 Hz. After 2 seconds, the Model 48-MAX will drop the transmitter.

### Interconnect and Dispatch

Our Interconnect and Dispatch user needs to be in both the ANI user database and the Repeater Panel user database. We first need to set up Dispatch by choosing a Decode tone/code (we will use D023). We then need to set *Enable* to “Yes” for DCS code 023.

## REPEATER PANEL USER MENU

- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1 - User range: 51            | 8 - Courtesy bip: Disabled          |
| 2 - <b>Enabled: Yes</b>       | 9 - Hog mode: Disabled              |
| 3 - Decode: D023              | 10 - DTMF Repeat : Disabled         |
| 4 - Encode: D023              | 11 - Morse ID:                      |
| 5 - Reserved: Disabled        | 12 - Tx hold time: 2000 msec        |
| 6 - Privacy: Disabled         | 13 - List users (in user range)     |
| 7 - Encode during TX hold: No | 14 - Airtime - Accumulate: 00:00:00 |
- <ESC> to exit  
Select a command:

We have now enabled D023 for dispatch activity. Next we must program our user for interconnect operation in the ANI user database. We want to use a multi digit ANI so we select a user higher in the database.

We need to change a few more items from default; *Enabled* set to “Yes”; *Access ANI* set to “\*45”; *Mobile-to-mobile* set to “Enabled”; *CTCSS/DCS decode* and *CTCSS/DCS encode* set to “D023” to match our enabled dispatch tone/code.

## INTERCONNECT USER MENU

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1 - User range: 45                   | 16 - CTCSS/DCS drop: No               |
| 2 - <b>Enabled: Yes</b>              | 17 - Call limit time: 03 mins         |
| 3 - <b>Access ANI: *45</b>           | 18 - Call detail logging: All         |
| 4 - Answer type: *                   | 19 - Toll restrictions: Blap          |
| 5 - Disconnect ANI: #                | 20 - Interconnect privacy: Repeat     |
| 6 - Equipment type: Mobile           | 21 - Scheduled telco access: Disabled |
| 7 - Mobile-to-phone: Enabled         | 22 - Courtesy tone: Disabled          |
| 8 - Phone-to-mobile: Enabled         | 23 - Mobile ringout: High warble      |
| 9 - <b>Mobile-to-mobile: Enabled</b> | 24 - Page forward user: None          |
| 10 - ANI Mobile-repeat: Disabled     | 25 - Autodial mode: 00                |
| 11 - Line select: L1 Only            | 26 - Hookflash mode: Disabled         |
| 12 - Selcall format: None            | 27 - Mobile activity timer: Enabled   |
| 13 - Selcall capcode:                | 28 - Interconnect hog mode: Disabled  |
| 14 - <b>CTCSS/DCS decode: D023</b>   | 29 - List users (in user range)       |
| 15 - <b>CTCSS/DCS encode: D023</b>   | 30 - Airtime - Accumulate: 00:00:00   |
- <ESC> to exit  
Select a command:

We now have a user with an ANI of “\*45” with privileges of Mobile-phone, Phone-mobile, Mobile-Mobile and dispatch operations. Program a DTMF equipped radio for the proper transmit and receive frequencies that correspond to the repeater that the Model 48-MAX is installed on. Set the DCS encode and decode for 023.

## Section 4. Programming

### **Dispatch operation:**

Key up and verify dispatch operation of the Model 48-MAX on DCS 023.

### **Mobile to phone operation:**

Key up and send the DTMF sequence “\*45”, unkey; the Model 48-MAX will key up and issue the *Steering digit prompt* (default is simulated dial tone). Key up and enter a DTMF “\*” or “9” for phone line access. Hear dial tone back from the Central office. Dial a 7 digit phone number. You should now be in the conversation mode. Key up and send a DTMF “#” for greater than 500mSec. The Model 48-MAX will send 5 short disconnect beeps and drop the transmitter.

### **Mobile to mobile operation:**

Key up and send the DTMF sequence “\*45”, unkey; the Model 48-MAX will key up and issue the *Steering digit prompt* (default is simulated dial tone). Key up and enter a DTMF “7” for mobile to mobile access. The Model 48-MAX will issue the *Overdial prompt* (default is an 800Hz beep tone). Key up and overdial 01 (001 for Roamer). The Model 48-MAX will now switch sub-audible encode to 100.0 Hz (our interconnect only user from the first example) and send ringing. Key up with 100.0 Hz and send a DTMF “\*” for greater than 500mSec to answer. The Model 48-MAX will now switch to D023 for encode. You are now in the conversation mode, radio to radio, with the Model 48-MAX doing the proper tone/code translation. When decoding 100.0 Hz it will encode D023; when decoding D023 it will encode 100.0Hz. Key up with 100.0 Hz or D023 and send a DTMF “#” for greater than 500mSec. The Model 48-MAX will send 5 short disconnect beeps and drop the transmitter.

### **Phone to mobile operation:**

Call into the Model 48-MAX, when the line is answered the *Overdial prompt tone* will be issued (default is an 800 Hz beep tone); overdial 45 (045 for Roamer), the Model 48-MAX will key the transmitter and start sending ringing tones and encoding D023. Key up and send a DTMF “\*” for greater than 500mSec to answer. You should now be in conversation mode. Key up and send a DTMF “#” for greater than 500mSec. The Model 48-MAX will send 5 short disconnect beeps and drop the transmitter.

## ACCESSING A MODEL 48-MAX BY MODEM

For remote programming, retrieval of billing data, and diagnostics, the Model 48-MAX has an internal 1200/2400 baud modem. It supports auto detection of Bell 212, CCITT V.22 (1200 baud), and CCITT V.22bis (2400 baud) modulation standards in both answer and originate modes of operation.

The typical method for remote access is to call the Model 48-MAX from the phone side. Once it has answered the phone line, wait for the over dial prompt and then dial the program access code. This will set the Model 48-MAX's internal modem to answer mode, which then responds with a CCITT V.25 answer sequence. It will then auto detect the calling modem's baud rate (1200 or 2400) and adjust accordingly. When your local modem responds with a "CONNECT" response, press ENTER (or RETURN) and the Main Menu will be displayed.

An alternative method is to use the dial modifier "R" appended to the end of the phone number. This reverses the operating mode of the calling modem from *Originate* to *Answer*. A number of commas ("," = delay characters) are inserted in between the phone number and the "R". This is to delay the start of the answer tone until after the Model 48-MAX has answered the phone line and issued its over dial prompt. When the Model 48-MAX answers the phone line, it gives two seconds of silence (billing delay) followed by its over dial prompt. It then listens for either Bell answer (2225 Hz), unscrambled marks at 1200 baud, or overdialed digits. If it hears another modem instead of DTMF tones, the Model 48-MAX will auto detect your modem's baud rate and connect accordingly. When your local modem responds with a "CONNECT" prompt to your computer screen, press ENTER and the Model 48-MAX will send the "ENTER PASSWORD ==>" prompt, just as it would to the local RS-232 port.

Once a successful handshake has taken place (i.e. you receive the CONNECT prompt), the Model 48-MAX waits up to 30 seconds for a Carriage Return character (what the computer sends when you press ENTER) to be received. If connected in the *Answer* mode, it has already received the program access and the Main Menu is displayed. If it connects in the *Originate* mode, the Model 48-MAX needs the program access code to validate access to programming.

Once the Model 48-MAX has been accessed by modem, interconnect call are no longer processed (phone-to-mobile, mobile-to-phone, ANI-mobile repeat) while the phone line is in use. Repeater panel operation, however, is not affected and can be monitored by the Real Time display function in the Diagnostic menu.

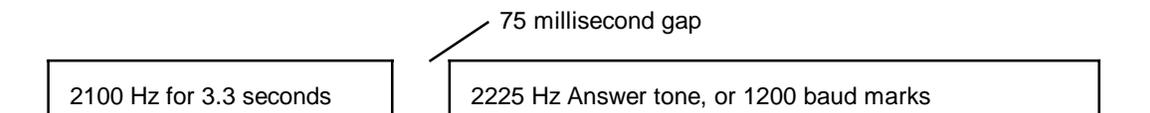


Figure 4. PROGRAMMING-2 CCITT V.25 Answer Sequence

## Section 4. Programming

The Answer sequence is as follows, the 2100 Hz CCITT Answer tone is presented for 3.3 seconds, followed by a 75 millisecond gap of silence. The actual handshake part of the sequence starts then, and is composed of a 2225 Hz Answer tone for Bell 212, or 1200 baud unscrambled marks for CCITT V.22 or V.22bis. The purpose of the 2100 Hz answer tone followed by silence is to disable echo suppressers in international trunk connections. The answering modem is the one who initiates the handshake with this sequence.

### Terminal Emulation Mode Example

This example assumes that you already know the basics of how to startup and configure the communications software that you will be using.

Start your communications program and enter into the terminal emulation mode (ANSI or VT102 should do).

Configure the software for the correct COM port (the one your modem is attached to) and set the parameters to 2400 baud, 8 data bits, 1 stop bit, and No Parity.

Type in the following “AT” commands one at a time, followed by a carriage return (ENTER), and wait for the modem's response.

AT Commands	Description
ATZ OK	Reset the modem to default programming. Response from the modem (local).
ATX1 OK	Enable blind dialing, modem does not need to detect dialtone. Response from the modem (local).
ATDT8206363; OK	Dial the phone number of the 48-MAX and stay in Command mode. Response from the modem (local).
ATDT12048	Send the program access code when you hear the overdial prompt.  You should hear the two modems bring up their carriers, handshake, and then silence when a connection has occurred.
CONNECT 2400	Response from the modem (local) indicating a valid connection at the baud rate indicated.

Press the ENTER key and the Main Menu of the Model 48-MAX is displayed.

An alternate method to the one just shown uses the “,” (comma character) delay marker to insert a delay period between the phone number and the program access code.

```
ATDT8206363,,,,,12048
```

This will dial the phone number and then wait about 10 seconds and send the program access code. You may need to add or subtract a few commas to adjust the delay period for a particular installation. Each comma inserts two seconds of delay. The idea is you want

enough delay to make sure that the Model 48-MAX has answered the line and the audio path has been established in both directions. You should be able to send the DTMF over any voice prompt or over dial prompt tone.

Another alternative is to use the “R”, reverse mode modifier. (Note modems with Rockwell chip sets may not support this mode!)

```
ATDT8206363,,,,,R
```

This will dial the phone number and then wait about 12 seconds before sending the Answer tone. You may need to add or subtract a comma to adjust the delay for any specific installation. Each comma inserts a two second delay. The idea is that you want enough of a delay to ensure that the Model 48-MAX has answered the line and started to issue the over dial prompt before the computer's modem starts its Answer tone. If voice prompts are programmed, you should set the delay long enough the voice prompt is completed before the Answer tone is sent to the Model 48-MAX. You will probably need to experiment a few times to get the timing right with the handshake. Each installation will be different and your mileage may vary.

### Using the Terminal in Microsoft Windows

The Terminal Application that comes in Microsoft Windows V3.1 can be used to communicate with the Model 48-MAX. It can be used for programming or used to perform file transfers. The default location for Terminal is in the Access folder.

#### Configuration:

1. Start Terminal by double clicking on its icon.
2. Open the Settings menu, select Binary Transfers, set this parameter to XMODEM.
3. Open the Settings menu, select Terminal Emulation, set this parameter to DEC VT100 (ANSI).
4. Open the Settings menu, select Communications, set the following parameters:
  - Baud rate = 2400
  - Data bits = 8
  - Stop bits = 1
  - Parity = None
  - Flow Control = Xon/Xoff
  - COM Port = the port your modem is connected to or configure for

These parameters set up the basic rules of communication between the modem and your PC.

## Section 4. Programming

5. Open the Settings menu, select Modem Commands, set the following parameters:

- Dial Prefix = ATDT
- Dial Suffix = ,,,,12048
- Hang-up prefix = +++
- Hang-up suffix = ATH
- Modem defaults = Hayes for most modems

These parameters set up how your modem dials a phone number and how it hangs up the phone line.

6. Open the Settings menu, select Phone Number, make the following entries:

- Dial = the phone number for the line to the Model 48-MAX
- Time out = 45 seconds

7. Open the File menu, select Save As, and enter a file name. This will save the configuration, complete with phone number and password, for this site.

You should now be setup to call a Model 48-MAX at 2400 baud, using the default password. You are also setup for file transfers as required.

### **Connecting:**

Open the Phone menu and select Dial. This will dial up the Model 48-MAX, pause 10 seconds, and send the program access code. You may need to add or subtract a “,” (comma) in the Dial suffix string to get the timing correct.

A pop-up window will appear indicating we are trying to connect to a modem, a timer will be counting down. You will also be able to hear the progression of the call. Once the modems have connected you will see “CONNECT 2400” indicating a successful connection with Model 48-MAX. Press the ENTER key (or RETURN key) and you will be presented with the Main Menu in the Model 48-MAX.

To perform a file transfer with the Model 48-MAX, you must first initiate the file transfer in the Model 48-MAX. This is done in the Accounting menu. You then open the Transfers menu in Terminal and select either Receive Binary File, or Send Binary File, and then select a file name. The bar on bottom of the window will give status information on the file transfer. Note that once a download from the Model 48-MAX has been started, it will take up to 20 seconds for the two machines to agree to start the transfer. This is normal. The Model 48-MAX supports XMODEM (checksum) data transfer protocol.

## DEVICE CONFIGURATION AND BILLING DATA

The Model 48-MAX provides a convenient way of saving and restoring device configurations and downloading billing information. The Model 48-MAX uses the XMODEM protocol for data transfers. This is supported by most popular software communications packages.

Device configuration is broken into three files: System Database, Interconnect User Database, and Repeater Panel User Database. Device configuration files are binary data and cannot be manipulated. They are intended for backup purposes only.

Billing data is also broken into three files: ANI User Airtime, Repeater Panel User Airtime, and Call detail records. Billing data files are in ASCII text and are suitable for import into billing software packages.

All data transfers are initiated in the Accounting Menu. Device configuration can be uploaded or downloaded. Billing data can only be downloaded. Transferring the System Database or Call Detail Records is accomplished by selecting the appropriate menu item and pressing ENTER. Then start the transfer in your communications software (see the manual for your communications software). Transferring the User Database or User Airtime records adds an additional step to the process. When you select the appropriate menu item, you will be able to toggle between "Interconnect" or "Repeater Panel". Simply press ENTER when the desired selection is displayed. Then start the transfer in your communications software (see the manual for your communications software).

### Billing File Formats

Downloaded billing files are in ASCII text. Each line is terminated with CR (13), LF (10). All three billing data files have a common header format to identify the file type and where and when the file was downloaded. Following the three-line header are the billing records, one record per line. The format is intended to make it easy to be read and understood by both a human and a billing software package.

**HEADER** - An example of a billing file header follows:

```
Model 48-MAX -- V1.00 S/N 101
SITE: BLACKNOSE MTN SITE
48M AA 09:07 09/01/95 4
```

Line 1 of the header identifies the unit (Model 48-MAX), the software version (V1.00), and the serial number (S/N 101).

Line 2 prints the Site ID string programmed into the unit.

Line 3 holds information useful when importing data to a computer program. It indicates the device type (48M), record type (AA), time and date of download (09:07 09/01/95), and number of records in file (4).

## Section 4. Programming

Valid record types in Line 3 are: CD = Call detail, AA = ANI airtime, and RA = Repeater panel airtime.

**RECORDS** - Following the three-line header are the billing records. Each line contains one record. Each record is terminated with CR (13) LF (10). Each field in a record is delimited with an ASCII space (32). Each record begins with a letter indicating record type. See Table 4. **PROGRAMMING-4** for a description of the fields in a record.

*Table 4. PROGRAMMING-4 Billing Data Record Fields*

<b>Field Name</b>	<b>Description</b>	<b>Variables</b>
Record Type	Distinguishes between types of records	A = ANI airtime R = Repeater panel airtime D = Call detail
Equipment Type	Distinguishes between two-way mobile calls and paging services	M = Mobile or Talkback P = Tone-only or Tone & Voice pager
Call Qualifier	Determines how a call was terminated and its billable status	A = Normal Call B = No answer by called mobile C = Supervisor override D = Invalid number overdialed E = Toll restricted F = Access denied G = Page forward H = Priority override
Call Type	Determines what type of call was placed	A = Mobile originated Line 1 B = Mobile originated Line 2 R = Validated repeater access M = Mobile-to-Mobile 1 = Phone-to-Mobile Line 1 2 = Phone-to-Mobile Line 2 0 = Phone-to-Mobile Local

ANI airtime records are those for Interconnect operation. Every user who is set for Prepay airtime, or who has Accumulated airtime of at least 1 minute, will be downloaded. Every user whose equipment type is Pager (Pager or Tone and Voice) will also be downloaded.

Examples of ANI Airtime records follow:

A 013 M Y A 00:16:22

A = ANI Airtime  
 013 = User number  
 M = Mobile equipment type (see Table 4-1)  
 Y = User is currently enabled  
 A = Airtime record is Accumulated  
 00:16:22 = Accumulated airtime in HH:MM:SS format

A 002 M Y P 00:21:37

A = ANI Airtime  
 002 = User number  
 M = Mobile equipment type  
 Y = User is currently enabled  
 P = Airtime record is Prepay  
 00:21:37 = Airtime available in HH:MM:SS format

A 099 P Y A 13

A = ANI Airtime  
 099 = User number  
 P = Pager equipment type  
 Y = User is currently enabled  
 A = Airtime record is Accumulated  
 13 = Accumulated number of pages

Repeater Panel Airtime records are those for Repeater Panel or dispatch operation. Every user who is set for Prepay airtime, or who has Accumulated airtime of at least 1 minute, will be downloaded. Examples of repeater panel airtime records follow:

R 013 Y 100.0 A 01:33:50

R = Repeater Panel Airtime  
 013 = Tone/code number  
 Y = Tone/Code is currently enabled  
 100.0 = decode tone  
 A = Airtime record is Accumulated  
 01:33:50 = Accumulated airtime in HH:MM:SS format

R 015 Y 107.2 P 00:43:56

R = Repeater Panel Airtime  
 015 = Tone/code number  
 Y = Tone/Code is currently enabled  
 107.2 = decode tone  
 P = Airtime count is Prepay  
 00:43:56 = remaining prepaid airtime in HH:MM:SS format

R 066 N D074 A 00:15:27

## Section 4. Programming

R = Repeater Panel Airtime  
066 = Tone/code number  
N = Tone/Code is currently disabled  
D074 = decode code  
A = Airtime count is Accumulated  
00:15:27 = Accumulated airtime in HH:MM:SS format

A call detail record is a log or record of a single interconnect call. All calls that are stored internally will be downloaded. The information in each field can change based on Call type and Call qualifier codes. Also the ANI field can be either the ANI programmed for the billed user or the ANI decoded as valid on the channel.

Examples of call detail records follow:

D 001 M A 11:20 09/01/95 8206363 A 000:28 \*8001

D = Call Detail record  
001 = ANI user number to whom call is billed  
M = Mobile equipment type (see Table 4-1)  
A = Call qualifier code indicates a normal call (see Table 4-1)  
11:20 09/01/95 = time/date of call origination  
8306363 = telephone number dialed  
A = Call type code indicates mobile originated Line 1 (see Table 4-1)  
000:28 = duration of call in MMM:SS format  
\*8001 = ANI of user to whom call is billed

D 010 M A 07:34 09/01/95 8206363 A 002:13 \*010

D = Call Detail record  
010 = ANI user number to whom call is billed (originating mobile)  
M = Mobile equipment type  
A = Call qualifier code indicates a normal call  
07:34 09/01/95 = time/date of call origination  
8306363 = telephone number dialed  
A = Call type code indicates mobile originated Line 1  
002:13 = duration of call in MMM:SS format  
\*010 = ANI who signed on to system (originating mobile)

## Section 4. Programming

D 010 M B 07:45 09/01/95 USR 099 M 000:36 \*010

D = Call Detail record  
 010 = ANI user number to whom call is billed  
 M = Mobile equipment type  
 B = Call qualifier code indicates no answer by called mobile  
 07:45 09/01/95 = time/date of call origination  
 USR 099 = ANI user number of destination or called mobile  
 M = Call type code indicates mobile to mobile  
 000:36 = duration of call in MMM:SS format  
 \*010 = ANI of user to whom call is billed

D 099 M E 08:09 09/01/95 Toll restrict B 000:08 \*099

D = Call Detail record  
 099 = ANI user number to whom call is billed (originating mobile)  
 M = Mobile equipment type  
 E = Call qualifier code indicates toll restricted, call terminated  
 08:09 09/01/95 = time/date of call origination  
 Toll restrict = Comment on call termination  
 B = Call type code indicates mobile originated Line 2  
 000:08 = duration of call in MMM:SS format  
 \*099 = ANI who signed on to system (originating mobile)

D 099 M D 08:34 09/01/95 Invalid entry M 000:08 \*099

D = Call Detail record  
 099 = ANI user number to whom call is billed (originating mobile)  
 M = Mobile equipment type  
 D = Call qualifier code indicates invalid number overdialed  
 08:34 09/01/95 = time/date of call origination  
 Invalid entry = Comment on call termination  
 M = Call type code indicates mobile to mobile  
 000:08 = duration of call in MMM:SS format  
 \*099 = ANI who signed on to system (originating mobile)

D 050 M A 10:26 09/01/95 1 001:04 \*050

D = Call Detail record  
 050 = ANI user number to whom call is billed (destination mobile)  
 M = Mobile equipment type  
 A = Call qualifier code indicates a normal call  
 10:26 09/01/95 = time/date of call origination  
 = normal phone to mobile call -- no entry  
 1 = Call type code indicates phone to mobile Line 1  
 001:04 = duration of call in MMM:SS format  
 \*050 = ANI to whom call is billed (destination mobile)

## Section 4. Programming

D 001 P A 10:39 09/01/95 2 000:14 \*

D = Call Detail record  
001 = ANI user number to whom call is billed (destination pager)  
P = Pager equipment type  
A = Call qualifier code indicates a normal call  
10:39 09/01/95 = time/date of call origination  
= normal phone to pager call -- no entry  
2 = Call type code indicates phone to pager Line 2  
000:14 = duration of call in MMM:SS format  
\* = ANI to whom call is billed (destination mobile)

## FILE TRANSFER ACCESS MODE

The File Transfer Access Mode is a method for accessing a Model 48-MAX for uploading and down loading of device configuration files, retrieval of billing data, and resetting the database and billing records when necessary. This mode of operation is designed to support communications packages with script languages, such as ProComm Plus. It can also be driven in a manual fashion using simple terminal emulation software such as Terminal, found in Microsoft Windows. The Model 48-MAX supports the XMODEM data transfer protocol for file transfers. All the commands accessible in the mode are also available in the normal programming menus.

Access to the File Transfer Access Mode is identical to normal program mode access, either by modem or local RS-232 port connection. Which mode is selected is determined by the password entered. Normal program mode uses the “Program Access Code” as the password (default is 12048). This is a fixed length, five digit number. All 16 DTMF tone-pairs are valid (0 to 9, A, B, C, D, \*, #). File Transfer Access Mode uses the same code, but with the last (or fifth) digit incremented by one for its access code. As an example, if the program access code is “12048” the file transfer access code is “12049”. Only the last digit is incremented, the first four digits will always be the same. The fifth digit increments by one and if required, will wrap around from “#” to “0”.

### Command structure:

File Transfer Access Mode uses simple commands to initiate actions by the Model 48-MAX. Commands are always a two digit number sent in ASCII followed by a <CR> (an ASCII carriage return character). All commands have a corresponding menu item in either the Accounting menu or the Diagnostic menu. The commands fall into two categories; 1) File Transfers, and 2) Clear commands. The File Transfer commands execute the same as if you had selected the item in the Accounting menu. The timing to start the file transfer is also the same. The Clear commands as well operate just as they would if chosen from the menu. Upon the successful completion of a command, the Model 48-MAX respond by sending the ASCII string “OK <CR> <LF>”, indicating that it is now ready for the next command. Unrecognized commands are responded to with the ASCII string “<NAK> (15) <CR> <LF>”.

## Section 4. Programming

With one exception, all of the commands in Table 4. PROGRAMMING-6 have a corresponding menu item associated with it. These commands are just short cuts to execute them in File Transfer Access Mode. The command # 90 has no corresponding menu item. Its primary use would be to identify the unit before file transfers are started. This could help a script file decide how to name files during a download for example.

*Table 4. PROGRAMMING-6 File Transfer Access Mode Commands*

Command #	Description	Equivalent Menu Item
20	download system data base to PC	Download SYSTEM database
21	download ANI user (interconnect) database	Download USER database
22	download RP user (repeater panel) database	Download USER database
23	upload system database	Upload SYSTEM database
24	upload ANI user database	Upload USER database
25	upload RP user database	Upload USER database
30	download ANI user billing records	Download airtime records
31	download RP user billing records	Download airtime records
32	download Call Detail billing records	Download Call detail records
40	clear system database	Reset System database to factory defaults
41	clear ANI user database to factory default	Reset User database to factory defaults
42	clear RP user database to factory default	Reset User database to factory defaults
43	clear ANI user billing records (reset accumulated)	Clear airtime records
44	clear RP user billing records (reset accumulated)	Clear airtime records
45	clear Call Detail billing records	Clear Call detail records
90	return device specific information	“WHO” (non-menu item)
99	exit File Transfer Access Mode (good-bye)	

### **Response to the “who” command:**

In response to the “WHO” command, the Model 48-MAX returns a string of ASCII characters similar to the following:

```
48M 101 1.20 S 154 D 1.10 1.10 1.10 43
```

Reading left to right, the groups represent the following information:

ITEM	Name	Description
48M	Zebra ID	Identifies base model (48M, 45M, 735, 745, 748,148)
101	S/N	Sequential serial number of the device
1.20	601 Version	Version number of the main control software
S	Model type	Basic, Selcall, Roamer
154	ANI database size	Size of the ANI user database (99, 154, 750)
D	Billing level	Basic billing or SMDR installed
1.10	System database revision	Version number for System database
1.10	ANI database revision	Version number for ANI user database
1.10	RPT database revision	Version number for RP user database
43	Option byte	Installed options byte (in hexadecimal)

The example shown is a Model 48-MAX, serial number 101, version 1.20 software, Selcall, 154 ANI users, Call detail installed, System database V1.10, ANI database V1.10, RPT database 1.10, options are 154 user, Call detail, Voice prompts, and D25 option installed.

### Script Files for ProComm Plus

The following pages contain two examples of working scripts that can be used with ProComm Plus. The first one downloads database files. The second one downloads and then clears the billing files. These scripts are intended only to illustrate the concept of using ProComm with the Model 48-MAX in the File Transfer Access Mode. A real script for practical use would also have error checking and naming conventions implemented in it

```
; ASPECT SCRIPT FILE TO DOWNLOAD DATABASE FILES FROM 4X-MAX BASED PRODUCTS
; THIS SCRIPT SENDS THE PHONE NUMBER FOLLOWED BY PASSWORD IN DTMF
; THE CALLING MODEM IS PUT INTO ORIGINATE MODE
```

```
DEFINE TELEPHONE_NUMBER "ATDT8206363;^M"
DEFINE UNIT_PASSWORD "12049^M"
```

```
PROC MAIN
  EMULATE ANSI                ;SET TERMINAL TO ANSI
  SET PROTOCOL XMODEM         ;SET DATA TRANSFER PROTOCOL TO XMODEM
  SET RELAXED OFF             ;SET XMODEM TIMING TO NORMAL
  SET PORT COM2               ;SET COM PORT TO COM2
  SET BAUDRATE 2400           ;SET BAUD RATE TO 2400
  SET DATABITS 8              ;SET NUMBER OF DATA BITS TO 8
  SET PARITY NONE             ;SET PARITY TO NONE
  SET STOPBITS 1              ;SET NUMBER OF STOP BITS TO 1

  TRANSMIT "ATZ^M"            ;RESET MODEM
  WAITFOR "OK^M^J"
  TRANSMIT "ATX1^M"           ;SET TO BLIND DIAL
  WAITFOR "OK^M^J"
  TRANSMIT "ATB0^M"          ;SET TO CCITT MODE
  WAITFOR "OK^M^J"
```

## Section 4. Programming

```
TRANSMIT TELEPHONE_NUMBER      ;SEND PHONE NUMBER
WAITFOR "OK^M^J"
PAUSE 10                        ;WAIT 10 SECONDS FOR UNIT TO ANSWER LINE
TRANSMIT UNIT_PASSWORD         ;SEND DATA TRANSFER MODE PASSWORD
WAITFOR "CONNECT 2400^M^J"     ;WAIT FOR MODEM TO CONNECT
TRANSMIT "^M"                  ;SEND A <CR> TO 48-MAX
WAITFOR "^F"                    ;RECEIVE AN <ACK> FROM 48-MAX
TRANSMIT "20^M"                ;SEND "DOWNLOAD SYSTEM DATABASE" COMMAND
GETFILE XMODEM "SYSTEM.DBS"    ;RECEIVE SYSTEM DATABASE FILE
WAITFOR "OK^M^J"               ;WAIT FOR AN "OK" FROM THE 48-MAX
TRANSMIT "21^M"                ;SEND "DOWNLAOD ANI USER DATABASE" COMMAND
GETFILE XMODEM "ANIUSR.DBS"    ;RECEIVE ANI USER DATABASE
WAITFOR "OK^M^J"               ;WAIT FOR "OK" FROM THE 48-MAX
TRANSMIT "22^M"                ;SEND "DOWNLOAD RP USER DATABASE" COMMAND
GETFILE XMODEM "TONEUSR.DBS"  ;RECEIVE RP USER DATABASE
WAITFOR "OK^M^J"               ;WAIT FOR "OK" FROM 48-MAX
TRANSMIT "99^M"                ;SEND "GOODBYE" COMMAND
HANGUP                          ;HANGUP LINE
ENDPROC
```

```
; ASPECT SCRIPT FILE TO DOWNLOAD DATABASE FILES FROM 4X-MAX BASED PRODUCTS
; THIS SCRIPT SENDS THE PHONE NUMBER FOLLOWED BY PASSWORD IN DTMF
; THE CALLING MODEM IS PUT INTO ANSWER MODE
```

```
DEFINE TELEPHONE_NUMBER "ATDT8206363,,,,,R^M"
DEFINE UNIT_PASSWORD "12049^M"
```

```
PROC MAIN
  EMULATE ANSI                  ;SET TERMINAL TO ANSI
  SET PROTOCOL XMODEM           ;SET DATA TRANSFER PROTOCOL TO XMODEM
  SET RELAXED OFF                ;SET XMODEM TIMING TO NORMAL
  SET PORT COM2                  ;SET COM PORT TO COM2
  SET BAUDRATE 2400              ;SET BAUD RATE TO 2400
  SET DATABITS 8                 ;SET NUMBER OF DATA BITS TO 8
  SET PARITY NONE                ;SET PARITY TO NONE
  SET STOPBITS 1                 ;SET NUMBER OF STOP BITS TO 1

  TRANSMIT "ATZ^M"               ;RESET MODEM
  WAITFOR "OK^M^J"
  TRANSMIT "ATX1^M"              ;SET TO BLIND DIAL
  WAITFOR "OK^M^J"
  TRANSMIT "ATB0^M"              ;SET TO CCITT MODE
  WAITFOR "OK^M^J"

  TRANSMIT TELEPHONE_NUMBER      ;SEND PHONE NUMBER
  WAITFOR "CONNECT 2400^M^J"     ;WAIT FOR MODEM TO CONNECT
  TRANSMIT "^M"                  ;SEND <CR> TO 48-MAX
  WAITFOR "ENTER PASSWORD ==>" ;WAIT FOR PASSWORD STRING FROM 48-MAX
  TRANSMIT UNIT_PASSWORD         ;SEND DATA TRANSFER PASSWORD
  WAITFOR "^F"                    ;RECEIVE <ACK> FROM 48-MAX
  TRANSMIT "30^M"                ;SEND "DOWNLOAD ANI BILLING" COMMAND
  GETFILE XMODEM "BILLING.ANI"   ;RECEIVE ANI USER BILLING DATABASE
  WAITFOR "OK^M^J"               ;WAIT FOR "OK" FROM 48-MAX
  TRANSMIT "31^M"                ;SEND "DOWNLOAD RP USER DATABSE" COMMAND
  GETFILE XMODEM "BILLING.RPT"  ;RECEIVE RP USER BILLING DATABASE
  WAITFOR "OK^M^J"               ;WAIT FOR "OK" FROM 48-MAX
  TRANSMIT "32^M"                ;SEND "DOWNLOAD CALL DETAIL" COMMAND
```

## Section 4. Programming

```
GETFILE XMODEM "BILLING.CD"      ;RECEIVE CALL DETAIL DATABASE
WAITFOR "OK^M^J"                 ;WAIT FOR "OK" FROM 48-MAX
TRANSMIT "43^M"                  ;TRANSMIT "CLEAR ANI BILLING" COMMAND
WAITFOR "OK^M^J"                 ;WAIT FOR "OK" FROM 48-MAX
TRANSMIT "44^M"                  ;TRANSMIT "CLEAR RP BILLING" COMMAND
WAITFOR "OK^M^J"                 ;WAIT FOR "OK" FROM 48-MAX
TRANSMIT "45^M"                  ; TRANSMIT "CLEAR CALL DETAIL" COMMAND
WAITFOR "OK^M^J"                 ;WAIT FOR "OK" FROM 48-MAX
TRANSMIT "99^M"                  ;SEND "GOODBYE" COMMAND
HANGUP                            ;HANG-UP LINE
ENDPROC
```

## Section 4. Programming

### DETAILED LISTING MENU

The first item in the Accounting menu is a selection for the Detail list menu. In this menu are selections to list out the programming or the billing records in a format suitable for making a hard copy record. At the start of a listing is a header which is used to identify the unit and file type.

An example of the start of the System database listing is shown here. Each menu in turn is printed with a single item on each line. Each menu in the listing is separated by its title.

```
Model 48-MAX -- V1.20 S/N 101 13:54 03/08/96
SITE: RATTLESNAKE MTN SITE
System Database V1.10
```

#### SYSTEM MENU

```
RS-232 port speed: 4800 baud
Program access code: 12048
Auxiliary input: Channel busy
ID call sign: PARIS
ID interval: 15 mins
ID speed: 20 wpm
Video mode: Color
DCS encode: Normal
DCS decode: Normal
Set time: 13:54
Set date: 03/08/96 Friday
```

The ANI user database listing has a similar header, but you can see that the third line of the header identifies the type of listing. All of the programmable items for a user are on a single line. See Table 4. **PROGRAMMING-8** for a translation key of the parameters found in a user line.

```
Model 48-MAX -- V1.20 S/N 101 13:54 03/08/96
SITE: BLACKNOSE MTN SITE
750 ANI User Database V1.10
```

USR	A-ANI	D-ANI	DCODE	ECODE	ABCDEFGHIJKLMN	OPQRST	UVWX	CAP	CODE	FWD
001	*	#	None	None	Ynnn	Ynnn	YYnn	1000000000	n	000

The Repeater Panel user database listing once again follows the same general flow to identify the type of listing.

```
Model 48-MAX -- V1.20 S/N 101 13:55 03/08/96
SITE: BLACKNOSE MTN SITE
Repeater Panel Database V1.10
```

USR	DCODE	ENB	ECODE	RES	HOG	TNT	PRI	BIP	DTMF	TX	HOLD	ID
001	67.0	No	67.0	No	No	No	No	No	No	20		

Table 4. PROGRAMMING-8 ANI User Listing Key

Key	Menu Item	Description
A	Enabled	Y = enabled, n = disabled
B	Scheduled Telco Access	Y = enabled, n = disabled
C	Call limit time	Y = extended, n = 3 minutes
D	CTCSS Drop mode	Y = enabled, n = disabled
E	Mobile activity timer	Y = enabled, n = disabled
F	Hookflash mode	Y = enabled, n = disabled
G	Interconnect Hog Mode	Y = enabled, n = disabled
H	Courtesy Tone	Y = enabled, n = disabled
I	Mobile-to-Phone	Y = enabled, n = disabled
J	Phone-to-Mobile	Y = enabled, n = disabled
K	Mobile-to-Mobile	Y = enabled, n = disabled
L	ANI Mobile Repeat	Y = enabled, n = disabled
M	Line Select	0 = Selectable, 1 = Line 1 only, 2 = Line 2 only
N	Mobile Ringout	0 = High Warble, 1 = Low Warble, 2 = Ding Dong, 3 = Singer
O	Equipment Type	0 = Mobile, 1 = Talkback, 2 = Tone Pager, 3 = Tone and Voice Pager
P	Selcall Format	0 = None, 1 = Two Tone, 2 = DTMF, 3 = DTMF-t, 4 = 5-tone (EIA), 5 = 5-tone (CCIR), 6 = 5-tone (PZVEI), 7 = 5-tone (EEA)
Q	Answer Type	0 = PTT, 1 = "*" to Answer, 2 = "ANI" to Answer
R	Toll Restrictions	0 = None Blap, 1 = None thru, 2 = 0+ or TblA Blap, 3 = Local or TblB Blap, 4 = AutoDial, 5 = 0+ or TblA thru, 6 = Local or TblB thru, 7 = PBX inside
S	Interconnect Privacy	0 = Half-duplex, 1 = Full-duplex, 2 = Privacy Tone
T	Call Detail Logging	0 = None, 1 = All, 2 = Toll Only, 3 = Time
U	Autodial Block	digits 0 to 9 are valid
V	Autodial Number	digits 0 to 9 are valid
X	Airtime billing Type	Y = Prepay, n = accumulate

### HOW TO PROGRAM ANI'S IN THE MODEL 48-MAX

ANI's (Automatic Number Identification strings) have been greatly expanded in their flexibility and degree of programmability, as compared to ANI's in other, earlier products. The *Access ANI* and *Disconnect ANI* codes are independent from each other and are separately programmed for each "User" (a User may be defined as an individual radio operator who gains access to the radio system by transmitting appropriate DTMF codes, either manually or by using codes preprogrammed into particular radios' ANI encoders). Each Access and Disconnect ANI code can be from one to ten digits in length, and may contain any of the 16 DTMF tone pairs, in any order or combination. Multiple short (single digit) sign-on users can be supported, side-by-side with those using multi-digit ANI sign-on. Wild ANI is supported in the Roamer version of the Model 48-MAX, and is indicated in the database by the presence of the DTMF fourth column "A" character, which may be positioned at any point within the ANI string. Exclusion programming is important when using Wild ANI, and is supported in the Model 48-MAX. Because of the flexibility in ANI programming, the system programmer must decide in advance how the system is to be used and must plan carefully *BEFORE* programming ANI's.

When replacing a controller on an existing system with a Model 48-MAX, careful attention must be paid to ANI programming. Users of an existing system will have become accustomed to certain access and disconnect routines, and care must be taken to make the transition to the Model 48-MAX operationally transparent for users. Reducing the need for retraining users and reprogramming radios yields dividends in time, money, and users' satisfaction.

New installations also require careful planning of ANI programming. Choices made at the start of a project can have long-term effects. Users' training, and their expectations regarding system operation, will affect the choice of short sign-on, or multi-digit ANI access. In new installations, there are usually two separate types of operation to consider. There are "in-house" installations, typically manufacturing or maintenance operations, where one company has enough radio traffic to require the sophistication of the Model 48-MAX. In these cases the user training can be fairly good, and at the same time there will be less need for security or air time tracking and accounting. The other common scenario is the commercial radio system (community repeaters, RCC's, etc.) where individuals and companies with diverse backgrounds are the users. In this second scenario, the radio system operator is mainly interested in the sales of radio air time, and the re-sale of telephone service to radio users. In the first case, no air time tracking or SMDR (Station Manager Detail Record) accounting is required, whereas these are of primary importance in the second case. In either case the installer and programmer must plan for initial use and possible future expansion.

With some of these ideas in mind, we will first define some terminology and then show some examples of how to program ANI's for various applications. Zetron Applications Engineers are also available to help in determining how best to support your particular requirements and trade offs involved. Applications support is available between 7:00 AM and 5:00 PM PST at (425) 820-6363, ask for Model 48-MAX Applications support.

### Short Sign-on

Short sign-on is defined as any single digit ANI (“\*” is the default ANI). It is used in conjunction with sub-audible decode (as validation) to provide single digit access to a specific function or privilege. The default for short sign-on is Mobile-to-phone on Line 1. Short sign-on requires a minimum of 500mSec digit duration to both qualify sub-audible decode and prevent falsing of single DTMF digits.

### Multi-Digit ANI

Multi-digit ANI is defined as any ANI that is more than 1 digit in length. All multi-digit ANI's are checked for conflicts and considered unique. A typical usage is when a steering digit is needed for access to multiple privileges with a single ANI. It also provides a unique ID for the purpose of call tracking and billing. A third use of multi-digit ANI is when trying to emulate leading steering digit installations. Sub-audible decode for validation is optional when using multi-digit ANI's.

### ANI Conflicts

ANI conflicts occur when one ANI code could be mistaken for another. Due to the flexibility of ANI programming in the Model 48-MAX, an understanding of how conflicts can arise is important. Every multi-digit ANI is checked against the existing database before being accepted into the database. Short sign-on by its very nature is limited in how many unique digits are available and is not checked for conflicts.

An ANI conflict is where one multi-digit ANI is a sub-set (starting with the first digit) of another multi-digit ANI. Conflicts between multi-digit ANI's that are checked for, follow this rule:

\*1 = \*12 = \*123 = .. = \*123456789

An ANI of \*1 will match long before the 2 is ever sent!

Conflicts between Short sign-on and multi-digit ANI's are NOT checked for during programming. There are two ways this can happen; a short sign-on (“\*”) = the first digit of a multi-digit ANI (“\*123”), or using steering digits with short sign-on.

### Conflicts to avoid:

- If “\*” is used for short sign-on (the default ANI) any multi-digit ANI that starts with “\*” could be a conflict.
- If no sub-audible decode is used to validate a short sign-on user, a conflict may exist.
- Using steering digits with short sign-on presents a problem. All multi-digit ANI's with a valid steering digit as the second digit could be a possible conflict.

## Section 4. Programming

### **Solutions:**

- Always use sub-audible decode for enabled short sign-on users. All short sign-on's use sub-audible decode to define them as unique.
- Always put short sign-on users at low user numbers in the database. If you use Short sign-on without sub-audible decode, any disabled user with short sign-on may be a conflict. The ANI search routine stops at the first valid match. The default ANI is “\*”, Short sign-on with no sub-audible decode and disabled.
- Never use steering digits for short sign-on users; in other words don't enable multiple privileges for short sign-on users

Wild ANI's present a unique twist to defining what is a conflict and what is not. Wild ANI allows a block or range of sequential ANI's to access the Model 48-MAX under a single user (radio) entry. To exclude a sub-range of that block means that a possible conflict exists. The Model 48-MAX accommodates this in its conflict checking routine by doing a digit for digit comparison. Since the defined sub-set in a Wild ANI system will look unique (length is the same but not all the digits) the ANI is allowed in as unique.

### **SYSTEM EXAMPLES**

To illustrate some of the programming concepts discussed above, we will show some examples of Short sign-on, Multi-digit ANI, Steering digit applications and Wild ANI systems. Before trying any of the examples, go to the Diagnostic Menu and reset the Model 48-MAX to factory defaults, both System and User.

#### **Short Sign-on**

Our example system for Short sign-on is an in-plant system connected to the PBX at a manufacturing facility. Multiple user groups are supported including Maintenance, Manufacturing and Security. Radios are primarily handheld transceivers, some with DTMF keypads. User groups are separated by sub-audible tone/code. Security and Maintenance have dispatch enabled for communications between radios within each user group. Mobile-to-phone calls can be initiated to others in the plant through the PBX. Mobile-to-mobile calls can be initiated to allow communications between user groups (who are on different sub-audible tone/code).

Users in general are not very knowledgeable and only receive basic instruction on the radio's operation. The requirement here is that it be simple to use. Short sign-on and COR to answer is the way to do this. User operation is straight forward:

- “\*” gets dial tone from the PBX (mobile-to-phone)
- “7” to call another user group (mobile-to-mobile)
- PTT to answer (PTT)
- “#” to disconnect (disconnect ANI)

The first thing we need to do is choose three sub-audible tone/codes, one for each of our user groups. We also need the Repeater Panel User number for each sub-audible tone/code we want to enable for dispatch operation.

User Group	Sub-audible	Repeater Panel User #
Maintenance	127.3 Hz	(User # 20)
Manufacturing	74.4 Hz	(User # 04)
Security	D031	(User # 54)

**Application Note:**

The Repeater Panel User database supports 154 user groups. The sub-audible decode is pre-determined for each user group by its corresponding user number. Users 1 - 50 are CTCSS tones, Users 51 - 154 are DCS codes. See “CTCSS Tones” and “Digital Squelch Codes” in Section 8 to obtain the user number for dispatch operation.

Next we need to choose Interconnect User numbers for each of our user groups. This is the ID number that callers will use to reach a user group. This number will be overdialed for Mobile-to-mobile calls and Phone-to-mobile calls. In this installation we will only be using short sign-on, user number placement can be anywhere.

- Maintenance                    10     Dial 10 for Maintenance
- Manufacturing                20     Dial 20 for Manufacturing
- Security                        50     Dial 50 for Security

We now have completed the necessary planning, prior to programming the Model 48-MAX to support our three user groups. First we will enable dispatch operation for Maintenance and Security in the Repeater Panel User database. Next we will program the Interconnect User database to support short sign-on.

To enable the Maintenance user group for dispatch operation on 127.3 Hz, select User range and set the range to “20”. Verify that Decode is “127.3”. Set Enabled to “Yes”.

REPEATER PANEL USER MENU	
1 - User range: 20	8 - Courtesy bip: Disabled
2 - <b>Enabled: Yes</b>	9 - Hog mode: Disabled
3 - Decode: 127.3	10 - DTMF Repeat: Disabled
4 - Encode: 127.3	11 - Morse ID:
5 - Reserved: Disabled	12 - Tx hold time: 2000 msec
6 - Privacy: Disabled	13 - List users (in user range)
7 - Encode during TX hold: No	14 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

## Section 4. Programming

To enable the Security user group on D031 select User range and set the range to “54”. This selects the Repeater Panel User number corresponding to D031. Verify that Decode is “D031”. Set Enabled to “Yes”.

We now have CTCSS tone 127.3 Hz and DCS code D031 enabled for dispatch operation.

Program the radios for each user group with the proper sub-audible tone/code. Verify dispatch operation (for 127.3 and D031). Verify proper decode of 74.4 in the Diagnostic menu.

Next we need to program our user groups for interconnect operation. Since we are using short sign-on, we will have each user group in the Interconnect User database twice. Once for Mobile-to-phone operation and again for Mobile-to-mobile operation. Our database will look like this:

<b>User #</b>	<b>User Group</b>	<b>Function or Privilege</b>
User 10	Maintenance	(Mobile-to-phone)
User 11	Maintenance	(Mobile-to-mobile)
User 20	Manufacturing	(Mobile-to-phone)
User 21	Manufacturing	(Mobile-to-mobile)
User 50	Security	(Mobile-to-phone)
User 51	Security	(Mobile-to-mobile)

First, we need to remove an ANI conflict with User 1. Since we will be using short sign-on and “\*” for one of the ANI's, a conflict will occur since User 1 has no sub-audible decode for validation. To do this we simply disable User 1 in the Interconnect User database.

Second, since we are on a PBX, we need to set PBX outside line digit to the digit(s) required to place an outside phone call. This is in the Interconnect Telco System menu. The Model 48-MAX will now allow inside calls to be placed (typically three digits) with no restrictions. Outside calls (those that start with the PBX outside line digit to follow all the normal toll restriction rules.

Now we are ready to setup our first user, Maintenance as User 10. Select User range and set the range to “10”. Set Enabled to “Yes”. Our default ANI is correct, “\*”. Set Answer type to “PTT”. Set CTCSS/DCS decode and CTCSS/DCS encode to “127.3”.

INTERCONNECT USER MENU	
1 - User range: 10	16 - CTCSS/DCS drop: No
2 - <b>Enabled: Yes</b>	17 - Call limit time: 03 mins
3 - Access ANI: *	18 - Call detail logging: All
4 - <b>Answer type: PTT</b>	19 - Toll restrictions: Blap
5 - Disconnect ANI: #	20 - Interconnect privacy: Repeat
6 - Equipment type: Mobile	21 - Scheduled telco access: Disabled
7 - Mobile-to-phone: Enabled	22 - Courtesy tone: Disabled
8 - Phone-to-mobile: Enabled	23 - Mobile ringout: High warble
9 - Mobile-to-mobile: Disabled	24 - Page forward user: None
10 - ANI Mobile-repeat: Disabled	25 - Autodial mode: 00
11 - Line select: L1 Only	26 - Hookflash mode: Disabled
12 - Selcall format: None	27 - Mobile activity timer: Enabled
13 - Selcall capcode:	28 - Interconnect hog mode: Disabled
14 - <b>CTCSS/DCS decode: 127.3</b>	29 - List users (in user range)
15 - <b>CTCSS/DCS encode: 127.3</b>	30 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

Increment User range with “N”. Set Enabled to “Yes”. Set Access ANI to “7”. Set Answer type to “PTT”. Set Mobile-to-phone and Phone-to-mobile to “Disabled”. Set Mobile-to-mobile to “Enabled”. Set CTCSS/DCS decode and CTCSS/DCS encode to “127.3”.

INTERCONNECT USER MENU	
1 - User range: 11	16 - CTCSS/DCS drop: No
2 - <b>Enabled: Yes</b>	17 - Call limit time: 03 mins
3 - <b>Access ANI: 7</b>	18 - Call detail logging: All
4 - <b>Answer type: PTT</b>	19 - Toll restrictions: Blap
5 - Disconnect ANI: #	20 - Interconnect privacy: Repeat
6 - Equipment type: Mobile	21 - Scheduled telco access: Disabled
7 - <b>Mobile-to-phone: Disabled</b>	22 - Courtesy tone: Disabled
8 - <b>Phone-to-mobile: Disabled</b>	23 - Mobile ringout: High warble
9 - <b>Mobile-to-mobile: Enabled</b>	24 - Page forward user: None
10 - ANI Mobile-repeat: Disabled	25 - Autodial mode: 00
11 - Line select: L1 Only	26 - Hookflash mode: Disabled
12 - Selcall format: None	27 - Mobile activity timer: Enabled
13 - Selcall capcode:	28 - Interconnect hog mode: Disabled
14 - <b>CTCSS/DCS decode: 127.3</b>	29 - List users (in user range)
15 - <b>CTCSS/DCS encode: 127.3</b>	30 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

Proceed to program User 20 and 21 also per the example, but set the CTCSS/DCS decode and CTCSS/DCS encode to “74.4”. Do the same for User 50 and 51, but set the CTCSS/DCS decode CTCSS/DCS encode to D031.

## Section 4. Programming

### **Mobile to Phone operation:**

Maintenance wants to check with receiving to see if a needed part has arrived. To call receiving on the phone, key the radio and press “\*” for greater than 500mSec and then unkey. The Model 48-MAX will see “\*” + 127.3 Hz as User 10 (maintenance) and originate a call on Line 1. The Model 48-MAX will then key up with 127.3 Hz encode and allow the dial tone from the PBX to pass out on the channel. The radio user then keys up and dials the extension for receiving. Receiving answers the phone and takes down the needed information to check on the part. To terminate the call, key the radio and press “#” for greater than 500mSec and then unkey.

### **Phone to Mobile operation:**

Receiving has verified the part needed by maintenance has arrived. The receiving clerk places an internal call to the extension for the Model 48-MAX. The Model 48-MAX waits the programmed Rings before answer, answers the incoming call and then issues the Overdial prompt (default is 800 Hz). At the prompt, the receiving clerk overdials “10” for maintenance. The Model 48-MAX keys the transmitter with 127.3 Hz and sends ringing on the channel. Only radios programmed to unscquelch with 127.3 Hz will hear the ringing. This means that neither manufacturing or security will hear the ringing intended for maintenance. Maintenance can answer by just pressing “PTT” on their handheld. The Model 48-MAX sees carrier and 127.3 Hz sub-audible and connects receiving and maintenance. Receiving informs maintenance that their part has arrived. To terminate the call, key the radio and press “#” for greater than 500mSec and then unkey.

### **Mobile to Mobile operation:**

Manufacturing needs to contact security to open a storage area. To reach security on the radio, key the radio and press “7” for greater than 500mSec and the unkey. The Model 48-MAX will see “7” + 74.4 Hz as User 21 (manufacturing) and originate a mobile-to-mobile call. The Model 48-MAX will key up with 74.4 Hz and send back the Overdial prompt (default is an 800 Hz beep). At this point the Model 48-MAX acts just like it does in a phone-to-mobile call, only the originator is another radio instead of a phone caller. Manufacturing keys the radio and dials “50” for security. The Model 48-MAX will switch encoding to D031 and send ringing on the channel. During the time of ringouts to security, unless manufacturing is in “monitor mode”, they will not be able to hear the ringing. Security can answer by just pressing “PTT” on their handheld. The Model 48-MAX sees carrier and D031 sub-audible and switches encode to 74.4 Hz and enables repeat audio. The Model 48-MAX will perform tone/code translation between the user groups. Either radio can key up and send “#” for greater than 500mSec to terminate the call when complete.

As you can see from this example, simple communications can be accomplished with Short sign-on. Each user group only hears calls intended for them, but can still contact each other as required.

### **Multi-digit ANI**

Our example system for Multi-digit ANI is installed at radio site with good coverage of the local metro area. It has a single phone line installed at the site. Current billing is flat rate per

month per radio. It has two customers with multiple radios each on the system. The radio shop also uses it for dispatch and interconnect. The radio shop will soon be moving to a different channel and would like to load this site with more customers and bill for long distance.

In general users are knowledgeable and receive any training as required. Both customers on this system are sub-contractors in the building trades and have similar needs. The main office needs to reach individual crews for job scheduling and changes. Individual crews need to reach the main office to arrange for delivery of materials. Occasionally individual crews need to contact each other to exchange tools or materials.

For consistency, all radios for each customer should be on the same sub-audible tone/code. Each radio has a individual ANI, with DTMF ANI microphones and the ability to decode DTMF selective calling. This provides the ability to selectively call the radio of interest. The goal is to provide reliable operation with room to grow as customer requirements change. Operation must be logical and consistent for the users. Programming must be setup to allow room for growth.

Multi-digit ANI is the way to go here. Phone-to-mobile, Mobile-to-phone and Mobile-to-mobile calls are required. Multi-digit ANI gives individual addressing for identifying radios and additional billing data.

Format of ANI:

- ANI's should be fixed length (6)
- ANI's include 4 digit Customer number and 2 digit User number

User numbers are used for Overdial (Phone-to-mobile, Mobile-to-mobile).

First we need to assign a Customer number for each user group. This identifies the user group each radio belongs to. We also need to assign a block of user numbers for each user group with some room for growth.

<b>Customer number</b>	<b>User numbers</b>	<b>ANI numbers</b>
1040	10 - 29	104010 - 104029
2040	50 - 59	204050 - 204059

User group 1040 has 11 radios now and will need more soon. We have allocated a block of 20 to accommodate that expected growth. User group 2040 has 7 radios and has no future growth plans.

To keep the selective calling simple, we will use each radio's ANI for the Selcall capcode.

We now have our ANI numbering established, our user number blocks chosen and selective calling format chosen. Let's go program up some users.

## Section 4. Programming

For user group 1040, we first set the User range for “10 - 21”. We can now set Enabled to “Yes”, Mobile-to-mobile to “Enabled” and Selcall format to “DTMF”.

```
INTERCONNECT USER MENU

 1 - User range: 10 - 21
 2 - Enabled: Yes
 3 - Access ANI: *
 4 - Answer type: *
 5 - Disconnect ANI: #
 6 - Equipment type: Mobile
 7 - Mobile-to-phone: Enabled
 8 - Phone-to-mobile: Enabled
 9 - Mobile-to-mobile: Enabled
10 - ANI Mobile-repeat: Disabled
11 - Line select: L1 Only
12 - Selcall format: DTMF
13 - Selcall capcode:
14 - CTCSS/DCS decode: None
15 - CTCSS/DCS encode: None
16 - CTCSS/DCS drop: No
17 - Call limit time: 03 mins
18 - Call detail logging: All
19 - Toll restrictions: Blap
20 - Interconnect privacy: Repeat
21 - Scheduled telco access: Disabled
22 - Courtesy tone: Disabled
23 - Mobile ringout: High warble
24 - Page forward user: None
25 - Autodial mode: 00
26 - Hookflash mode: Disabled
27 - Mobile activity timer: Enabled
28 - Interconnect hog mode: Disabled
29 - List users (in user range)
30 - Airtime - Accumulate: 00:00:00

<ESC> to exit

Select a command:
```

Next we need to set ANI, Selcall capcode and sub-audible for each user one at a time. First set Access ANI and Selcall capcode to “104010”. Next set CTCSS/DCS decode and CTCSS/DCS encode to 103.5 Hz. Increment to the next user by selecting User range and entering “N” for “Next”. Repeat the process for all 11 enabled users in the block.

INTERCONNECT USER MENU	
1 - User range: 10	16 - CTCSS/DCS drop: No
2 - Enabled: Yes	17 - Call limit time: 03 mins
3 - <b>Access ANI: 104010</b>	18 - Call detail logging: All
4 - Answer type: *	19 - Toll restrictions: Blap
5 - Disconnect ANI: #	20 - Interconnect privacy: Repeat
6 - Equipment type: Mobile	21 - Scheduled telco access: Disabled
7 - Mobile-to-phone: Enabled	22 - Courtesy tone: Disabled
8 - Phone-to-mobile: Enabled	23 - Mobile ringout: High warble
9 - Mobile-to-mobile: Disabled	24 - Page forward user: None
10 - ANI Mobile-repeat: Disabled	25 - Autodial mode: 00
11 - Line select: L1 Only	26 - Hookflash mode: Disabled
12 - Selcall format: DTMF	27 - Mobile activity timer: Enabled
13 - <b>Selcall capcode: 104010</b>	28 - Interconnect hog mode: Disabled
14 - <b>CTCSS/DCS decode: 103.5</b>	29 - List users (in user range)
15 - <b>CTCSS/DCS encode: 103.5</b>	30 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

Repeat the process for the block of users allocated to user group 2040 using its sub-audible tone/code.

#### **Mobile to Phone operation:**

Crew #12 wants needs to have some additional material delivered to finish a job. To reach the office, press the ANI key on the microphone. The radio keys up and sends an ANI of "104012". The Model 48-MAX will see "104012" + 103.5 Hz as User 12. The Model 48-MAX will then key up with 103.5 and issue the Steering digit prompt (default is dial tone) and wait 5 seconds for a digit. Key up and press "\*" or "9", the Model 48-MAX will then take Line 1 off hook. The Model 48-MAX will then allow the dial tone from the central office to pass on to the channel. The radio user then keys up and dials the phone number for the office. To terminate the call, key the radio and press "#" for greater than 500mSec and then unkey.

#### **Phone to Mobile operation:**

The main office wants to change the job assignment for Crew #17. A call is placed to the phone number that the Model 48-MAX is connected to. The Model 48-MAX waits the programmed Rings before answer, answers the incoming call and then issues the Overdial prompt (default is 800 Hz). At the prompt, the clerk overdials "17" for Crew #17. The Model 48-MAX keys the transmitter with 103.5 Hz and sends the DTMF sequence "104017" followed by ringing on the channel. Only radio "17" is programmed to unsquelch with 103.5 Hz and Selcall capcode. This means that none of the other radios on that tone will hear the ringing intended for Crew #17. To answer the call, key the radio and press "\*" for greater than 500mSec. The Model 48-MAX sees 103.5 Hz sub-audible plus "\*" and connects the call. The main office informs crew #17 of their new assignment for the day. To terminate the call, key the radio and press "#" for greater than 500mSec and then unkey.

## Section 4. Programming

### **Mobile to Mobile operation:**

Crew #13 wants to know if Crew #19 can drop off a needed tool. To reach Crew #19 on the radio, press the ANI key on the microphone. The radio keys up and sends an ANI of "104013". The Model 48-MAX will see "104013" + 103.5 Hz as User 13. The Model 48-MAX will then key up with 103.5 and issue the Steering digit prompt (default is dial tone) and wait 5 seconds for a digit. Key up and press "7", the Model 48-MAX will originate a Mobile-to-mobile call. The Model 48-MAX will send back the Overdial prompt (default is an 800 Hz beep). At this point the Model 48-MAX acts just like a phone-to-mobile call, only the originator is another radio not a phone caller. Crew #13 keys the radio and dials "19". The Model 48-MAX will encode 103.5 Hz and send the DTMF sequence "104019" followed by ringing on the channel. To answer the call, key the radio and press "\*" for greater than 500mSec. The Model 48-MAX sees 103.5 Hz sub-audible plus "\*" and enables repeat audio. Crew #13 can then request the tool from Crew #19. To terminate the call, key the radio and press "#" for greater than 500mSec and then unkey.

### **Steering Digit Applications**

The Model 48-MAX follows the RCC convention of using trailing steering digits for sign-on. For most installations this won't present a problem. Leading steering digits can be supported with a little creative programming. We will show two examples of programming a user (radio) for the same privileges and same ANI, one using trailing steering digits, the other using leading steering digits.

When using a trailing steering digit, a Steering digit prompt (default is dial tone) is issued and additional time (5 seconds) is allowed for entering the steering digit (the Model 48-MAX already knows it has a valid ANI). When using a leading steering digit, the steering digit becomes part of the ANI and all the rules for entering ANI's apply.

Our example user needs to receive Phone-to-mobile calls, place Mobile-to-phone and Mobile-to-mobile calls. The site has only 1 phone line (Line 1). Our user has an Access ANI of 304025 and uses "\*" to answer calls. Overdial on Phone-to-mobile and Mobile-to-mobile calls directed to our user is 25.

**Trailing Steering Digit**

INTERCONNECT USER MENU	
1 - User range: 25	16 - CTCSS/DCS drop: No
2 - <b>Enabled: Yes</b>	17 - Call limit time: 03 mins
3 - <b>Access ANI: 304025</b>	18 - Call detail logging: All
4 - Answer type: *	19 - Toll restrictions: Blap
5 - Disconnect ANI: #	20 - Interconnect privacy: Repeat
6 - Equipment type: Mobile	21 - Scheduled telco access: Disabled
7 - Mobile-to-phone: Enabled	22 - Courtesy tone: Disabled
8 - Phone-to-mobile: Enabled	23 - Mobile ringout: High warble
9 - <b>Mobile-to-mobile: Enabled</b>	24 - Page forward user: None
10 - ANI Mobile-repeat: Disabled	25 - Autodial mode: 00
11 - Line select: L1 Only	26 - Hookflash mode: Disabled
12 - Selcall format: None	27 - Mobile activity timer: Enabled
13 - Selcall capcode:	28 - Interconnect hog mode: Disabled
14 - <b>CTCSS/DCS decode: 100.0</b>	29 - List users (in user range)
15 - <b>CTCSS/DCS encode: 100.0</b>	30 - Airtime - Accumulate: 00:00:00
<ESC> to exit	
Select a command:	

As you can see from the screen capture above, trailing steering digits only require one user location in the database to support multiple privileges.

User # 25 was selected to support the overdial requirement. To originate calls the sign-on sequence looks like this:

- Mobile-to-phone 304025 + (\* or 9) for the default phone line
- Mobile-to-mobile 304025 + 7 for mobile to mobile overdial prompt
- Phone-to-mobile 25 for overdial to call this user

## Section 4. Programming

### Leading Steering Digit

To support leading steering digits in our example requires that we put the user (radio) in the database twice, once for each mobile originate function.

```
INTERCONNECT USER MENU

1 - User range: 25
2 - Enabled: Yes
3 - Access ANI: *304025
4 - Answer type: *
5 - Disconnect ANI: #
6 - Equipment type: Mobile
7 - Mobile-to-phone: Enabled
8 - Phone-to-mobile: Enabled
9 - Mobile-to-mobile: Disabled
10 - ANI Mobile-repeat: Disabled
11 - Line select: L1 Only
12 - Selcall format: None
13 - Selcall capcode:
14 - CTCSS/DCS decode: 100.0
15 - CTCSS/DCS encode: 100.0
16 - CTCSS/DCS drop: No
17 - Call limit time: 03 mins
18 - Call detail logging: All
19 - Toll restrictions: Blap
20 - Interconnect privacy: Repeat
21 - Scheduled telco access: Disabled
22 - Courtesy tone: Disabled
23 - Mobile ringout: High warble
24 - Page forward user: None
25 - Autodial mode: 00
26 - Hookflash mode: Disabled
27 - Mobile activity timer: Enabled
28 - Interconnect hog mode: Disabled
29 - List users (in user range)
30 - Airtime - Accumulate: 00:00:00

<ESC> to exit
Select a command:
```

User 25 (above) supports the over dial requirement of Phone-to-mobile plus Mobile-to-phone. \*304025 gets dial tone on Line 1.

```
INTERCONNECT USER MENU

1 - User range: 26
2 - Enabled: Yes
3 - Access ANI: 1304025
4 - Answer type: *
5 - Disconnect ANI: #
6 - Equipment type: Mobile
7 - Mobile-to-phone: Disabled
8 - Phone-to-mobile: Disabled
9 - Mobile-to-mobile: Enabled
10 - ANI Mobile-repeat: Disabled
11 - Line select: L1 Only
12 - Selcall format: None
13 - Selcall capcode:
14 - CTCSS/DCS decode: 100.0
15 - CTCSS/DCS encode: 100.0
16 - CTCSS/DCS drop: No
17 - Call limit time: 03 mins
18 - Call detail logging: All
19 - Toll restrictions: Blap
20 - Interconnect privacy: Repeat
21 - Scheduled telco access: Disabled
22 - Courtesy tone: Disabled
23 - Mobile ringout: High warble
24 - Page forward user: None
25 - Autodial mode: 00
26 - Hookflash mode: Disabled
27 - Mobile activity timer: Enabled
28 - Interconnect hog mode: Disabled
29 - List users (in user range)
30 - Airtime - Accumulate: 00:00:00

<ESC> to exit
Select a command:
```

User 26 (above) supports Mobile-to-mobile. 1304025 gets Mobile-to-mobile over dial prompt.

### Wild ANI

The Model 48-MAX supports Wild ANI in the Roamer version. This feature allows users (radios) from different areas to move or roam around between compatible systems and still have access to mobile originated interconnect privileges. This is possible by allowing a block or range of sequential ANI's to access the Model 48-MAX under a single ANI entry in the database. Accounting is possible when used with the Call Detail option. When a roamer signs on to the system, the actual Access ANI decoded and allowed on the system is saved in the Call Detail record for that call. This would allow the host system to forward billing information to the actual user of the system.

An important part of Wild ANI is the ability to exclude specific ANI's or sub-sets of enabled ANI's. This greatly increases the flexibility and security of the system. The Roamer comes with a large database to fully support these features.

Wild ANI works by allowing a wildcard or don't care character to be entered into an ANI field. The Model 48-MAX uses "A" as the wildcard character. Wild ANI can be enabled or disabled in the Mobile System Menu. Wild ANI is valid in either Access ANI or Disconnect ANI when enabled.

A Wild ANI works like this:

- Access ANI = 1030AAA
- Valid ANI range = 1030000 - 1030FFF (all 16 DTMF tone pairs valid!)
- Valid ANI digits are 0..9, A, B, C, D, \*, # (\* = E, # = F)

Since the Model 48-MAX supports all 16 DTMF tone pairs you need to look at a range of ANI numbers as Hexadecimal numbering (Base16) not Decimal numbering (Base10).

Exclusion programming is a means of eliminating or excluding a range of ANI's from being valid in a system supporting Wild ANI. The ANI decoder scans the database from user number 1 through user 750 looking for a match. Exclusion is accomplished by finding the disabled or excluded ANI before the enabled ANI. This works by putting the Access ANI you want to exclude, low in the database and disabling the user. When that ANI is decoded, access is denied. As the ANI decoder scans, it MUST find these excluded users FIRST to work with Wild ANI. You can disable deadbeat customers or sub-sets of a larger Wild ANI block that is enabled.

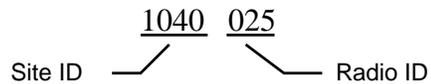
For Wild ANI to work, the length of the ANI must be fixed. A typical system might use a 7 digit ANI with 4 digits defining a user group and 3 digits defining a specific radio. Each user group would receive a single user (radio) in the database. Any exclusion items for that user group would precede that user entry. Generally mobiles who roam into a system only originate calls. Setting up the ability to receive phone calls can be done, but the phone caller would have no way of knowing if the roaming mobile is within range of the Model 48-MAX at any given time.

To illustrate the concepts described above, we will describe and program an example system.

## Section 4. Programming

Our example system for Wild ANI is one site of 7 located across the south western corner of a large Western state. This gives good coverage between 2 major population centers and the several smaller towns. In the north western corner of the same state, another operator has a similar system of 9 sites across 3 population centers. These two operators have a co-operative agreement to allow each others customers access to a system when in a supported area.

A numbering plan for ANI's was established; 7 digits in length, first 4 indicate Site ID, last 3 indicate specific radio.



Each site was assigned a 4 digit Site ID:

<b>SW System</b>	<b>NW System</b>	
1010	4010	Site 1
1020	4020	Site 2
...	...	...
1070	4090	Site n

The Site ID also serves to identify the Home system or site of any radio on the system.

Other basic operation functions were defined as well:

- Steering digits (if ANY)
- Answer mode, Disconnect type
- Sub-audible tone/code

Database layout looks like this:

User 001 - 100	Home system customers
User 200 - 700	Exclusion area
User 701 - 750	Wild ANI customers

Home system customers are the primary users of the system at that site. Their ANI is fully defined under a single user entry. They are give Phone-to-mobile access on a defined user number for over dial. These customers are low in the database to take advantage of the User number for over dial from the phone side. Some of these customers may have roaming access on other sites.

Exclusion area is where either specific ANI's or blocks of ANI's are defined and disabled to prevent unauthorized use of the system.

## Section 4. Programming

Wild ANI customers are the roamers who use the system when in the range or area of this particular site.

Here is a typical example of a Home system user (radio). His ANI is fully defined (no wild markers). As you can see from his ANI, he is on Site 1040 and has a Radio ID of 025. Phone-to-mobile and Mobile-to-mobile are enabled privileges. Call detail logging has also be changed to "Toll". This only logs calls that are billable for this user.

```
INTERCONNECT USER MENU

 1 - User range: 25
 2 - Enabled: Yes
 3 - Access ANI: 1040025
 4 - Answer type: *
 5 - Disconnect ANI: #
 6 - Equipment type: Mobile
 7 - Mobile-to-phone: Enabled
 8 - Phone-to-mobile: Enabled
 9 - Mobile-to-mobile: Enabled
10 - ANI Mobile-repeat: Disabled
11 - Line select: L1 Only
12 - Selcall format: None
13 - Selcall capcode:
14 - CTCSS/DCS decode: 100.0
15 - CTCSS/DCS encode: 100.0
16 - CTCSS/DCS drop: No
17 - Call limit time: 03 mins
18 - Call detail logging: Toll
19 - Toll restrictions: Blap
20 - Interconnect privacy: Repeat
21 - Scheduled telco access: Disabled
22 - Courtesy tone: Disabled
23 - Mobile ringout: High warble
24 - Page forward user: None
25 - Autodial mode: 00
26 - Hookflash mode: Disabled
27 - Mobile activity timer: Enabled
28 - Interconnect hog mode: Disabled
29 - List users (in user range)
30 - Airtime - Accumulate: 00:00:00

<ESC> to exit
Select a command:
```

Here is a typical entry in one of the other sites that allow our user above to "Roam" into another system and have phone access.

```
INTERCONNECT USER MENU

 1 - User range: 714
 2 - Enabled: Yes
 3 - Access ANI: 1040AAA
 4 - Answer type: *
 5 - Disconnect ANI: #
 6 - Equipment type: Mobile
 7 - Mobile-to-phone: Enabled
 8 - Phone-to-mobile: Disabled
 9 - Mobile-to-mobile: Disabled
10 - ANI Mobile-repeat: Disabled
11 - Line select: L1 Only
12 - Selcall format: None
13 - Selcall capcode:
14 - CTCSS/DCS decode: 100.0
15 - CTCSS/DCS encode: 100.0
16 - CTCSS/DCS drop: No
17 - Call limit time: 03 mins
18 - Call detail logging: All
19 - Toll restrictions: Blap
20 - Interconnect privacy: Repeat
21 - Scheduled telco access: Disabled
22 - Courtesy tone: Disabled
23 - Mobile ringout: High warble
24 - Page forward user: None
25 - Autodial mode: 00
26 - Hookflash mode: Disabled
27 - Mobile activity timer: Enabled
28 - Interconnect hog mode: Disabled
29 - List users (in user range)
30 - Airtime - Accumulate: 00:00:00

<ESC> to exit
Select a command:
```

## Section 4. Programming

All mobiles with an ANI of 1040000 - 1040FFF and CTCSS encode of 100.0 Hz will have phone access on Line 1. You can use Exclusion programming to narrow down the range of ANI's that are allowed in under this wild ANI. To remove the 4<sup>th</sup> column digits from the block of possible ANI's you would do the following user number slots.

<b>User #</b>	<b>ANI</b>	<b>Enabled</b>	<b>CTCSS/DCS Decode</b>
400	1040BAA	No	None
401	1040CAA	No	None
402	1040DAA	No	None
403	1040*AA	No	None
404	1040#AA	No	None
405	1040ABA	No	None
406	1040ACA	No	None
407	1040ADA	No	None
408	1040A*A	No	None
409	1040A#A	No	None
410	1040AAB	No	None
411	1040AAC	No	None
412	1040AAD	No	None
413	1040AA*	No	None
414	1040AA#	No	None

Operation for our example user (radio), with an Access ANI of 1040025 when on his home system, would follow the examples in "Multi-digit ANI" earlier in this section.

Operation for our example user (radio) when out of his home area:

Roamers in this system only have Mobile-to-phone access when out of their home area. This differs from normal operation in that they do not have to enter a steering digit to gain access to the phone line. To gain access the mobile keys up with 100.0 Hz encode and send an ANI of "1040025". The Model 48-MAX sees this as User 714 and allows the call. The Model 48-MAX then keys the transmitter with 100.0 Hz encode, seizes Line 1 and allows the dial tone from the central office to pass out on to the channel. The mobile now dials a phone number and the call proceeds as normal.

At call completion the call detail record will look like this:

Date	Time	Usr	Air-Time	Type	Called/Comments	ANI
09/01/95	10:04:23	714	00:01:47	M1	12068206363	1040025

Phone number dialed and ANI allowed on to the system is recorded in the Call Detail record.



## 5. FEATURE SET REFERENCE

INTERCONNECT FUNCTIONS.....	5-2
Access ANI.....	5-2
Add/Delete/View Prefix .....	5-3
Airtime .....	5-4
ANI Mobile-repeat.....	5-5
Answer Type.....	5-6
Autocall User (Line 1, Line 2).....	5-7
Autodials - Autodials Mode.....	5-8
Busy Tone Disconnect - 2nd Dialtone Disconnect.....	5-10
Call Detail Logging .....	5-11
Call Limit Time - Extended Call Limit.....	5-12
Call Alert Beeps.....	5-13
Clear Airtime Records .....	5-14
Clear Call Detail Records .....	5-15
Cordless Telephone User .....	5-16
Courtesy Tone.....	5-17
CTCSS/DCS Decode - CTCSS/DCS Encode.....	5-18
CTCSS/DCS Drop .....	5-19
DCS Decode (polarity) - DCS Encode (polarity) .....	5-20
Dialout Mode .....	5-21
Disconnect ANI .....	5-22
Dispatch Override .....	5-23
Display Statistics.....	5-24
DTMF On Time - DTMF Off Time.....	5-25
DTMF-t Collect Time .....	5-26
DTMF-t Reset Time.....	5-27
DTMF-t Reset Digit.....	5-28
DTMF Interdigit Time .....	5-29
Enabled .....	5-30
Equipment Type.....	5-31
Emergency Prefix.....	5-33
Fast ANI Access .....	5-34
Hookflash Mode.....	5-35
ID Call Sign - ID Interval - ID Speed.....	5-36
Interconnect Hog Mode - Interconnect Hog Time.....	5-37
Interconnect Privacy .....	5-38
Interconnect - Allowed Days / Restricted Days.....	5-39
Interconnect - Start Time / Stop Time .....	5-39
Keyup Delay .....	5-41
Line Select .....	5-42
Line Connection (Line 1, Line 2) .....	5-43
List Airtime Records.....	5-44

Continued ...

List Call Detail Records (SMDR).....	5-45
List Users .....	5-46
Log Errors in Call Detail Records .....	5-47
Loop Disconnect Time.....	5-48
Maximum Regenerated Digits - Minimum Regenerated Digits.....	5-49
Minimum Call Duration.....	5-50
Mobile Activity Time .....	5-51
Mobile Answer Time .....	5-52
Mobile Ringout.....	5-53
Mobile-to-Mobile.....	5-54
Mobile-to-Phone .....	5-55
Multiple Line Menu .....	5-56
Overdial (Line 1, Line 2, Local, Mobile-to-Mobile) .....	5-58
Overdial Prompt.....	5-59
Page Forward User.....	5-60
Pager Talk Time.....	5-61
PBX Outside Line Digit.....	5-62
PBX Extension Length .....	5-63
Phone-to-Mobile .....	5-64
Priority Override.....	5-65
Program Access Code.....	5-66
PSTN Feature Code .....	5-67
Reset System Database / User Database to Factory Default .....	5-68
Rings Before Answer (Line 1, Line 2) .....	5-69
Ringouts Sent to Mobile .....	5-70
RS-232 Port Speed.....	5-71
Scheduled Telco Access .....	5-73
Selcall Capcode.....	5-74
Selcall Format .....	5-80
Set Date - Set Time.....	5-81
Site Name.....	5-82
Steering Digit Prompt .....	5-83
Supervisor User.....	5-84
System Memory Test .....	5-85
Toll Restrict Menu .....	5-86
Toll Restrict Plan .....	5-86
Toll Restrictions.....	5-87
Unerase Call Detail Records (SMDR).....	5-89
User Range.....	5-90
Video Mode .....	5-92
Voice Prompts.....	5-93
Wild ANI .....	5-95

Continued ...

REPEATER PANEL FUNCTIONS .....	5-96
Airtime .....	5-96
Carrier Squelch Repeat .....	5-97
Courtesy Bip - Tail Bips .....	5-98
DTMF Repeat .....	5-99
Decode .....	5-100
Encode.....	5-100
Enabled .....	5-101
Encode During TX Hold.....	5-102
Hog Mode .....	5-103
Hog Idle .....	5-103
Hog Limit.....	5-104
Hog Penalty.....	5-104
ID Rate .....	5-105
Initial TX Hold Time - TX Hold Time .....	5-106
List Users .....	5-107
Morse ID.....	5-108
Privacy .....	5-109
Reserved.....	5-110
Stuck Mic ID.....	5-111
TX Timeout.....	5-112
User Range.....	5-113

## 5. FEATURE SET REFERENCE

This section describes each programmable function or command in the Model 48-MAX. The purpose of the function or command, how it is used, and how to program it are included. The functions or commands are listed in alphabetical order for easy reference. References are also made back to Sections 3 and 4 for detailed discussions or examples of various features and how the functions or commands affect operation.

*Please read Sections 3 and 4 first.* An overview of various features and how different functions or commands affect operation is covered in Section 3. Section 4 includes detailed examples of typical system configurations.

This section is divided into two main parts. The first part covers Interconnect related operation. Also included are some items found in the System and Accounting menus. The second part covers Repeater Panel related operation.

## INTERCONNECT FUNCTIONS

### Access ANI

Before a user (radio) may sign on using a mobile or portable, an *Access ANI* (Automatic Number Identification) code must be assigned to the user. This code provides access to the interconnect. Without it, a user cannot make or receive calls. The Model 48-MAX supports two types of *Access ANI*'s, Short sign-on (single digit ANI) and ANI sign-on (multi-digit ANI). ANI's can be random in length up to 10 digits, using any of the 16 DTMF tone pairs (0 to 9, A to D, \*, #).

*Wild ANI* is supported in the Roamer version of the Model 48-MAX. It is indicated in the database by the presence of the DTMF fourth column "A" character. *Wild ANI* must also be enabled in the Mobile System menu.

Multi-digit ANI's are checked for conflicts and are considered unique. Short sign-on or single digit ANI's are not checked for conflicts. Conflicts between multi-digit ANI's and short sign-on are not checked for. An ANI conflict is when one ANI can be mistaken for another. This is typically when one ANI is a sub-set of another beginning with the first digit. Please see "How to Program ANI's in the Model 48-MAX" in Section 4.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the Interconnect User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Access ANI* followed by ENTER. The current *Access ANI* will appear along with a message instructing you to enter the new *Access ANI* code. Type in the new *Access ANI* and press ENTER when you have finished.

If a conflict is found with another *Access ANI* or *Program Access code*, an error message will be displayed and the ANI returned to default.

The default *Access ANI* is "\*". To clear a user's ANI, press the space bar followed by pressing ENTER. This will clear the current ANI and set it to "\*".

When a short sign-on is programmed (single digit ANI), two other parameters are defaulted. All calling privileges are disabled except *Mobile-to-phone* and *Phone-to-mobile*. Also, *Line select* is set to Line 1 only.

*Access ANI* is not supported by block or range programming. To help verify ANI's, a method of searching for an *Access ANI* can be performed from *User range*. See "User Range" later in this section or "Convenience Features" in Section 4.

### **Add/Delete/View Prefix**

In some areas of North America, the local telephone company has two types or levels of toll calls, those that require a 1+ or 0+ and those that do not (non 1-plus). Local Zone calls (non 1-plus) are toll calls that have normal 7-digit telephone numbers. For example, in most areas callers have to dial 1-820-6363 or 1-425-820-6363 in order to make a long distance call within the area code, but in “non 1-plus” areas, the call is placed just by dialing 820-6363. The only way to toll restrict this type of call is to know all the telephone number prefixes which are toll calls. The Model 48-MAX uses a 1000-prefix (all possible prefixes) toll table to determine which prefixes are Local Zone or non 1-plus toll calls. It will not allow calls to restricted prefixes if the user is toll restricted.

The Prefix table can be made up of either “Allowed” or “Restricted” prefixes. Your local area will probably only have either a few “Free” prefixes or a few “Toll” prefixes. Set the sense of the table to minimize the number of prefixes you need to enter. Any non 1+ or 0+ number dialed will be checked against the Prefix table for a determination of “Toll” or “Local” call.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER and the Interconnect Menu will appear. Type “2” and press ENTER and the Telco System menu will appear. Select the item number for *Toll restrict menu*. The “North American Toll Restrict” menu will be displayed.

### **Add a prefix:**

To add a prefix, type “2” and press ENTER. You will be prompted to enter the prefix to add, do so and press ENTER. It will then prompt you again since it is likely you will need to restrict many prefixes. The Model 48-MAX allows you to add prefixes in bulk. When you are finished adding prefixes, press ENTER.

### **Delete a prefix:**

To delete a prefix, type “3” and press ENTER. You will be prompted to enter the prefix to delete, do so and press ENTER. The Model 48-MAX also allows you to delete prefixes in bulk. Keep entering prefixes to delete and press ENTER when you're finished.

### **View the toll table:**

To view the prefixes in the table, type “4” followed by ENTER. The prefixes that are in the table will be displayed in columns along with the currently selected sense (Allowed or Restricted) of the table.

### **Set sense of prefix table:**

To set the sense of the table, type “1” and press ENTER. Press the space bar to select between “Allowed” or “Restricted”. Press ENTER to accept.

## Section 5. Feature Set Reference

### **Airtime**

The Model 48-MAX keeps an *Airtime* record for each user. *Airtime* is counted in 1-second increments. Each user can be setup as either “Accumulate” (count up) or “Pre-pay” (count down). If you bill for airtime used, then Accumulate mode will work well. If your customers purchase blocks of airtime, Pre-pay mode will accommodate that.

When Pre-pay mode is active for a user, the Model 48-MAX will first check to see if how much airtime is available before allowing the call to proceed. If the *Airtime* count is greater than 2 hours, the call will be proceed as normal. If the *Airtime* count falls below 2 hours but has not reached 0 (zero), a warning prompt will alert the mobile that it is time to purchase another block of airtime. The warning prompt will be sent to the mobile when the Model 48-MAX first keys up in response to a valid *Access ANI* before any other prompts or action. If the *Airtime* count is allowed to go to 0 (zero), no further calls will be processed. The mobile will still get the warning prompt response when trying to access the Model 48-MAX. This lets the mobile know why access has been denied.

Maximum count in an *Airtime* record is 99:59:59 in Hours:Minutes:Seconds format.

At the end of each billing cycle, the *Airtime* records can be downloaded for processing. See “Device Configuration and Billing Data” in Section 4 for information on downloading billing records.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the Interconnect User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Airtime* followed by ENTER. The current *Airtime* record will appear. Type in the new value for the *Airtime* record and press ENTER when you have finished.

To set a user for Pre-pay, set *Airtime* to a non-zero value.

To set a user for Accumulate, set *Airtime* to zero. This can be done by just pressing the space bar and press ENTER, like any other string variable.

The Default setting for *Airtime* is accumulate.

### **ANI Mobile-repeat**

One of the privileges that can be enabled for a user (radio) is *ANI Mobile-repeat*. This is ANI validated access for repeat or dispatch operation.

This privilege allows the mobile to “open the repeater” for repeat or dispatch operation. A fixed 25 second hang time on the transmitter is active. The programmed *Call limit time* is also active, just like any other interconnect privilege.

To use this privilege, the mobile keys his radio, encoding any required subaudible tone/code and enters his *Access ANI* code. If the user (radio) has the ability to perform more than one privilege (Mobile-to-mobile, Mobile-to-phone, or ANI Mobile-repeat) then the Model 48-MAX requires steering digit of “5”. If the user only has been given the ability to perform one function, the Model 48-MAX will automatically take care of it without the steering digit.

The ANI mobile-repeat function is used to force the Model 48-MAX to drop into repeater operation. It is a cross between Mobile-to-mobile (requires ANI validation to initiate) and repeater panel or dispatch (single subaudible decode and encode). ANI mobile-repeat function does not require a user number or ANI for the destination mobile. The call limit and mobile activity timers will be in effect and can terminate the call. The call can also be terminated with the *Disconnect ANI*.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the Interconnect User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *ANI Mobile-repeat* followed by ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

Every user in the system defaults to “Disabled” for the *ANI Mobile-repeat* privilege.

*ANI Mobile-repeat* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **Answer Type**

When the Model 48-MAX starts an interconnect call to a user (radio) on the channel, it must have a way of knowing when the called party (user) has answered to connect the parties.

*Answer type* sets this parameter for each user (radio).

There are three ways to answer a call:

- 1) "\*" to answer, this is the default. The user keys his radio, encoding any required subaudible tone/code and sends a DTMF "\*" for greater than 500 milliseconds.
- 2) "PTT" to answer. The user keys his radio, encoding any required subaudible tone/code. No DTMF required here.
- 3) "ANI" to answer. The user keys his radio, encoding any required subaudible tone/code and sends his Access ANI.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the Interconnect User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Answer type* followed by ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default *Answer type* is "\*" to answer for all users.

*Answer type* is supported by block or range programming. See "User Range" later in this section for details.

### **Autocall User (Line 1, Line 2)**

When the Model 48-MAX answers the telephone, it generates a prompt tone (Default is 800Hz beep) or Voice prompt #1 and waits for the caller to over dial a user number, a user ANI, or the program access code. The caller has twice the *DTMF interdigit time* to start entering the first digit. After the first digit, the *DTMF interdigit time* becomes the interdigit timeout period.

The Model 48-MAX can be programmed to automatically call a user even if the caller does not enter any DTMF digits. This is so inexperienced callers can call a user without having to know that they must enter a user number or ANI. They simply call the Model 48-MAX, and after the over dial prompt tone and expiration of twice the *DTMF interdigit time* of silence, they will hear ringing. The user that is automatically called is referred to as the *Autocall user*. The *Autocall user* may be any interconnect user (1 to 99 or 750). Entering 0 as the *Autocall user* will turn off the feature for that line. When the autocall feature is off, the Model 48-MAX will terminate the call if no entry is made.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER and the Interconnect Menu will be displayed. Type "3" and press ENTER and the Telco Specific Menu will appear. Select the item number for Autocall user (Line 1 or Line 2) followed by ENTER. The current setting for *Autocall user* will appear along with a message instructing you to enter the new value and a range of the values you may enter. Enter the User number of the mobile you wish to be called (typically the Supervisor user) if no over dial is performed and press ENTER to accept it.

The default User number entered for the *Autocall user* is "0" or "None" for both Line 1 and Line 2.

#### **Application note:**

The *Autocall user* on Line 2 works with the *Priority Override* function. If an *Autocall user* is programmed on Line 2 and *Priority Override* is enabled, no over dial on Line 2 is required. This differs from the *Cordless Phone user* available on Line 1, in that Line 2 is answered prior to starting the ringouts on the channel.

## Section 5. Feature Set Reference

### **Autodials - Autodials Mode**

The Model 48-MAX has 99 autodial or speed dial locations that can be programmed. Autodials can be used as part of the Toll restrictions for a user or as a convenience feature for frequently dialed numbers.

The specific autodial(s) any user (radio) has access to is configured by the *Autodial mode* in the Interconnect User Menu. This can be set to give access to 1, 10 or 99 autodials. Autodials can also be part of the toll restrictions for a user. Setting *Toll restrictions* to “AutoD” limits Mobile-to-Phone calls to only programmed autodials. If a user has any toll restrictions in effect, then “empty” or unprogrammed autodials are considered toll restricted and will not be allowed.

Valid digits (digits that will be dialed) are 0..9, \*, #. An additional character “,” can also be included to insert a pause or delay (default pause time is 2.5 seconds) before continuing with dialing the number. The maximum number of digits in an autodial is 16.

*Autodial mode* determines for each user which autodials he has access to. This is a two digit number indicating which autodials a user has access to. The first digit indicates which block of ten (1x through 9x) or “0” for all. The second digit indicates which individual autodial (1 to 9) in that block or “0” for all in that block. For example a user with *Autodial mode* set to “20”, has access to 10 autodials (20 to 29). A user with *Autodial mode* set to “23” is forced to autodial #23. A user with *Autodial mode* set to “00” has access to all 99 autodials plus last number redial (Autodial 00).

To use the autodials, a mobile will access the Model 48-MAX as programmed for a Mobile-to-Phone call. When the mobile hears dial tone (from the local central office), he keys up and sends “\*” followed by the autodial number. For users who have access to a block of ten numbers, it is a single digit. For users who have access to all autodials, it is a two digit number.

To take advantage of the forced autodial mode, set that users *Autodial mode* to a single autodial. When this user accesses the Model 48-MAX, the autodial number indicated in *Autodial mode* is dialed immediately.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

### **Autodials:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER and the Interconnect Menu will be displayed. Type “6” and press ENTER and the first of three autodial tables will be displayed (33 autodials per screen). Select the autodial you wish to program (1 - 99) and press ENTER. The currently programmed number in the selected autodial location will be displayed. Enter the new autodial number and press

ENTER when you have finished. The screen to which that autodial appears will be reprinted if not already displayed.

To clear or delete an autodial, select the autodial as above and simply press the space bar for the first character and then press ENTER.

Alphanumeric characters are valid in autodial, however only "0..9", "\*", "#", and "," will be dialed. This can be useful for making the telephone numbers easier to read "1 (425) 820-6363" is easier to read than "14258206363". Text is valid also but there is still a maximum of 16 characters per autodial location.

### **Autodial mode:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the Interconnect User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Autodial mode* followed by ENTER. The currently selected "Autodial block" will be displayed (this is the first digit of *Autodial mode*). Select "1" to "9" for a block of ten or "0" for all 99 autodials and press ENTER. The currently selected "Autodial number" will be displayed (with the updated "Autodial block" on the line above it). Select "1" to "9" for a forced autodial or "0" for all ten in the selected block.

### **Application note:**

The large number of autodials combined with the ability to limit or select a block of autodials for individual users can be a powerful tool. When selling interconnect service to an individual or user group, the dealer can include a block of ten autodials specific for that customer.

Another powerful use is the forced autodial. When the Model 48-MAX sees a specific ANI, a specific phone number can be dialed, or an ANI to phone number translation. This can be an emergency number for a user group or a way of reaching a dead beat customer who is not returning phone calls.

## Section 5. Feature Set Reference

### **Busy Tone Disconnect - 2nd Dialtone Disconnect**

The Model 48-MAX monitors the phone line for progress tones whenever the phone line is off hook. The Model 48-MAX is capable of detecting dialtone and busy tone and disconnecting the call. When *Busy tone disconnect* is enabled, five cycles of busy tone (0.5 second on, 0.5 second off) and the Model 48-MAX will disconnect the call with three fast busy tones. When *2nd dialtone disconnect* is enabled and a call is in the conversation mode, 2.5 seconds of dial tone (continuous tone) will disconnect the call with three fast busy tones.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "2" and press ENTER, the Telco System Menu will be displayed. Select the item number for *Busy tone disconnect* or *2nd dialtone disconnect* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the Local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 144# (beep beep)

Enter: [0 = disabled, 1 = enabled] # (beep beep beep beep beep)

Enter: 145# (beep beep)

Enter: [0 = disabled, 1 = enabled] # (beep beep beep beep beep)

Exit program mode:

Enter: 99# (beep beep beep beep beep)

*Busy tone disconnect* 144# 0/1# (where 0 = disabled, 1 = enabled)

*2nd dialtone disconnect* 145# 0/1# (where 0 = disabled, 1 = enabled)

The default setting for both *Busy tone disconnect* and *2nd dialtone disconnect* is "Enabled".

### **Call Detail Logging**

When the Call Detail Option (950-9587) has been installed, the Model 48-MAX will log and/or record SMDR (Station Message Detail Record) information on interconnect calls. This record includes time/date of call, duration, user number and ANI against whom the call is billed, telephone number dialed and call completion status. The Model 48-MAX will also log errors such as invalid user number overdialed or toll restriction invoked on a telephone number dialed.

The Call Detail Option has the ability to store internally up to 4000 SMDR records for later download or retrieval. Once the storage capacity has been reached, additional records are no longer stored internally. To help maximize the value of data that is stored internally, the Model 48-MAX allows you to control or filter out which records are stored. All calls are always logged out the local RS-232 port in real time.

*Call detail logging* lets you select what type of calls are stored internally for any individual user. Choices are “All” (default) stores all calls; “Toll” stores only toll calls as determined by the Toll restrict plan in effect; “None” turns off storage of all calls placed by this user; “Time” stores only calls which exceed the programmed *Minimum call duration*.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Call detail logging* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for all users is to log “All” calls.

*Call detail logging* is supported by block or range programming. See “User Range” later in this section for details.

At the system level you can set *Log errors in Call detail records* to “Enabled” to store all call attempts. This is useful in troubleshooting problems. To conserve internal storage space, set it to “Disabled”. This feature can be found in the Accounting Menu. See *Log errors in Call Detail Records* later in this section.

## Section 5. Feature Set Reference

### **Call Limit Time - Extended Call Limit**

The Model 48-MAX has two timers for setting the maximum length of interconnect calls (Mobile-to-phone, Phone-to-mobile, Mobile-to-mobile or ANI mobile-repeat). One is a fixed 3 minute timer (default) and the second one is programmable (1 - 60 minutes) with a default setting of 6 minutes. When you set the *Call limit time* for a user, it will toggle between the two choices and display the actual time limit the user is set for.

When the *Call limit time* for a user expires, the call is terminated and five short beeps are sent to the telephone user and to the mobile user. To inform the users that the call is about to be terminated, the Model 48-MAX will issue dual warning beeps every 3 seconds starting 15 seconds before the call is terminated. There is no way of extending the call.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

#### **Extended call limit:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "1" and press ENTER, the Mobile System menu will appear. Select the item number for *Extended call limit* and press ENTER. The current value for *Extended call limit* will be displayed, along with a message showing the range of valid data. Type the desired setting and press ENTER. The screen will be updated with the new value.

The default setting is 6 minutes with a range from 1 to 60 minutes.

#### **Call limit time:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Call limit time* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default *Call limit time* setting for all users is the fixed, 3-minute time limit.

*Call limit time* is supported by block or range programming. See "User Range" later in this section for details.

### **Call Alert Beeps**

If an interconnect call is in progress (Mobile-to-phone, Mobile-to-mobile, ANI mobile-repeat) and one of the telco lines (Line 1 or Line 2) starts receiving ringing voltage, the Model 48-MAX can issue an alert tone on the channel that follows the incoming ring. This allows the mobiles currently on the channel to terminate the call in progress and allow the Model 48-MAX to answer the ringing telco line. The alert tone is issued while ringing voltage is detected. This allows the alert tone to follow the ring cadence.

#### **How to program it:**

Using DTMF either over the air, on the telephone line, or through the Local telephone port:

Enter the program mode using the program access code (default is 12048).

Enter: 143# (beep beep)

Enter: [1 = enabled, 0 = disabled] # (beep beep beep beep)

Exit program mode:

Enter: 99# (beep beep beep beep)

The default setting for *Call Alert beeps* is disabled.

#### **Application note:**

This feature does not give an alert if dispatch or repeater traffic is active. See *Dispatch Override* later in this section.

## Section 5. Feature Set Reference

### **Clear Airtime Records**

The Model 48-MAX keeps track of each user's airtime. This can be either Accumulated (count up) or Pre-pay (count down). The current airtime record for each user is displayed as the last item number in the User menu (both for Interconnect and Repeater Panel users).

If an Interconnect User's Equipment type is "Tone Pager" or "Tone/Voice" then instead of airtime, the Model 48-MAX counts the "Number of pages" issued.

This command in the Accounting menu will clear or zero out all airtime records for either "Interconnect" or "Repeater Panel" users. Note that users that are currently set to Pre-pay will not be cleared.

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "4" and press ENTER and the Accounting Menu will appear. Select the correct item number for *Clear airtime records* and press ENTER. The Model 48-MAX will let you select between "Interconnect" and "Repeater Panel". Press space bar to change, ENTER to select. You will then be prompted for confirmation. Type "Y" to accept, "N" to abort followed by ENTER.

*This command is NOT reversible.*

#### **Application note:**

If you are using airtime billing, you will want to setup your airtime accounts at the start of each billing cycle. One way to do this is to use the user database archive to reset your billing data. Setup your users, including airtime and save it. At the start of each billing cycle you would execute *Clear airtime records* and then upload the archived user database. This restores your pre-pay airtime counts and clears your accumulated counts.

### **Clear Call Detail Records**

The Call detail records are stored in battery backed RAM. It will hold a maximum of 4000 records and must be downloaded before it is filled. If the Call detail records are not periodically downloaded, additional calls once the storage has become full will be lost. Once you have downloaded the Call detail records, you need to clear the number of records. Use this command to clear or reset the number of records in storage. If by chance you do clear the Call detail records in error, you can use the *Unerase Call detail records* command to undo the erasure. The Unerase command will only work if there haven't been any new entries into the call detail storage between the time you cleared it and the time you are attempting to restore it.

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "4" and press ENTER, the Accounting Menu will be displayed. Select the item number for *Clear Call detail records* and press ENTER. The Model 48-MAX will prompt you for confirmation. Type "Y" to accept, "N" to abort followed by ENTER.

#### **Application note:**

When the number of records held in internal storage reaches 80% or greater of maximum capacity (3200), the Model 48-MAX will issue three high/low error tones just prior to dropping the transmitter. This is to give warning of the impending need to retrieve the billing data and clear the counts to prevent loss of data.

## Section 5. Feature Set Reference

### **Cordless Telephone User**

*Cordless telephone user* is both a mode of operation and an interconnect user whom it operates with. It is similar in operation to “No Answer ringout” mode in other interconnect products like the venerable Model 35A. This feature is only available on Line 1.

*Cordless telephone user* allows the Model 48-MAX to selectively call and ringout to a user (radio) without answering the telephone line. This makes the Model 48-MAX act like a high-performance cordless telephone. When the Model 48-MAX detects ringing, it begins counting the rings. Once the specified Rings to answer has been reached, the Model 48-MAX keys the transmitter, sends any required selective calling and begins ringing on the channel. When the mobile answers the call, the telephone line is answered and the call progresses as usual.

If the mobile has not answered after 12 rings on the channel, the Model 48-MAX will answer the line and allow normal overdial operation such as access to programming or calling a mobile.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” to and press ENTER and the Interconnect Menu will be displayed. Type “3” and press ENTER and the Telco Specific Menu will appear. Select the item number for *Cordless telephone user* and press ENTER. The current user number will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default for the *Cordless telephone user* is “None”, and may be programmed with a user number from 1 to 99 (750) or 0 for off or none.

#### **Application note:**

The ability to operate in the “Cordless telephone mode” is really quite useful. Using this, the Model 48-MAX can share a telephone line like an answering machine would. You can set the Rings before answer to four rings. If you are in the office you can pick up the telephone and answer the call. If you are not in the office, the Model 48-MAX will ring out to your mobile where you can be reached.

The programming for the user selected must have the Equipment type set for “Mobile”. If not the Model 48-MAX will simply force the issue and act “as if” the Equipment type is set for mobile. This is the only equipment type that does not require the phone line to be answered to call the user (radio). When the user (radio) does answer the Model 48-MAX can then connect the call by answering the ringing phone line.

### **Courtesy Tone**

A *Courtesy tone* is a short prompt tone that is sent just after the mobile unkeys to prompt the other party to begin speaking. It is also sometimes referred to as an “Over” prompt or beep. The *Courtesy tone* is a 1200 Hz tone with a duration of 50 milliseconds. It is enabled or disabled on a per user basis.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Courtesy tone* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Courtesy tone* is disabled or off for all users.

*Courtesy tone* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **CTCSS/DCS Decode - CTCSS/DCS Encode**

The Model 48-MAX has the ability to decode and encode CTCSS or DCS for an interconnect call. Decode is typically used for validation along with Access ANI during call setup. Encode is typically used for selective calling a user or user group during call setup.

Decode can be used for answering calls, removing the need for DTMF to answer calls. It is also useful in validating disconnect ANI's and audio gating to prevent barge in by impatient users.

Encode is can also be used in channel busy applications to keep the called radio unsquelched and prevent others from barging in or initiating a call until the channel is again free.

The Model 48-MAX is capable of decoding and encoding 50 CTCSS tone and 104 DCS codes. Refer to “CTCSS Tones” and “Digital Squelch Codes” in Section 8 for a full listing of the supported tones and codes.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *CTCSS/DCS decode* or *CTCSS/DCS encode* and press ENTER.

The current setting will appear along with a message instructing you to enter the new value. Enter the new CTCSS/DCS and press ENTER when you have finished.

To program the CTCSS tones, just enter the desired tone directly (i.e. enter 67 for 67.0 Hz, or 118 for 118.8 Hz) decimal point is optional.

To program the DCS codes, preface the code with a D and then enter the actual DCS code (i.e. D023 for 023).

To clear a tone or code, simply type “0” and press ENTER.

*CTCSS/DCS decode* and *CTCSS/DCS encode* defaults to “None” for all users.

*CTCSS/DCS decode* and *CTCSS/DCS encode* is supported by block or range programming. See “User Range” later in this section for details.

### **CTCSS/DCS Drop**

When a call has come into the Model 48-MAX, and the caller has selected a user to call, the Model 48-MAX generates CTCSS or DCS (depending on the CTCSS/DCS encode) and sends out the selective calling, and then the ringing. If *CTCSS/DCS drop* is ON (yes), CTCSS or DCS will be dropped when the mobile answers. If it is OFF (no), the encode will continue for the duration of the call.

If the system has a fleet of mobiles that are on the same tone, you will want the tone/code to drop when the correct mobile answers, otherwise everyone else in the fleet will have to listen to the call. If the system has a tone per user, leave the *CTCSS/DCS drop* OFF (no) so that the mobile won't have to hear additional channel traffic.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *CTCSS/DCS drop* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *CTCSS/DCS drop* for all users is OFF or "no".

*CTCSS/DCS drop* is supported by block or range programming. See "User Range" later in this section for details.

## Section 5. Feature Set Reference

### **DCS Decode (polarity) - DCS Encode (polarity)**

When DCS is transmitted or received, it may be inverted depending on the number of inverting amplifiers in the receiver and in the transmitter. Inverting refers to switching the polarity of the 1's and 0's that make up the DCS pattern. For example 023 becomes 047 when inverted. To make sure the Model 48-MAX receives and encodes the correct DCS code from your mobiles, the Model 48-MAX has the ability to invert the signal it receives or transmits (change all the 1's to 0's, and change all of the 0's to 1's).

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "3" and press ENTER, the System Menu will be displayed. Select the item number for *DCS decode* or *DCS encode* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 120# (beep beep)

Enter: [0 = normal, 1 = inverted] # (beep beep beep beep beep)

Enter: 121# (beep beep)

Enter: [0 = normal, 1 = inverted] # (beep beep beep beep beep)

Exit program mode:

Enter: 99# (beep beep beep beep beep)

*DCS encode polarity* 120# 0/1# (where 0 = normal, 1 = inverted)

*DCS decode polarity* 121# 0/1# (where 0 = normal, 1 = inverted)

The default setting is normal, or no DCS inversion.

### Dialout Mode

When placing a Mobile-to-phone call, the Model 48-MAX regenerates the telephone number using either Touch-Tone (DTMF) or Pulse dialing. There are two speeds for Touch-Tone or DTMF dialing. Pulse dialing is at 10 pps (pulses per second and two Break/Make ratios.

Choices for Dialout mode are:

- “DTMF 5dsp” (5 digits per second or 100mSec on/off timing)
- “DTMF 10dps” (10 digits per second or 50mSec on/off timing)
- “Pulse 60/40” (10 pulses per second at 60mSec break / 40mSec make)
- “Pulse 67/33” (10 pulses per second at 67mSec break / 33mSec make)

In most installations in North America, DTMF will be the choice. If pulse dialing is used, “Pulse 60/40” will work in North America and areas that have compatible equipment. “Pulse 67/33” will work in areas that have CCITT compatible equipment (Europe, Australia and Hong Kong)

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER. The Interconnect Menu will be displayed. Type “2” and press ENTER to get the Telco System Menu. Select the item number for *Dialout mode* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default *Dialout mode* is “DTMF 5dps”.

## Section 5. Feature Set Reference

### **Disconnect ANI**

Once a call has been established and is in the conversation mode, the Model 48-MAX must have a way of knowing when the mobile or radio wants to terminate the call. This is done by sending a DTMF string or code indicating “disconnect or terminate the call”.

Each Interconnect user has a *Disconnect ANI* that is separate and distinct from the *Access ANI*. It works very similar to the *Access ANI* in that it is used to identify a specific user and is validated with subaudible tone/code. *Disconnect ANI*'s are not checked for conflicts in the database like *Access ANI*'s. This is because since the Model 48-MAX knows who the user's on the system are, it also knows how they are required to disconnect the call.

ANI's can be random in length up to 10 digits, using any of the 16 DTMF tone pairs (0 to 9, A to D, \*, #). Single digit ANI's have a minimum on time requirement of 500mSec for validation. Multi-digit ANI's have no minimum timing requirements.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Disconnect ANI* and press ENTER. The current *Disconnect ANI* will be shown along with a message instructing you to enter a new *Disconnect ANI*. Type in the new *Disconnect ANI* and press ENTER when finished.

The default *Disconnect ANI* is “#”. To clear a user's ANI, press the space bar followed by pressing ENTER. This will clear the current *Disconnect ANI* and set it to “#”.

### **Application note:**

Wild cards are supported in the *Disconnect ANI* as well as the *Access ANI*. All the same rules apply.

### **Dispatch Override**

When a phone caller attempts to make a call and the channel is busy, the Model 48-MAX will send busy tone to the caller or Voice prompt #7 until the channel clears or becomes quiet (3 seconds of no channel activity). *Dispatch override* when enabled no longer requires the 3 seconds of quiet time on the channel to allow the call to proceed. A typical use of this function would be when distant co-channel carrier disallows normal use of the Model 48-MAX. When enabled, *Dispatch override* will also override any repeater panel in operation (even local ones), in effect giving priority to the incoming phone line.

*Dispatch override* can be independently set for each incoming End-to-End line (Line 1 and Line 2).

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "3" and press ENTER, the Telco Specific menu will be displayed. Select the item number for *Dispatch override* (Line 1 or Line 2) and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default *Dispatch override* setting for both Line 1 and Line 2 is "Disabled".

## Section 5. Feature Set Reference

### **Display Statistics**

The *Display statistics* command in the Diagnostic Menu displays data accumulated in monitoring the Model 48-MAX. It provides data on the number of power losses, resets and any Users who have checksum errors.

Power fails is the number of times the power to the Model 48-MAX has been cycled.

Resets is the number of times the Model 48-MAX has reset without power being removed. This could be caused by a brown out condition at the site.

When power is first applied to the Model 48-MAX, it will do a System and User database test on the integrity of the data. If the System database fails, it will reset the System database. When the Model 48-MAX checks the User database (Interconnect and Repeater Panel), it is checking the integrity of each individual User. If a User's data failed, that User will be marked as "Bad" in the statistics. If more than 20 Users turn up bad, the Model 48-MAX will reset the User database (Interconnect or Repeater Panel). Any users that have been marked as bad will also be displayed under System statistics.

Bad users are also displayed when the Main Menu is displayed the first time in a programming session.

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type "5" and press ENTER, the Diagnostic Menu will be displayed. Select the item number for *Display statistics* and press ENTER. Current reset counts and date of last occurrence, "bad" Users if any, unit serial number and hour meter will be displayed. Any key will return to the Diagnostic Menu.

#### **Application note:**

The number of power failures and when the last occurrence was can be very useful information. If you suspect marginal power at the site, reset counts can help diagnose or confirm a potential problem.

### **DTMF On Time - DTMF Off Time**

These two commands control the duty-cycle of the DTMF tones during selective calling. Both Selcall formats, DTMF and DTMF-t, use this timing when sending tones.

The *DTMF on time* sets the on duration of the tone in 10-millisecond increments. The *DTMF off time* sets the duration between the tones, also in 10-millisecond increments. By varying the two times, you can customize the duty-cycle for the decoders used on the system. If the decoder can see a valid tone after 40 milliseconds, you could set the on time for 50 milliseconds. If the decoder can see a valid break in 20 milliseconds, you could set the off time for 30 milliseconds. The net result is 80 milliseconds per digit instead of 100 milliseconds per digit (50% duty-cycle).

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "1" and press ENTER, the Mobile System Menu will be displayed. Select the item number for *DTMF on time* or *DTMF off time* and press ENTER.

The current timing value will be shown along with a message showing the range of data that can be entered. Enter the new value and press ENTER.

The default setting for both *DTMF on time* and *DTMF off time* is 50 milliseconds (5).

Note that this only affects DTMF selective calling on the channel. It does not affect or change DTMF regenerated into the phone lines.

## Section 5. Feature Set Reference

### **DTMF-t Collect Time**

This command is used to set the duration of the Collect tone or digit for the DTMF-t Selcall format. This is the tone or digit transmitted at the start of a page to “alert” the decoders in the mobile that a page is coming. The duration can be set in 100 millisecond increments from 100 milliseconds to 5000 milliseconds (5 seconds).

This tone or digit is the first tone or digit in a user's Selcall capcode. If a DTMF “D” is being used as the Collect tone or digit, and the address for a mobile is 1234, you would enter D1234 as the user's Selcall capcode.

See “DTMF-t Signaling” in Section 8.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *DTMF-t Collect time* and press ENTER. The current timing will be shown along with a message showing the range of data that can be entered. Enter the new timing value and press ENTER to accept.

The default setting for *DTMF-t Collect time* is 2000 milliseconds (20).

### **DTMF-t Reset Time**

This command is used to set the duration of the Reset tone or digit for the DTMF-t Selcall format. This is the tone or digit transmitted at the end of a transmission to “reset” the mobiles’ decoder. The reset tone or digit is also sent as the first tone or digit on a phone to mobile call. The duration can be set in 100 millisecond increments from 100 milliseconds to 5000 milliseconds (5 seconds).

This tone or digit is defined on a system wide basis using the *DTMF-t Reset digit* command.

See “DTMF-t Signaling” in Section 8.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *DTMF-t Reset time* and press ENTER. The current timing will be shown along with a message showing the range of data that can be entered. Enter the new timing value and press ENTER to accept.

The default setting for *DTMF-t Reset time* is 1000 milliseconds (10).

## Section 5. Feature Set Reference

### **DTMF-t Reset Digit**

This command is used to set the Reset tone or digit for the DTMF-t Selcall format. This is the tone or digit transmitted at the end of a transmission to “reset” the mobiles’ decoders. The reset tone or digit is also sent as the first tone or digit on a phone to mobile call.

The duration for this tone or digit is defined using the *DTMF-t Reset time* command.

See “DTMF-t Signaling” in Section 8.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *DTMF-t Reset digit* and press ENTER. The current digit will be shown. Enter the new digit and press ENTER to accept. Valid range of digits for this command is any of the 16 DTMF tone pairs (0 to 9, A to D, \*, #).

The default setting for *DTMF-t Reset digit* is “A”.

### **DTMF Interdigit Time**

There are three instances where the *DTMF interdigit time* has an effect:

- 1) When a mobile is dialing a telephone number.
- 2) When either a mobile or a telephone caller is over dialing a User number or ANI to call a mobile.
- 3) During a hookflash initiated regenerate period.

The reason for the *DTMF interdigit time* is to leave a path for the Model 48-MAX to take in the event the user quits entering digits during telephone dialing or during ANI or user number over dial.

Each time a new digit is pressed, the *DTMF interdigit time* is reset. The *DTMF interdigit time* sets the minimum speed that the digits must be entered. It is not the time to enter all of the digits, just the maximum amount of time between digits that is allowed without the call being terminated.

To help keep the *DTMF interdigit time* as short as practical, the time allowed for the first digit is twice this value. Most people have a tendency to delay that first digit relative to the remaining digits in the sequence. This can be due to searching for a physical item with the number on it, to just a momentary lapse of memory as to which number to dial.

#### **Example:**

The default value is 4 seconds, the time allowed for the first digit would be 8 seconds, then 4 seconds for every following digit.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect menu will be displayed. Type "1" and press ENTER, the Mobile System Menu will be displayed. Select the correct item for *DTMF interdigit time* and press ENTER. The current *DTMF interdigit time* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

The default for the *DTMF interdigit time* is 4 seconds and may be programmed anywhere from 2 to 10 seconds.

## Section 5. Feature Set Reference

### **Enabled**

The *Enabled* command is used to turn users on and off. Regardless of how the user has been programmed, access will be totally denied to the interconnect until the user has been *Enabled*.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Enabled* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

*Enabled* is supported by block or range programming. See "User Range" later in this section for details.

### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 101# (beep beep)

Enter: [uuu = user number] # (beep beep)

Enter: [0 = disable, 1 = enable] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Enabled* is "No" or disabled for all users except User #1, who defaults to "Yes" or enabled.

### **Application note:**

Customers that have delinquent accounts can be disabled using this command and enabled later. By doing this, you don't have to reprogram the user's parameters, you simply re-enable the user when the account is settled.

### Equipment Type

Because of the Model 48-MAX's flexibility, many types of equipment can be used on the same system. *Equipment type* sets the characteristics of the user (radio) on the channel. It determines how call setup is performed and whether or not the user (radio) can originate calls. The Model 48-MAX supports four modes or types of equipment: "Mobile", "Talkback", "Tone/Pager" and "Tone/Voice" pager. These four types are described in Table 5. **FEATURE SET REFERENCE-1.**

Table 5. **FEATURE SET REFERENCE-1** User Equipment Types

Equipment Type	Description
Mobile	A "Mobile" is a radio that can receive and originate calls. This is the default Equipment type. It can make full use of selective calling formats and ringout styles. A "Mobile" must be capable of answering a call based on Answer type to receive calls. It must also be capable of generating DTMF to originate a call.
Talkback	"Talkback" is a radio that can also receive and originate calls like a "Mobile" but has two differences when receiving calls. 1) If selective calling is used, no ringouts are generated on the channel. If selective calling is not used, a single ringout is transmitted instead. 2) During the Mobile answer time, the caller can "voice hail" the radio on the channel. This works like a "Tone/Voice" pager but the radio can answer back if they choose.
Tone/Pager	This is a pager that beeps when the correct sequence of tones are sent to it. It does not have the ability to transmit, or to receive audio. When the Model 48-MAX is called, the caller enters the user number or ANI and hears simulated beeper tones indicating to the caller that the page has been sent. Tone-only pagers cannot originate calls.
Tone/Voice	This is a pager that beeps when the correct sequence of tones are received and unquelsches to allow a voice message to be received. It does not have the ability to transmit. When the Model 48-MAX is called, the caller enters the user number or ANI and hears a single beep indicating that he can speak his voice message. When the talk time expires, or the caller quits talking, double beeps are sent to the caller indicating that his time is up, and the Model 48-MAX hangs up. "Tone/Voice" pagers cannot originate calls.

#### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Equipment type* and press ENTER.

## Section 5. Feature Set Reference

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Equipment type* is “Mobile” for all users.

*Equipment type* is supported by block or range programming. See “User Range” later in this section for details.

### **Application note:**

*Equipment types* “Talkback” and “Tone/Voice” presume a selective calling format will be used to alert or unquench a receiver. If one is not used, a single ringout will be transmitted on the channel instead. This works well in applications where just an open audio path from the phone caller is desired.

## **Emergency Prefix**

In many areas, emergency services like the Fire department or Police department can be reached directly with a special three digit prefix like “911” or “311”. The Model 48-MAX supports this by allowing the prefix to be programmed for the proper three digit number based on where it is installed. It can even be disabled by simply clearing this prefix (setting it to no prefix).

When a mobile dials the *Emergency prefix*, the Model 48-MAX does a couple of things different for that call. First, it drops out of regeneration and into the conversation mode after the three digit prefix has been dialed. Second, it disables both the call limit and mobile activity timers. This is to ensure that information is not lost or the call is cut short prematurely.

The *Emergency prefix* is available to all users on the system who can manually dial telephone numbers and is not toll restricted.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “2” and press ENTER, the Telco System menu will be displayed. Select the item number for *Emergency prefix* and press ENTER. The current *Emergency prefix* will be displayed along with a prompt instructing you to enter a new value. Enter in a new three digit prefix and press ENTER when you have finished. To clear the *Emergency prefix* just enter a “ ” (press the space bar) for the first character and press ENTER.

### **Application note:**

To disable the *Emergency prefix*, set the prefix to an empty string. Just press the space bar for the first character like any other string variable. This clears the *Emergency prefix* and disables it.

## Section 5. Feature Set Reference

### **Fast ANI Access**

To help thwart hackers from gaining access to a system, the Model 48-MAX can require that all multi-digit ANI's meet a minimum average digit speed of five digits per second. This requires that the mobiles be equipped with ANI microphones like the ZMX or have the ability to transmit an ANI at greater than five digits per second average speed.

When enabled, all multi-digit ANI's (Access and Disconnect) from the radio side will be required to meet the timing requirements.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "1" and press ENTER, the Mobile System menu will be displayed. Select the item number for *Fast ANI access* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

Enter:           125# (beep beep)

Enter:           [0 = disable, 1 = enable] # (beep beep beep beep)

Exit programming mode:

Enter:           99# (beep beep beep beep)

The default setting for *Fast ANI access* is "Disabled".

### Hookflash Mode

The Model 48-MAX can support the mobile in performing a hookflash on the current line once in the conversation mode. One of the more typical installations where hookflash is used is on PBX installations. This is enabled on a per user basis. On PSTN calls a user's *Toll restrict type* must be set to “None” for access to hookflash to work. On PBX calls, a user's *Toll restrict type* can be set to anything except “AutoD” for access to hookflash to work. It is initiated by the mobile sending a DTMF “\*0” while in conversation mode. The Model 48-MAX then does a “flash”, or “breaks” the loop current for 600 milliseconds. What happens next is based on whether the call is internal PBX call or a PSTN call.

On PSTN calls, the Model 48-MAX temporarily enables DTMF regeneration. While in the temporary regenerate mode, all digits decoded from the mobile will be regenerated to the phone (0 to 9, A to D, #). Once a hookflash has been performed, the mobile has two times the programmed *DTMF interdigit time* in which to dial the first digit. This is used to control staying in the regenerate mode. After the first digit has been dialed, the specified *DTMF interdigit time* is used. Allowing the interdigit time to expire or sending a DTMF “\*” will turn off the regeneration at any time. If disconnect on second dial tone is enabled (the default condition), the Model 48-MAX will ignore dial tone from the telco line immediately after a hookflash.

On internal PBX calls, only a hookflash is performed and the Model 48-MAX returns immediately to the conversation mode. Since all DTMF is passed thought from the mobile, there is no need to stay in the regenerate mode.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Hookflash mode* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Hookflash mode* is “Disabled” for all users.

*Hookflash mode* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **ID Call Sign - ID Interval - ID Speed**

The *ID call sign* is the station ID for a single license station. The *ID call sign* will be transmitted, in Morse code, at the end of a call when the *ID interval* has expired. For example, if the interval is set to 15 minutes (default), once the ID has been sent, it won't be sent again for another 15 minutes, regardless of the number of calls made during the 15 minute interval. Once the 15 minute interval has expired, the ID will be sent at the end of the next call. To send the ID at the end of every call, set the *ID interval* to 0.

The *ID speed*, the rate in words per minute that Morse code is transmitted by the Model 48-MAX, is programmable from 10 to 25 wpm, the default is 20 wpm.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem. Once connected to the Model 48-MAX and the Main menu is on the screen, type "3" and press ENTER, the System menu will be displayed.

- ID call sign**      Select the item number for *ID call sign* and press ENTER. The current *ID call sign* will be displayed along with a prompt instructing you to enter a new value. The range of values for *ID call sign* is 0 to 9, A to Z, up to 9 characters in length. To clear the *ID call sign* just enter a " " (press the space bar) for the first character and press ENTER.
- ID interval**      Select the menu item for *ID interval* and press ENTER. The current *ID interval* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.
- ID speed**          Select the menu item for *ID speed* and press ENTER. The current *ID speed* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new value and press ENTER when you have finished.

The default for *ID call sign* is none. No ID is programmed.

The default for *ID interval* is 15 minutes, with a range of 0 to 60 minutes.

The default for *ID speed* is 20 wpm, with a range of 10 to 20 words per minute.

#### **Application note:**

If a Voice ID has been programmed (voice prompt #8), the Voice ID will override the *ID call sign*.

To have the *ID call sign* sent at regular intervals regardless of channel activity, enable *Periodic ID*. See "DTMF Commands" in Section 8.

### **Interconnect Hog Mode - Interconnect Hog Time**

The *Interconnect hog mode* feature allows the system operator to provide equal opportunity access to the interconnect. Its primary function is to prevent users from making back to back interconnect calls. It does this by saving the user number for each valid mobile access. Each user is allowed one shot at the Model 48-MAX. Once in the “Last User” slot, they must wait the duration of the *Interconnect hog time* to gain access again. The only other way is for another user to gain access to the Model 48-MAX, thereby putting that user in the “Last User” slot.

The *Interconnect hog time* is the amount of time that a user is prevented access to the Model 48-MAX. It can be programmed in 1-second increments ranging from 10 to 250 seconds.

This is a per user function. Once enabled, it affects only users with this function enabled.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

#### **Interconnect hog mode:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect menu will be displayed. Type “4” and press ENTER, the User Menu will be displayed. The *Interconnect hog mode* is supported by block or range programming. See User Range for details, later in this section.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **Interconnect hog time:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect menu will be displayed. Type “1” and press ENTER, the Mobile System Menu will be displayed. Select the menu item for *Interconnect hog time* and press ENTER. The current *Interconnect hog time* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

The default setting for *Interconnect hog mode* is “Disabled”.

The default setting for *Interconnect hog time* is 60 seconds.

## Section 5. Feature Set Reference

### **Interconnect Privacy**

When the Model 48-MAX is connected to a repeater, it can provide the users with added privacy. Since the repeater is capable of full duplex conversation, you have the following options; repeating the mobile's audio, running full duplex (repeating both the mobile's audio and the telephone audio at the same time), or sending out a blocking tone in place of the mobile's audio. The blocking tone provides privacy since listeners on the channel will hear only half of the conversation (the telephone caller).

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Interconnect privacy* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting is "Half Duplex" or to repeat the mobile's audio, for all users.

*Interconnect privacy* is supported by block or range programming. See "User Range" later in this section for details.

## **Interconnect - Allowed Days / Restricted Days**

### **Interconnect - Start Time / Stop Time**

The Model 48-MAX Selcall and Roamer versions include a feature called *Scheduled Telco Access*. It uses its internal real time clock to restrict, or limit, access to the interconnect based on time of day and day of week. If you limit interconnect access to normal business hours (8-to-5, Monday through Friday), you can prevent access to the interconnect on a per user (radio) basis outside of those hours. This can be a useful feature for a private, in-house installation where control of radio access is a concern. This feature can also be useful in a system where dispatch and interconnect are mixed. You can disable interconnect during peak dispatch traffic (giving priority to dispatch) and still be able to offer interconnect during the off peak hours. This allows a premium to be charged for unrestricted interconnect access.

*Interconnect start time* and *Interconnect stop time* define what hours of the day the interconnect may be used. Interconnect access is valid for all users anytime after the start time but before the stop time. If we set start time = 8:00 (8:00 AM) and stop time = 17:00 (5:00 PM), the default setting, then interconnect function is allowed from 8:00 AM to 5:00 PM. So during business hours, the interconnect function is allowed.

*Interconnect allowed days* and *Interconnect restricted days* are both the same command. It sets which days of the week to use the start and stop times for interconnect access. If a day is allowed, the Model 48-MAX will only allow interconnect access between the start and stop times. If the day is restricted, the Model 48-MAX will not allow interconnect access at any time. The Model 48-MAX defaults to Saturday and Sunday being restricted and Monday through Friday being allowed. This means that the Model 48-MAX will only pay attention to the start and stop times on Monday through Friday, and will restrict interconnect access 24 hours a day on Saturday and Sunday.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is displayed, type "1" and press ENTER, the Interconnect Menu will be displayed, Type "2" and press ENTER, the Telco System menu will be displayed. The system wide settings for the *Scheduled telco access* feature are defined in this menu.

### **Time of day:**

Select the item number for *Interconnect start time* or *Interconnect stop time* and press ENTER. The current time will be will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

Time is entered in 24 hour format. A colon or other non-numeric character is considered a separator between hours and minutes.

## Section 5. Feature Set Reference

### **Days of the week:**

Select the item number for *Interconnect allowed days* or *Interconnect restricted days* and press ENTER. You will be prompted for each day of the week, beginning with Sunday with its current status (“Allowed” or “Restricted”). Press the space bar to change and ENTER to accept. Each time ENTER is pressed, the next day and its current status will appear. This will continue through all 7 days of the week. When completed both *Interconnected allowed days* and *Interconnected restricted days* will be updated on screen.

Day of the week abbreviations used:

U	Sunday
M	Monday
T	Tuesday
W	Wednesday
H	Thursday
F	Friday
S	Saturday

### **Keyup Delay**

The Selcall and Roamer versions of the Model 48-MAX provide the capability to selectively call a field unit using an analog tone signaling format. *Keyup delay* is the amount of time the Model 48-MAX waits between keying the transmitter and sending the selective calling tones.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect menu will be displayed. Type "1" and press ENTER, the Mobile System Menu will be displayed. Select the menu item for *Keyup delay* and press ENTER. The current *Keyup delay* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

The default setting for *Keyup delay* is 500 milliseconds.

## Section 5. Feature Set Reference

### Line Select

The Model 48-MAX provides the ability to control which telephone line(s) are accessible for mobile originated calls by a user (radio). *Line select* can be set to “L1 only” (the default), “L2 only” or “Selectable”. Each user (radio) can be automatically guided to a line or allowed to select a line.

In steering digit applications, a “\*” or “9” will select the default line. If set for “L1 only” or “L2 only”, then that is the default line. If set for “Selectable”, then Line 1 is the default line. A steering digit of “8” is used to select the alternate line (Line 2) when set for “Selectable”.

Note that when *Line select* is set as “Selectable”, a steering digit is required to “select” an outbound line.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Line select* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Line select* is “L1 only” for all users.

*Line select* is supported by block or range programming. See “User Range” later in this section for details.

### Application note:

If you don't want to use a steering digit (short sign-on), program *Line select* to a single telco line. Then enable only the Mobile-to-phone privilege.

When setting up a user for short sign-on, this parameter automatically is reset to “L1 only”.

**Line Connection (Line 1, Line 2)**

The Model 48-MAX has two end-to-end line interfaces suitable for connection to a two wire circuit. This can be either a two wire end-to-end from the PSTN, or a PBX two wire end-to-end extension line. *Line connection* is used to configure each end-to-end line as either a PBX extension or a PSTN line. When connected to a PBX, the Model 48-MAX can distinguish between an internal call (to another extension) on the PBX or a call on an outside line (through the PBX to the PSTN). This distinction is based on the first digit dialed on a line configured (in software) as a PBX line. The first digit dialed is scanned against the *PBX outside line digit*. If it matches, then a call to the PSTN is assumed and the first digit dialed is ignored. If it does not match, then the call is considered an internal call and the Model 48-MAX drops out of regeneration.

When a mobile originated call is placed on a line configured as PSTN, the programmed toll restricts are always enforced. When a mobile originated call is placed on a line configured as PBX, the first digit dialed is used to determine if it is an internal or external call. The programmed toll restricts are only enforced if the call is to an outside line.

**How to program it:**

Access to Model 48-MAX through your direct connect PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem. Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will be displayed. Type a "3" and press ENTER and the Telco Specific Menu will appear. Select the item number for *Line connection* (Line 1 or Line 2) followed by ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state of the currently selected menu item changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Line connection* is PSTN for both lines.

## Section 5. Feature Set Reference

### List Airtime Records

For system evaluation or billing, you may list the airtime records for all users that have greater than 1 minute of airtime. The Model 48-MAX will display a list in numerical order (by user number) showing the user and the airtime record indicating “Accumulate”, “Pre-pay” or the number of pages. The airtime records for Interconnect and Repeater panel user databases are separate and distinct. When you select this command you will be asked which records you wish to list.

The Model 48-MAX supports XON/XOFF protocol. If during listing of data you wish to pause, CTRL-S will stop the listing and CTRL-Q will restart the listing. Be aware that CTRL-S will only pause the listing for 20 seconds. You may also terminate the listing at any time with CTRL-C (a CTRL- command is holding down the CTRL key and pressing the second key).

If you are using communications software that supports the XMODEM data transfer protocol, you can download the users airtime records into an ASCII file. See “Device Configuration and Billing Data” in Section 4.

If you are using communications software that supports a “Log file”, you can “capture to disk” the list that the Model 48-MAX sends you. Simply turn on the “Log file” before executing this command. When the list is complete, turn off or close the “Log file”. Once you have done this, you may print the list or view it with a text editor.

#### How to execute it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “4” and press ENTER, and the Accounting Menu will appear. Then type “1” and press ENTER to bring up the Detailed List menu Enter the item number for *List airtime records* and press ENTER. You will then be prompted to select either “Interconnect” or “Repeater Panel” records to list. Press the space bar to change and ENTER to accept. The Model 48-MAX will then scan the database looking for airtime records of greater than 1 minute and print them as it finds them.

### **List Call Detail Records (SMDR)**

The Model 48-MAX can list the Call detail records that is currently stored internally. This can be useful to evaluate recent activity on the system without having to download the records. The records are listed in a “first in first out” sequential order. The first call since the last time the Call detail buffer was cleared, is listed first and the most recent call is listed last.

The Model 48-MAX supports XON/XOFF protocol. If during listing of data you wish to pause, CTRL-S will stop the listing and CTRL-Q will restart the listing. Be aware that CTRL-S will only pause the listing for 20 seconds. You may also terminate the listing at any time with CTRL-C (a CTRL- command is holding down the CTRL key and pressing the second key).

If you are using communications software that supports the XMODEM data transfer protocol, you can download the users airtime records into an ASCII file. See “Device Configuration and Billing Data” in Section 4. If you are using communications software that supports a “Log file”, you can “capture to disk” the list that the Model 48-MAX sends you. Simply turn on the “Log file” before executing this command. When the list is complete, turn off or close the “Log file”. Once you have done this, you may print the list or view it with a text editor.

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “4” and press ENTER and Accounting Menu will be displayed. Then type “1” and press ENTER to bring up the Detailed List menu. Enter the item number for *List Call detail records* and press ENTER. The 48-MAX will start listing all the internally stored Call detail records.

## Section 5. Feature Set Reference

### List Users

This command is found in the User Menu (both Interconnect and Repeater Panel) and will display or list important data for each user specified. *User range* sets the starting and stopping user number that will be displayed by the *List user* command.

Note that when you first enter the User Menu on a Model 48-MAX, *User range* is set to start at 1 and end at 1 (“User range: 1”). Using the *List users* command will only display one user until the *User range* is changed.

The Model 48-MAX supports XON/XOFF protocol. If during listing of data you wish to pause, CTRL-S will stop the listing and CTRL-Q will restart the listing. Be aware that CTRL-S will only pause the listing for 20 seconds. You may also terminate the listing at any time with CTRL-C (a CTRL- command is holding down the CTRL key and pressing the second key).

If you are using communications software that supports a “Log file”, you can “capture to disk” the list that the Model 48-MAX sends you. Simply turn on the “Log file” before executing this command. When the list is complete, turn off or close the “Log file”. Once you have done this, you may print the list or view it with a text editor.

#### How to execute it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the item number for *User range* and set the starting and stopping user numbers you wish to list.

Next, select the item number for *List users* (in user range) and press ENTER. The Model 48-MAX will start listing the user data beginning with the first (lowest) user number specified in *User range* through the last (highest) user number specified in *User range*.

See also “User Range” later in this section.

For a detailed listing of user information, go to the “Detailed Listing Menu”, item one in the Accounting menu. See the description of the “Detailed Listing Menu” in Section 4.

### **Log Errors in Call Detail Records**

When the Call Detail Option (950-9587) has been installed, the Model 48-MAX will log or record SMDR (Station Message Detail Record) information on interconnect calls. This record includes time/date of call, duration, user number and ANI against whom the call is billed, telephone number dialed and call completion status. The Model 48-MAX will also log errors such as invalid user number overdialed or toll restriction invoked on telephone number dialed.

The Call Detail Option has the ability to store internally up to 4000 SMDR records for later download or retrieval. Once the storage capacity has been reached, additional records are no longer stored internally. To help maximize the value of data that is stored internally, the Model 48-MAX allows you to control or filter out which records are stored. All calls are always logged out the local RS-232 port in real time.

*Log errors in Call detail records* lets you turn on or off the storage of errors such as invalid user number overdialed or toll restriction invoked. All calls are always logged out the local RS-232 serial port.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "4" and press ENTER, the Accounting Menu will be displayed. Select the item number for *Log errors in Call detail records* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting is that *Log errors in Call detail records* is disabled.

See also "Call Detail Logging" earlier in this section.

## Section 5. Feature Set Reference

### **Loop Disconnect Time**

When the Model 48-MAX has seized or gone off-hook on a phone line, it has completed a series circuit with the local central office or PBX. Loop current is present and can be detected by the Model 48-MAX. *Loop disconnect time* is the amount of time that it will allow for “loss of loop current” before disconnecting the call. This can be used to support “called party disconnect” where a momentary break in loop current is provided when the distant party hangs up.

This timer can also be disabled by setting it to 255.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect menu will be displayed. Type “2” and press ENTER, the Telco System Menu will be displayed. Select the menu item for *Loop disconnect time* and press ENTER. The current *Loop disconnect time* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

Enter:           209# (beep beep)

Enter:           [10-255] # (beep beep beep beep beep)

Exit programming mode:

Enter:           99# (beep beep beep beep beep)

The default setting for *Loop disconnect time* is 255 or disabled.

### **Maximum Regenerated Digits - Minimum Regenerated Digits**

These two parameters are part of the International or “Custom” *Toll restrict plan*. They are used to set the minimum and maximum length of a valid phone number. They are only in effect when *Toll restrict plan* is set to “Custom”.

Please see “Enhanced Toll Restriction” in Section 3.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect menu will be displayed. Type “2” and press ENTER, the Telco System Menu will be displayed. Select the menu item for *Maximum regenerated digits* or *Minimum regenerated digits* and press ENTER. The current setting will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new value and press ENTER when you have finished.

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

##### *Minimum regenerated digits*

Enter: 146# (beep beep)

Enter: [2-7] # (beep beep beep beep)

##### *Maximum regenerated digits*

Enter: 147# (beep beep)

Enter: [7-30] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Maximum regenerated digits* is 15.

The default setting for *Minimum regenerated digits* is 4.

## Section 5. Feature Set Reference

### **Minimum Call Duration**

When the Call Detail Option (950-9587) has been installed, the Model 48-MAX will log and/or record SMDR (Station Message Detail Record) information on interconnect calls. This record includes time/date of call, duration, user number and ANI against whom the call is billed, telephone number dialed, and call completion status. The Model 48-MAX will also log errors such as invalid user number overdialed or toll restriction invoked on a telephone number dialed.

The Call Detail Option has the ability to internally store up to 4000 SMDR records for later download or retrieval. Once the storage capacity has been reached, additional records are no longer stored internally. To help maximize the value of the data that is stored internally, the Model 48-MAX allows you to control or filter out which records are stored. All calls are logged out the local RS-232 port in real time.

*Minimum call duration* sets the minimum duration of a call before it will be added to the internal storage. Use of this filter is selectable on a per ANI basis by setting *Call detail logging* to “Time” for any given ANI. If Minimum call duration is set to 60 seconds, all calls of 60 seconds and longer, whose ANI is configured to log calls based on “Time”, will be added to the internal SMDR storage.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “4” and press ENTER, the Accounting Menu will be displayed. Select the item number for *Minimum call duration* and press ENTER. The current setting will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter a new value and press ENTER when you have finished.

The default setting for *Minimum call duration* is 60 seconds.

### **Mobile Activity Time**

During an interconnect call (mobile-to-phone, mobile-to-mobile), the mobile side must be in control of the interconnect at all times (the mobile must be able to terminate the call). In order to insure that the mobile is in control of the interconnect, the *Mobile activity timer* guards against the mobile getting out of range or for any other reason is unable to disconnect the call. A timer is initialized every time the mobile keys up and the Model 48-MAX sees carrier plus any required subaudible decode. If this timer is allowed to time out, the call is disconnected. The *Mobile activity timer* is the time or value that initializes this timer.

Single warning beeps are sent every 3 seconds starting 12 seconds before the *Mobile activity timer* expires to warn the mobile that the call is about to be terminated. The mobile simply needs to key up to reset the timer, thus keeping the conversation alive. When the timer expires, five short beeps are sent to the telephone user and to the mobile user indicating that the call is over.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "1" and press ENTER, the Mobile System Menu will be displayed. Select the item number for *Mobile activity timer* and press ENTER. The current *Mobile activity timer* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

The default for *Mobile activity timer* is 30 seconds. Its range is from 15 seconds to 150 seconds.

The *Mobile activity timer* can also be "Enabled" or "Disabled" on a per user basis in the Interconnect User menu.

## Section 5. Feature Set Reference

### **Mobile Answer Time**

When a Mobile-to-mobile or Telephone-to-mobile call is placed, the *Mobile answer time* determines how long the called mobile has to answer the call. Regardless of what the number of *Ringouts sent to mobile* is set to, the *Mobile answer time* determines the maximum time allowed before it is terminated as “No Answer”. So, if *Ringouts sent to mobile* is set to a large value, and the *Mobile answer time* is set to a short value, not all of the rings will be sent to the mobile.

Each ring on the channel takes about 6 seconds; 2 seconds of ring, and 4 seconds of silence, so six rings takes about 36 seconds. If you look at the defaults for the ringouts and answer time, you will notice that the number of ringouts = 6 which is 36 seconds of ringing, but the mobile answer time default is set to only 30 seconds. This means that only about five rings (30 seconds) go out to the mobile before the call is terminated. In this case, by setting the number of ringouts to something greater than the mobile answer time, you are assured that ringing occurs until the mobile answers or until the timer expires. Separate control over these two functions may seem a little confusing but it provides flexibility. For example, with separate controls, you can make the Model 48-MAX ring on the channel one time and wait 60 seconds for a mobile to answer. You do this by setting *Ringouts sent to mobile* to 1, and the *Mobile answer time* to 60 seconds. Note that the transmitter will remain keyed during the answer time to keep the channel busy until the mobile answers the call. If the mobile does not answer, five short beeps will be sent to the telephone caller indicating that the call is being terminated, and the Model 48-MAX will hang up. If the mobile doesn't answer the call, the Call detail record will contain a note indicating that there was no answer.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System Menu will be displayed. Select the item number for *Mobile answer time* and press ENTER. The current *Mobile answer time* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

*Mobile answer time* defaults to 30 seconds and may be programmed anywhere from 1 second to 60 seconds.

### **Application note:**

When calling a mobile, if the channel is busy, busy tone or Voice prompt #7 will be sent to the telephone indicating to the caller that the channel is in use. If the caller stays on the line, ringing will commence as soon as the channel is free. The Model 48-MAX will allow the caller to stay on the line for the *Mobile answer time* before hanging up.

### Mobile Ringout

There are four different styles of ringing tones that may be sent to the mobile when a call is made. There are two warble type ringouts, “High warble” and “Low warble”. The “High warble” sounds like an electronic telephone ring. The “Low warble” has the same cadence, but lower in pitch or tone. It sounds more like a regular telephone ringing. The two other type of ringouts are “Ding dong” and “Singer”. The “Ding dong” is a High tone followed by a low tone similar to a door bell. The “Singer” is a two higher tones that have a lower “beat” frequency to give a warble quality to it.

The ability to send different ringing types can be useful in many applications. One possibility is the supervisor or service personnel who monitors the channel. A unique ringout style would alert him that the a call was intended for him. Another possibility is multiple users in a user group. Each could have a different ringout, but everyone on the same subaudible tone. Each user in the group would know who the call was intended for and could even answer for them if desired.

#### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Mobile ringout* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default *Mobile ringout* setting for all users is “High warble” ringout style.

*Mobile ringout* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **Mobile-to-Mobile**

*Mobile-to-mobile* is the ability to call another mobile through the interconnect using selective calling. This is one of the mobile originate privileges supported in the Model 48-MAX. When a user (radio) signs on, he will hear the *Overdial prompt* tone or Voice prompt #5 from the Model 48-MAX. At this point the call proceeds just like a *Phone-to-mobile* call, the mobile must overdial a User number or ANI indicating who the called party is.

The Model 48-MAX will selectively call and ring out on the channel. When the proper mobile answer is received, the Model 48-MAX allows repeat operation while performing any required cross encoding of subaudible. The *Call limit timer* and *Mobile activity timer* are active and can terminate the call. Either user may terminate the call with his *Disconnect ANI* code.

If the originating mobile has more than one privilege enabled, a steering digit will be required. After sending his *Access ANI* the Model 48-MAX will key up and send the *Steering digit prompt* tone. The mobile then sends a "7", the steering digit for *Mobile-to-mobile* calls.

See "Mobile-to-Mobile" in Section 3 for a detailed description of *Mobile-to-mobile* operation.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see "User Range" later in this section). Select the item number for *Mobile-to-mobile* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default for all users is "Disabled" for *Mobile-to-mobile* privileges.

*Mobile-to-mobile* is supported by block or range programming. See "User Range" later in this section for details.

### **Application note:**

If no steering digit is desired, all other privileges (*Mobile-to-phone* and *ANI mobile-repeat*) must be disabled. This makes *Mobile-to-mobile* the only calls that can be made.

### **Mobile-to-Phone**

*Mobile-to-phone* is the ability for a mobile to place an outbound telephone call. This is one of the mobile originate privileges supported in the Model 48-MAX. The mobile keys his radio and enters his *Access ANI* code followed by a steering digit if required. The phone line is taken off hook and audio is allowed to pass from the phone line to the mobile.

The mobile then dials a phone number and it is regenerated into the phone line. At the completion of dialing, *Mobile-to-phone* audio is enabled. The *Call limit timer* and *Mobile activity timer* are active and can terminate the call. The mobile may terminate the call with his *Disconnect ANI* code.

If the originating mobile has more than one privilege enabled, a steering digit will be required. After sending his *Access ANI* the Model 48-MAX will key up and send the *Steering digit prompt* tone. The mobile then sends a “\*”, “9” or “8” as the steering digit for *Mobile-to-phone* calls.

See “Mobile-to-Telephone” in Section 3 for a detailed description of *Mobile-to-phone* operation.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Mobile-to-phone* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default for all users is “Enabled” for *Mobile-to-phone* privileges.

*Mobile-to-phone* is supported by block or range programming. See “User Range” later in this section for details.

#### **Application note:**

If no steering digit is desired, and *Mobile-to-phone* is the only privilege you wish to perform, then you must also set Line select to “L1 only” or “L2 only”.

## Section 5. Feature Set Reference

### Multiple Line Menu

An option for the Model 48-MAX is the Model 51 Line Expander, (901-9170). The Model 51 expands a single End-to-End line to eight End-to-End telephone lines. A single Model 51 can be installed on each of the Model 48-MAX's two End-to-End lines. The *Multiple line menu* holds the programming associated with the Model 51 for each End-to-End line.

The Model 51 Line Expander provides an alternative to DID (Direct Inward Dial) lines. Individual users (radios) can be given their own phone line, billing can then be between the phone company and the customer for both the line and toll calls. No over dialing is required, when a line on the Model 51 rings, it forwards the line number to the Model 48-MAX, who then calls the user (radio) on the channel. When the user (radio) answers, the Model 51 answers the ringing line and the call is connected. For Mobile-to-phone calls, the user (radio) has his own line for making outbound calls on. No special codes or other knowledge is required by the user to access his line.

You can also have pooled or party lines. These lines are shared or common for all users. On Phone-to-mobile calls, over dial is still required. Mobile-to-phone calls work the same as before also. The advantage here is, you can give premium grade of service to those customers who need or want their own line and still service the others as before. In fact, adding the Model 51 to an existing system should be transparent to all mobiles. The only difference to the users with individual lines would be the new telephone number that does not require over dial. The bonus is that the old number and over dial will still work (it is now the pooled or party line).

### Line expander:

This command is what determines if a Model 51 is attached to an end-to-end line on the Model 48-MAX. The default is "Disabled" or no Model 51 attached. There is a command for each End-to-End line (Line 1 and Line 2). You need to "Enable" *Line expander* operation on the End-to-End line you have the Model 51 attached to.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "5" and press ENTER, the *Multiple line menu* will be displayed. Select the item number for *Line expander* for the End-to-End line desired and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

**Line #:**

This command, one for each of the eight lines, sets the line as either Pooled or Line per subscriber. The default is pooled or “None” for all lines. To set Line per subscriber for any line, enter the *User number* for that line.

**How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “5” and press ENTER, the *Multiple line menu* will be displayed. Select the item number for *Line number* for the End-to-End line desired and press ENTER. The current *User number* for the *Line number* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new *User number* and press ENTER when you have finished.

**Line per subscriber:**

This mode is where a specific user (radio) is assigned a line for his exclusive use. To illustrate this lets show an example. A Model 51 is connected to the Model 48-MAX's Line 1. Lines 1 - 4 on the Model 51 each have a user assigned, Lines 5 - 8 do not. Lines 1 - 4 are “Line per subscriber” and Lines 5 - 8 are “Pooled”. User 10 is assigned to Line 3 and has no line select privileges. Any time User 10 places a Mobile-to-phone call, it is placed out on Line 3. When an inbound call on Line 3 rings, the Model 51 passes this information to the Model 48-MAX which in turn rings out on the channel to User 10. When User 10 answers, Line 3 is connected to User 10.

**Pooled line:**

This mode is where no user (radio) is assigned to a given line. A *User number* of “0” accomplishes this. To follow on with our example from above, User 12 is not assigned a specific line in the Model 51 and has no line select privileges. This means he will be using a Pooled line for all his calls. In this example the first Pooled line available is Line 5. This is the first one that does not already have a *User number* associated with it. Any time User 12 places a Mobile-to-phone call, it is placed out on Line 5. When an inbound call on Line 5 rings, the Model 51 passes this information to the Model 48-MAX which in turns answers Line 5 and issues an over dial prompt to the caller. The caller can now over dial as normal if the Model 51 was not installed.

**Application note:**

When installing a Model 51 it is a good idea to have at least one pooled line. The pooled line provides the only way of accessing the Model 48-MAX for modem programming through a Model 51.

## Section 5. Feature Set Reference

### **Overdial (Line 1, Line 2, Local, Mobile-to-Mobile)**

To place a call to a user (radio) requires some way of identifying that user (radio). The process of entering the number or ID of a user (radio) is called “Overdial”.

There are two ways to tell the Model 48-MAX which user (radio) you want to call; The default is “User #”. This is the place holder or slot in the user database that a user occupies. The second method is “ANI” or *Access ANI* of a user. Use of “ANI” is not practical when using Short sign-on as the ANI is no longer assured to be unique.

The Local line, Line 1, and Line 2 and Mobile-to-mobile calls can each use a different method for calling users. The *Overdial* mode commands allow you to set it for each.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

**Line 1 and Line 2** Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “3” and press ENTER, the Telco Specific menu will be displayed. Select the item number for *Overdial* on the Line you wish to change and press ENTER.

**Local phone** Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “2” and press ENTER, the Telco System menu will be displayed. Select the item number for *Local phone overdial* press ENTER.

**Mobile to Mobile** Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *Mobile-to-mobile overdial* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for all *Overdial* modes is “User #”.

### **Overdial Prompt**

To single out a user or radio in a multi-user interconnect requires overdial of a number to select a user to call. The Model 48-MAX provides a prompt tone to the caller (phone or radio) indicating “please overdial now”. This prompt tone can be either an 800 Hz tone (default) or dialtone. To keep operation consistent, the *Overdial prompt* tone is the same for both phone originated (Phone-to-mobile) callers and mobile originated (Mobile-to-mobile) callers.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “2” and press ENTER, the Telco System menu will be displayed. Select the item number for *Overdial prompt* press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the Local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 141# (beep beep)

Enter: [0 = beep, 1 = dialtone] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Overdial prompt* is an 800 Hz “Beep tone”.

#### **Application note:**

The *Overdial prompt* is typically set to be the inverse or opposite of the *Steering digit prompt*. This is to give a distinction in the prompt tones for a Mobile-to-mobile caller.

## Section 5. Feature Set Reference

### **Page Forward User**

Each user (radio) has the ability to have his mobile calls forwarded to another user (radio) if he does not answer a call or page. If the mobile does not answer (Mobile answer time expires), the Model 48-MAX can try calling a second mobile before terminating the call. If the call to the *Page forward user* is not answered either, the Model 48-MAX will terminate the call. The Call detail record for a call that has been forwarded, will show twice. The first Call detail record would show that the original user did not answer the call but was Page forwarded. The second Call detail record would show that a call has taken place. This would give the system operator the ability to charge a premium for this type of extra service, by being able to separate out when a Page forward call has taken place.

An example of how to use this feature is the contractor who has his mobile in his truck. When not in his truck he wants to be able to answer his calls. He has a handheld radio when away from his truck. His mobile radio is page forwarded to his handheld radio. If he does not answer the call in his truck, he will be called on the handheld and be able to answer the call.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see "User Range" later in this section).

Select the item number for *Page forward user* and press ENTER. The current setting for *Page forward user* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new *Page forward user* and press ENTER when you have finished.

To disable this feature, simply enter a "0" for user number.

The default setting for all users is "0" or None.

*Page forward user* is supported by range or block programming. See "User Range" later in the section for details.

### **Pager Talk Time**

When making a call to a “Tone/Voice” pager, the Model 48-MAX will send the paging tones over the channel to unquench the pager. The Model 48-MAX will send a single beep or Voice prompt #6 to the telephone caller indicating that he may begin speaking. Telephone audio is then passed to the transmitter. The caller may talk up to the *Pager talk time*, after which the Model 48-MAX will send dual beeps to the caller and terminate the call. During the *Pager talk time* if the VOX indication drops for 3 seconds, it is assumed that the caller is finished talking and the call is terminated. This function is only applicable when calling a “Tone/Voice” pager, so it has no function when calling any other type of equipment.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System Menu will be displayed. Select the item number for *Pager talk time* and press ENTER. The current setting for *Pager talk time* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new time and press ENTER when you have finished.

The default for the *Pager talk time* is 10 seconds and may be programmed anywhere from 5 seconds to 60 seconds.

## Section 5. Feature Set Reference

### **PBX Outside Line Digit**

This command accommodates the Model 48-MAX's operation on a PBX. The Model 48-MAX monitors what is being dialed and knows when the dialing is finished based on guidelines about dialing (see "Enhanced Toll Restriction" in Section 3). A PBX requires a preceding digit (such as 8 or 9) to gain access to an outside telephone line when placing a call.

The *PBX outside line digit* allows you to tell the Model 48-MAX what digits may be used to gain access to the outside line. You are allowed to enter up to four digits, and by entering digits you also tell the Model 48-MAX that it is connected to a PBX. When a Mobile-to-telephone call is made, the Model 48-MAX waits for the first digit. Once the first digit of the telephone number comes in, the Model 48-MAX scans the digits in *PBX outside line digit* for a match. If no match is found, it drops into conversation mode where the user may continue dialing an extension on the PBX. If the first digit dialed matches a digit in the *PBX outside line digit*, then an outside call is assumed. The Model 48-MAX stays in regeneration and monitoring the dialed digits just as if the first digit (required for an outside line) had not been dialed. All programmed *Toll restrictions* are in effect.

The *Line connection* must be set to "PBX". If *Line connection* is set to "PSTN" (default), then *PBX outside line digit* has no effect.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "2" and press ENTER, the Telco System Menu will be displayed. Select the item for *PBX outside line digit* and press ENTER. The current *PBX outside line digit* will appear along with a message instructing you to enter the new digits. Enter the digit(s) that gain access to an outside line and press ENTER when you have finished.

Valid digits to enter for *PBX outside line digit* are "0" through "9".

To turn off the PBX support (clear all outside line digits) simply enter a " " (space bar) followed by ENTER. This will clear all outside line digits.

The *PBX outside line digit* is defaulted to "9".

### **Application note:**

To bypass all DTMF regeneration, set this to a digit that will never be used as the first digit dialed. When a mobile places a Mobile-to-phone call, it will then drop out of regeneration after the first digit dialed.

### **PBX Extension Length**

The Model 48-MAX has the ability to distinguish between an internal call to another PBX extension and one where an outside line has been selected. Using this knowledge the 48-MAX will only apply toll restrictions for outside calls and only regenerate the number of digits specified by *PBX extension length* for inside calls. PBX's typically have 2, 3 or 4 digit extension numbers when calling extension to extension.

When a mobile to phone call is placed to a PBX extension number, the Model 48-MAX will regenerate the number of digits specified by *PBX extension length*. The 48-MAX will then drop out of regeneration and drop into conversation mode enabling mobile to phone audio. The complete extension number dialed by the mobile is contained in the SMDR record for that call.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "2" and press ENTER, the Telco System Menu will be displayed. Select the item number for *PBX extension length* and press ENTER. The current setting will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter a new value and press ENTER when you have finished.

The default setting for *PBX extension length* is 3. The range is 1 to 4 digits.

## Section 5. Feature Set Reference

### **Phone-to-Mobile**

When the Model 48-MAX answers a phone line, the caller is prompted to over dial a number to select the mobile he wishes to call. For a mobile to receive phone originated calls, *Phone-to-mobile* must be “Enabled”.

See “Telephone-to-Mobile Calls” in Section 3 for a detailed description of *Phone-to-mobile* operation.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Phone-to-mobile* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default for all users is “Enabled” for *Phone-to-mobile* privileges.

*Phone-to-mobile* is supported by block or range programming. See “User Range” later in this section for details.

### **Priority Override**

This command allows Line 2 to be configured as a override or emergency line. When this command is enabled, an inbound call on Line 2 will override any interconnect call in progress. Once the number of *Rings before answer* on Line 2 has been received, the Model 48-MAX will issue a high/low alert, indicating that the call in progress is being terminated by the *Priority override* function. Once the call in progress has been terminated, the Model 48-MAX will take Line 2 offhook and allow the caller to over dial as normal.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "3" and press ENTER, the Telco Specific menu will be displayed. Select the item number for *Priority override* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Priority override* is "Disabled".

#### **Application note:**

The *Autocall user* on Line 2 works with the *Priority Override* function. If an *Autocall user* is programmed on Line 2 and *Priority Override* is enabled, no over dial on Line 2 is required. This differs from the *Cordless Phone user* available on Line 1 in that Line 2 is answered prior to starting the ringouts on the channel.

## Section 5. Feature Set Reference

### **Program Access Code**

To gain access to the Model 48-MAX for programming by any method (direct, modem or DTMF) requires the *Program access code*. This is to prevent unauthorized access to the operational programming and billing information. This is a unique five digit number and is checked for in the ANI conflict routines. Any of the 16 DTMF digits can be used (0 to 9, A to D, \*, #). This provides the maximum number of combinations for a fixed five digit number accessible with DTMF.

The default *Program access code* is “12048”.

When accessing the Model 48-MAX directly using the local RS-232 port, you will be presented with a prompt “ENTER PASSWORD ⇒”. Type in the *Program access code* and press ENTER. As you type, “.” will be echoed back instead of the digits.

When accessing the Model 48-MAX for modem programming, send the *Program access code* in DTMF via your modem (ATDT12048). The Model 48-MAX will send back answer tone and establish a connection with your modem. When you see “CONNECT,” press ENTER and the Main menu will be displayed.

When accessing the Model 48-MAX from the telephone for DTMF programming, over dial the *Program access code* at the *Overdial prompt* tone. You will hear modem tone (Caution! watch your ears!). Send a DTMF “#” to drop into DTMF programming.

You may also gain access to DTMF programming over the radio channel by entering *Program access code* from a DTMF equipped mobile or portable.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX’s internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “3” and press ENTER, the System Menu will be displayed. Select the item number for *Program access code* and press ENTER. The current *Program access code* will appear along with a message instructing you to enter the new digits. Enter five digits for the new *Program access code* and press ENTER when you have finished.

Default *Program access code* is “12048”. Valid digits are 0 to 9, A to D, \*, #.

### **Application note:**

The *Program access code* is checked against Access ANI's for conflicts. To the Model 48-MAX, the *Program access code* is just another unique ANI. When using “User #” for Overdial, a time out is used to distinguish between the *Program access code* and a *User number* on Phone-to-mobile calls. Example would be that either user 12 or 120 requires the DTMF interdigit time to expire before processing the call. User 12 or 120 also looks like 12048.

### **PSTN Feature Code**

The *PSTN Feature code* is a string of DTMF digits which is dialed before any other digits on all mobile to phone calls. This would typically be used to send the “disable call waiting” function code prior to the mobile actually dialing the phone number. Any valid DTMF digit plus the pause character “,” are valid in the string. The string can be up to a maximum of nine digits long.

When a mobile first accesses the phone line, the 48-MAX waits for the first digit of a phone number from the mobile. This allows the mobile to listen for dial tone prior to dialing. Once the first digit has been received from the mobile, the 48-MAX will dial the *PSTN Feature code* while buffering the digits received from the mobile. The buffered digits will be regenerated by the 48-MAX after the PSTN feature code has been dialed. The string is only dialed once at the start of the call.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “2” and press ENTER, the Telco System Menu will be displayed. Select the item number for *PSTN Feature code* and press ENTER. The current setting will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter a new value and press ENTER when you have finished.

The default setting for *PSTN Feature code* is no code has been programmed.

Valid digits are “0-9”, “A-D”, “\*”, “#” and “,”.

## Section 5. Feature Set Reference

### **Reset System Database / User Database to Factory Default**

These two commands will reset the Model 48-MAX to factory default settings. The reset function has been split into separate commands to allow maximum flexibility when it becomes necessary to execute them. It is considered good practice to execute these commands as the first step in programming a unit for a new installation. This then clears out any forgotten users or parameters that could cause undesired results later.

#### **CAUTION:**

*These commands are irreversible. Once executed they cannot be undone.*

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

#### **Reset System database:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "5" and press ENTER, the Diagnostic Menu will be displayed. Select the item number for *Reset System database to factory default* and press ENTER.

You will be prompted for conformation, type "Y" to confirm or "N" to abort.

#### **Reset User database:**

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "5" and press ENTER, the Diagnostic Menu will be displayed. Select the item number for *Reset User database to factory default* and press ENTER. You will be prompted for select either "Interconnect" or "Repeater Panel" user database. Press the space bar to change or ENTER to accept.

You will be prompted for conformation, type "Y" to confirm or "N" to abort.

### **Rings Before Answer (Line 1, Line 2)**

The Model 48-MAX knows of an incoming call by detecting the ringing voltage for each of its End-to-End lines. The on / off cadence of the ringing voltage is used to count the incoming rings. Once the number of rings has exceeded the specified *Rings before answer*, the Model 48-MAX will take action on the ringing line. This can be either to answer the ringing telephone line and allow over dial or key the transmitter and call a pre-determined user (radio).

The Model 48-MAX counts rings on the leading edge of a ringing impulse. The default number of *Rings before answer* is 2. This will cause it to answer on the leading edge of the second ringing impulse after a valid pause between ring impulses. Minimum pause between ring impulses is 1.5 seconds.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu will be displayed. Type "3" and press ENTER, the Telco Specific Menu will be displayed. Select the item number for *Rings before answer* for either Line 1 or Line 2. The current setting for *Rings before answer* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new value and press ENTER when you have finished.

The default for *Rings before answer* for both lines is 2. Either line may be programmed for two to nine rings.

## Section 5. Feature Set Reference

### **Ringouts Sent to Mobile**

When a mobile-to-mobile or telephone-to-mobile call is placed there is a specified number of *Ringouts sent to mobile*. Regardless of the number of ringouts, the mobile has the *Mobile answer time* to answer the call, before it is terminated as “No Answer”. So, if the number of *Ringouts sent to mobile* is set to a large value, and the *Mobile answer time* is set to a short value, not all of the rings will be sent to the mobile.

Each ring on the channel takes about 6 seconds; 2 seconds of ring, and 4 seconds of silence, so six rings takes about 36 seconds. If you look at the defaults for the ringouts and answer time, you will notice that the number of ringouts = 6 which is 36 seconds of ringing, but the answer time is set to only 30 seconds. This means that only about five rings (30 seconds) go out to the mobile before the call is terminated. In this case, by setting the number of *Ringouts sent to mobile* to something greater than the *Mobile answer time*, you are assured that ringing occurs until the mobile answers or until the *Mobile answer time* expires. Separate control over these two functions may seem a little confusing but it provides flexibility. For example, with separate controls, you can make the Model 48-MAX ring on the channel one time and wait 60 seconds for a mobile to answer. You do this by setting the number of *Ringouts sent to mobile* to “1”, and the *Mobile answer time* to 60 seconds. Note that the transmitter will remain keyed during the answer time to keep the channel busy until the mobile answers the call. If the mobile does not answer, five short beeps will be sent to the telephone caller indicating that the call is being terminated, and the Model 48-MAX will hang up. If the mobile doesn't answer the call, the Call detail record will contain a note indicating that there was no answer.

### **Application note:**

When calling a mobile, if the channel is busy, busy tone or Voice prompt #7 will be sent to the telephone indicating to the caller that the channel is in use. If the caller stays on the line, ringing will commence as soon as the channel is free. The Model 48-MAX will allow the caller to stay on the line for the *Mobile answer time* before hanging up.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *Ringout sent to mobile* and press ENTER. The current setting for the *Ringouts sent to mobile* will appear along with a message instructing you to enter the new value and the range of values you may enter. Enter the new number of ringouts and press ENTER when you have finished.

The default for the number of *Ringouts sent to mobile* is 6 rings and may be programmed anywhere from 1 ring to 16 rings.

### **RS-232 Port Speed**

When you want to program the Model 48-MAX using the local serial port, you will need a terminal or a computer running communication software that supports the ANSI protocol for screen control. Most commercial communications software will support ANSI terminal emulation. For the Model 48-MAX and the computer or terminal to communicate you will need to specify how to send and receive characters. Set the terminal or computer to communicate with 8 data bits, 1 stop bit and no parity (see your terminal or software manual). Once you have specified these communication parameters in the terminal or computer you must set the baud rate. The baud rate is the number of bits per second that the information is sent and received. There are 10 bits per character (a character is any number or letter that you can type on your keyboard) so 300 baud is about 30 characters per second and 4800 baud is about 480 characters per second. You can easily see the differences on your screen when you download Call Detail records or system programming. We suggest you set the speed to the maximum value for your terminal or computer.

Once the baud rate of the terminal or computer is set, the same baud rate must be specified in the Model 48-MAX using the *RS-232 port speed* command. The Model 48-MAX is capable of communicating at 300, 1200, 2400, 4800, 9600 baud on the local RS-232 port.

Note that the baud rate only affects local programming through the RS-232 port (DB-9 on the back); it DOES NOT change the operating speed of the modem.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "3" and press ENTER, the System Menu will be displayed. Select the item number for *RS-232 port speed* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The baud rate is updated each time you exit from the Main Menu (item 7).

The *RS-232 port speed* or baud rate can also be set using from DTMF programming. This is convenient during installation of the Model 48-MAX. It can also be a useful troubleshooting tool if you are having RS-232 communications problems.

## Section 5. Feature Set Reference

### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the *Program access code* (default is 12048).

*RS-232 port speed* or baud rate:

Enter:           122# (beep beep)

Enter:           [0 = 300 baud  
                  1 = 1200 baud  
                  2 = 2400 baud  
                  3 = 4800 baud  
                  4 = 9600 baud] # (beep beep beep beep beep)

Exit programming mode:

Enter:           99# (beep beep beep beep beep)

The default *RS-232 port speed* or baud rate is set at 4800 baud.

### **Scheduled Telco Access**

This feature is included in the Selcall and Roamer versions of the Model 48-MAX. It allows the system operator to restrict or limit interconnect access based on time of day and day of the week. If you limit interconnect access to only normal business hours (i.e. 8:00 AM to 5:00 PM, Monday to Friday), you can prevent access to the interconnect on a per user (radio) basis during non-business hours. This can be a useful feature for a private in-house installation where control of radio access is a concern. This feature can also be useful in a system where dispatch and interconnect are mixed. You can disable interconnect during peak dispatch traffic (giving priority to dispatch) and still be able to offer interconnect during off peak hours. This allows a premium to be charged for unrestricted interconnect access.

This command in the Interconnect User menu “Enables” or “Disables” a user to follow the interconnect restrictions for *Scheduled telco access*. When set to “Disabled”, a user is not restricted from placing or receiving interconnect calls at any time. When set to “Enabled”, a user can only place and receive calls on the allowed days between the Interconnect start and stop times.

#### **How to program it:**

Access the Model 48-MAX through your direct connect PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will be displayed. Type “4” and press ENTER, the User menu will be displayed, using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Scheduled telco access* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press the ENTER key to accept it. Note that, if you accidentally pass the mode or state you want, just keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

All users default to “Disabled” ignoring the interconnect restriction time. *Scheduled telco access* is supported by block or range programming. See “User Range” later in this section for details.

See also *Interconnect Start time - Stop time* and *Interconnect Allowed days / Restricted days* earlier in this section.

## Section 5. Feature Set Reference

### Selcall Capcode

The Model 48-MAX Selcall and Roamer versions include the ability to perform selective calling using analog tone signaling formats. The Model 48-MAX supports DTMF, DTMF-t, 2-tone and 5/6-tone selective calling formats. Each is different and each requires a different type of decoder. You may use more than one format in the system (some users could have 2-tone while others have DTMF). The *Selcall capcode* indicates to the Model 48-MAX what sequence of tones is sent to call a particular user. The type of signaling is set with the *Selcall format* command (DTMF, DTMF-t, 2-tone, 5/6-tone).

#### Application note:

*Selcall format* must be set before you can program the *Selcall capcode*.

### DTMF Signaling

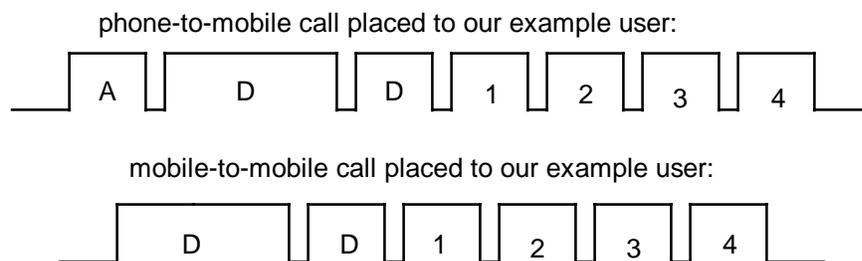
DTMF call codes are entered just the way they are to be sent. For example, to send “12345”, simply enter “12345” into the call code. The signaling speed is programmed in the Mobile System menu using *DTMF on time* and *DTMF off time*. The default is 10 digits per second.

### DTMF-t Signaling

DTMF-t is a form of DTMF signaling compatible with most older forms of scan based DTMF trunking. This type of format has Collect digit to “wake up” decoders and a Reset digit to put decoders “to sleep”. The Reset digit is set in the Mobile System menu. The signaling speed is programmed in the Mobile System menu using *DTMF on time* and *DTMF off time*. The duration of the Reset and Collect digits is also set in the Mobile System menu. The Collect digit is part of the *Selcall capcode* (the first digit of the capcode) when using this format. The default settings for this format are:

<i>DTMF-t Reset time:</i>	1000msecs
<i>DTMF-t Collect time:</i>	2500msecs
<i>DTMF-t Reset digit:</i>	A

If a mobile has an decoder address of 1234, and the system is using a Collect digit of “D”, the Selcall capcode would be “D1234”. Here is an example page using DTMF-t as the format, and D1234 as the Selcall capcode.



On disconnect, the Reset digit will be sent to “reset” all the decoders on the channel. The Reset digit will be sent also if the user receives a phone-to-mobile call, on disconnect of the call.



**Two-tone Signaling**

Two-tone call codes are a little more complicated since you must specify the timing, the code plan, the cap code, and the tones to send. The format for entering a 2-tone call code is:

TCCABCX: T = Timing (1-8 Two-Tone Timing table)  
 CC = Codeplan (1-24 Two-Tone Codeplan table - Column)  
 A = Pager Cap-Code (0-9 Two-Tone Codeplan table - Row)  
 B = Tone 1 (first tone sent)  
 C = Tone 2 (second tone sent)  
 X = 0=Group, 1=Diagonal 1, 2=Diagonal 2

The timing is determined from the Two-Tone Timing table and specifies the timing for particular type of signaling. The codeplan is from the Two-Tone Codeplans table, and determines the column in which the tone set is located. The pager capcode is the actual entry (row) in the codeplan table to determine the sets of tones to be used for Tone 1 and Tone 2. Tone 1 and Tone 2 are the actual tones in the Two-tone Tone Groups table. See “Two-Tone Signaling” in Section 8 for the two-tone tables.

Below are three examples of how to determine the *Selcall capcode* entry for the Model 48-MAX. Example 1 assumes you know the timing and two tones required to set off the pager. Example 2 assumes you know the code plan and capcode. Example 3 assumes you are translating an existing Model 45 or Model 48 database where the page code was specified as T G1 G2 T1 T2 (Timing, Group 1, Group 2, Tone 1, Tone 2).

**Example 1:**

You have a pager that is setup for standard timing (1 second “A” tone, 0 gap, 3 second “B” tone, and 8 second group calls), and has an “A” tone of 953.7 Hz followed by “B” tone of 767.4 Hz.

We look up the timing in the Timing Table (see “Two-Tone Timing” in Section 8), and see that timing 1 matches our pager. Finding the tone numbers is a little less direct. First we look up the actual tones in the Tone Group table (see “Two-Tone Tone Groups” in Section 8). We find that 953.7 Hz is tone number 5 in Tone Group 3, and 767.4 Hz is tone number 6 in Tone Group 5. Now we know that the “A” tone must come from Tone Group 3 and the “B” tone must come from Tone Group 5.

Our pager uses Tone Group 3 followed by Tone Group 5. We need to find a Code Plan that has a block in which Group 3 is followed by Group 5 (3+5). If we scan the Two-Tone Codeplan table (see “Two-Tone Codeplans” in Section 8), we see a line labeled “Groups”. This shows which tone groups are used by that codeplan in the column listed above. Any codeplan that uses group 3 followed by group 5, should work for our pager. By scanning the table we find that codeplan 5 and 11 both have 3+5 listed in the 8xx row. For our purposes either codeplan would work for our pager. The tone groups we need, under the codeplan 11, use capcode 8xx, this is the leading digit for our pager.

## Section 5. Feature Set Reference

Based on the information from the table, we can build the following capcode for it:

T =	1	(1.0,0.0,3.0,8.0)
CC =	11	(Codeplan Z11, Mot N)
A =	8	(Pager Cap-Code 8xx)
B =	5	(“A” tone, Tone Group 3, Tone Number 5)
C =	6	(“B” tone, Tone Group 5, Tone Number 6)

### Example 2:

You have a pager that is setup for Motorola Tone only timing (0.4 second “A” tone, 0 gap, 0.8 second “B” tone, and 8.0 second group call), uses Motorola C Codeplan and a capcode of 634.

We look up the timing in the Timing table (see “Two-Tone Timing” in Section 8), and see that timing 2 matches our pager. Next we look for Motorola C codeplan in the Two-Tone Codeplan table (see “Two-Tone Codeplans” in Section 8). We see that the second codeplan is labeled “Mot C groups”. Above it is **Z1**, this is the corresponding codeplan number 01. We look in the left-hand column labeled Pager Cap-Code until we see the row labeled 6xx. This matches the leading digit of our pager. Follow this row to the right over to our Mot C (**Z1**) codeplan column. You will see “2+1”, these are the Tone groups used for the “A” and “B” tones. With our capcode of 634, the “A” tone will be tone number 3 in Tone Group 2 and the “B” tone will be tone number 4 in Tone Group 1.

To see what the actual tones would be for our pager, we look at the Tone Group table (see “Two-Tone Tone Groups” in Section 8). We look for column labeled Tone Group 2, then follow that down to the row labeled Tone Number 3, we see that the “A” tone will be 669.9 Hz. Doing the same for the “B” tone, look for the column labeled Tone Group 1, then follow that down to the row labeled Tone Number 4, we can see that the “B” tone will be 418.8 Hz.

Based on the information from the table, we can build the following capcode for it:

T =	2	(0.4,0.0,0.8,8.0)
CC =	01	(Codeplan Z01, Mot C)
A =	6	(Pager Cap-Code 6xx)
B =	3	(“A” tone, Tone Group 2, Tone Number 3)
C =	4	(“B” tone, Tone Group 1, Tone Number 4)

As you can see with Example 2, if you know the codeplan and capcode, it is really quite simple to enter in a specific pager. If you only know the Tones, it is just a matter of doing the process in reverse.

### Group call and Diagonal tones:

The “X” in the call code is used when the two tones are the same. You can see that if you were to use a cap code of 106333 the codeplan is 3+3 (column 06, row 3 of the Two-tone Codeplans table) and that both tone 1 and tone 2 use row 3 in the Two-tone Tone Groups table which is 304.7 Hz. This creates a problem because the Model 48-MAX would send out two of the same tones without a gap and would appear to be a single long tone. There are

three ways to remedy this situation; make it a group call, replace tone 1 with the diagonal tone, or replace tone 2 with the diagonal tone. By entering 0 for “X”, the call will be made a group call and will use the “Group Call” timing from the Two-Tone Timing table (in this case 8 seconds). If you don't want a group call, you can select the diagonal tone (which is found at the bottom of the table in “Two Tone Groups” in Section 8) to replace tone 1 or tone 2.

For example, a cap code of 106333 presents such a problem. We can make it a group call by adding a “0” to the end of it (1063330). But if we want to call a pager, we must check to see in which place the pager expects to find the diagonal tone (either tone 1 or tone 2). If it requires it to be in tone 1 position, then we would add a “1” to our call code (1063331) and the tones going out would be 569.1 Hz (diagonal from column 3) and 304.7 Hz. By putting a “2” after the call code, we can elect to have the diagonal go in the tone 2 position. Then 304.7 Hz would go out followed by the diagonal 569.1 Hz. The “X” digit is only required when the codeplan numbers “x+x” are the same, and the tone 1 and tone 2 digits are the same.

### Example 3:

We are converting an existing Model 45 or Model 48 database over to the Model 48-MAX. Our first two-tone pager code is “11132” (T G1 G2 T1 T2) where:

T = timing 1 (1.0 0 3.0 8.0)  
 G1 = Group 1 (source for tone 1)  
 G2 = Group 1 (source for tone 2)  
 T1 = Tone 3 (from group 1 = 389.0 Hz)  
 T2 = Tone 2 (from group 1 = 368.5 Hz)

First we verify that the timing matches between the old and new. No changes required here. Next we need to pick a Cap code from the codeplan table (see “Two-Tone Codeplans” in Section 8) based on our existing G1 and G2. We see that G1 and G2 = 1+1. We now need to find a Cap code in the Codeplan table (see “Two Tone Codeplans” in Section 8) that has 1+1. Looking at the table we see that Codeplans **Z0** through **Z9** all have 1+1 listed as the tone groups for a Cap code of 1xx. For this example we will choose Code plan **Z1**. We now have all the information to do the conversion.

T = Timing 1 (1.0 0 3.0 8.0)  
 CC = Code Plan 01 (Z1)  
 A = Cap code 1xx  
 B = Tone 3 (from group 1 = 389.0 Hz)  
 C = Tone 2 (from group 1 = 368.5 Hz)

So “11132” in the Model 45 and Model 48 becomes “101132” in the Model 48-MAX.

## Section 5. Feature Set Reference

### Five-Tone Signaling

The Five-tone formats are easier to use than the Two-tone format. The format for a Five-tone call code is:

P12345X:    P        = Preamble (optional)  
              1-5      = Capcode (digits 0-9, G, B, C, D, R, F)  
              X        = Second address (1=No address, 2=2nd address)

The Model 48-MAX supports 4 five-tone formats, EIA, CCIR, PZVEI and EEA. The tones and timing are different for each; refer to “Five-Tone Group/Timing” in Section 8 for a list of the individual tones and timings. Programming is the same for all capcodes regardless of format used. The Five-Tone table can be found in Section 8.

Some pagers have battery-saving modes from which they need to be “awakened”. The pagers “sleep” for some period of time and then wake up and look for a tone. If the tone is not present, the pager goes to sleep again. If the tone is there, the pager stays alert and listens for signaling tones to appear. The preamble is the “wake-up” tone and is always 690 milliseconds long followed by a 65 millisecond gap before the signaling tones. Once the preamble has been transmitted, all pagers will be listening. The preamble is optional because not all systems require it, including mobiles equipped with decoders.

The actual cap code is programmed using five digits, each representing one tone (in the Five-tone format). Simply enter the call code or address of the mobile or pager. Normally with Five-tone, there is a repeat tone that is used when the call code requires two or more digits in a row that are the same. For example, the call code 13356 would send what appears to be four tones because the second and third tones (33) are the same. To compensate for this, the repeat tone is used in place of the duplicated digit. So, with a call code of 13356, and the EIA format, the following tones will be sent: 741 Hz, 1023 Hz, 459 Hz, 1305 Hz, 1446 Hz. If you are looking at the Five-tone Groups/Timing table (see Section 8), you will notice that there is no way of entering the repeat tone. This is because the Model 48-MAX knows that the call code has repeating numbers in it and will substitute the repeat tone automatically. For example, on a call code of 33333, the following tones will be sent by the Model 48-MAX: 1023 Hz, 459 Hz, 1023 Hz, 459 Hz, 1023 Hz, but you only enter 33333 and the Model 48-MAX will substitute the repeat tone.

You must however, notify the Model 48-MAX of the “X” tone. You instruct it either not to call the second address (1) or to call the second address (2). This is used for two address pagers, and when the second address is specified, the “X” tone will be sent as a sixth tone. The Model 48-MAX uses the number of digits in the call code to determine whether or not a preamble is sent. If there are six digits in the call code, it knows there is no preamble. Seven digits indicate that there is a preamble. This is why you must always enter the last digit.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

## Section 5. Feature Set Reference

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Selcall capcode* and press ENTER. The current *Selcall capcode* will appear along with a message instructing you to enter the new value. Enter the *Selcall capcode* and press ENTER when you have finished.

Valid digits for DTMF formats are any of the 16 DTMF tone pairs (0 to 9, A to D, \*, #).

Valid digits for Two-tone are numeric digits only (“0” to “9”).

Valid digits for Five/Six tone are 0 to 9, G, B, C, D, R, F.

No *Selcall capcode* are programmed for factory default.

To clear or default a *Selcall capcode*, press the space bar “ ” as the first character and press ENTER.

**Application note:**

*Selcall format* must be set before you can program the *Selcall capcode*.

## Section 5. Feature Set Reference

### **Selcall Format**

The Model 48-MAX Selcall and Roamer versions supports DTMF, DTMF-t, Two-tone and Five/Six-tone (EIA, CCIR, PZVEI, EEA) analog tone signaling. The *Selcall format* is used to specify the format or type of selective calling to be used when calling a particular user.

When selecting a Five/Six-tone tone set, the timing is also specified as part of the tone set.

When selecting Two-tone as the format, the *Selcall capcode* sets the timing and tones used.

When selecting DTMF or DTMF-t formats, timing and format specific parameters can be found in the Mobile System menu. These include *DTMF on time*, *DTMF off time*, *DTMF-t Reset digit*, *DTMF-t Reset time* and *DTMF-t Collect time*.

### **Application note:**

*Selcall format* must be set before you can program the *Selcall capcode*.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the *User number* you wish to program (see “User Range” later in this section). Select the item number for *Selcall format* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Selcall format* is “None”.

*Selcall format* is supported by block or range programming. See “User Range” later in this section for details.

### **Set Date - Set Time**

The Model 48-MAX Selcall and Roamer versions come with an internal clock/calendar. This is used by the *Scheduled telco access* feature. Internal diagnostics (reset counts, power failures, etc.) also make use of it. When the Call Detail option is installed, an internal clock/calendar is also included to provide a time/date stamp on call records.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "3" and press ENTER, the System Menu will be displayed. Select the item number for *Set date* or *Set time* and press ENTER. The current setting for time or date will appear along with a message instructing you to enter the current time or date. Press ENTER when finished.

Valid delimiters for setting date and time are any non numeric character including "/", "-", ":", " ".

Time is entered in the 24-hour format.

Days of the week are entered as numbers, as follows:

Sunday = 1  
Monday = 2  
...  
Saturday = 7

## Section 5. Feature Set Reference

### **Site Name**

To help identify billing files and sites, the ability to name a site has been included. The *Site name* is a 36 character string that can be used to describe the site where the Model 48-MAX is installed. It will always appear under the Main Menu header as a reminder which Model 48-MAX you are programming. The *Site name* will also appear as part of an ASCII header in the billing records downloaded from the Model 48-MAX. This lets you know which Model 48-MAX the billing information originated from.

Some operators find putting the site location and receive frequency in for *Site name* helpful. You can put any thing you want, or nothing. This is meant more as a convenience than anything else. It has no affect on operation of the Model 48-MAX in any way.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "4" and press ENTER, the Accounting Menu will be displayed. Select the item number for *Site name* and press ENTER. The current *Site name* will be displayed. You can enter in up to 36 characters. Type in the new *Site name*, when you are done press ENTER.

To clear the current *Site name*, press the space bar " " and press ENTER.

The default setting for *Site name* is no string.

### **Steering Digit Prompt**

When a mobile signs on to the system and has multiple privileges enabled, he must indicate which privilege he is requesting access to. The Model 48-MAX supports the RCC convention of trailing steering digits. To help prompt the mobile that one more digit is required of him, the *Steering digit prompt* is transmitted back to the mobile. The idea is similar to how a PBX works. Think of the Access ANI as lifting the receiver and *Steering digit prompt* as dialtone from the PBX.

The *Steering digit prompt* is typically set to the inverse or opposite of the *Overdial prompt*. This is so there will be a distinction in the prompts for a mobile-to-mobile caller. The *Steering digit prompt* has the same choices as the *Overdial prompt*, an 800 Hz “Beep tone” or a 350 Hz + 440 Hz “Dialtone” which is the default.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *Steering digit prompt* press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the Local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 142# (beep beep)

Enter: [0 = beep, 1 = dialtone] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Steering digit prompt* is “Dialtone”.

## Section 5. Feature Set Reference

### **Supervisor User**

The *Supervisor user* is a very powerful feature, and some understanding of its operation is required prior to implementation.

When a user is programmed as the *Supervisor user*, that user (radio) has some advantages over the other users. He can answer any call and disconnect any call. This gives the *Supervisor user* the ability to control the conversation of any call on the system. The main purpose for this is to prevent or stop abuse on the system. The *Supervisor user* can also jump into any conversation in process. If the supervisor's subaudible tone/code is decoded, the audio path will be opened. If it is a mobile to mobile call, the originating mobile's tone/code will be encoded while the supervisor's tone/code is being decoded.

Another aspect of the conversation that the *Supervisor user* can defeat is privacy tone. If a call in process has privacy tone enabled, all the supervisor has to do is key up on his subaudible tone/code. The Model 48-MAX will turn off the privacy tone and force the call to full-duplex. This allows the supervisor to monitor both sides of the conversation. This is only in effect for the duration of the call in process.

As you can see the *Supervisor user* can gain control of a conversation at any time. It also requires some thought in how to program up the interconnect user designated as the supervisor. There are some general rules that need to be followed to avoid undesired operation.

1. *Supervisor user* must have a multi-digit Access ANI
2. *Supervisor user* must use "ANI" to answer
3. *Supervisor user* must have a subaudible tone/code unique to him

The *Supervisor user* must be a unique radio ID (for answer and subaudible) to the Model 48-MAX to prevent other radios on the system to be mistaken for the supervisor.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, the Interconnect Menu is displayed. Type "1" and press ENTER, the Mobile System Menu will be displayed. Select the item for *Supervisor user* and press ENTER. The current setting for the *Supervisor user* will appear along with a message to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *Supervisor user* is "None" or "0".

### **System Memory Test**

This command will execute a non-destructive memory test on all RAM (random access memory) installed in the Model 48-MAX. The Model 48-MAX is capable of holding up to 128k bytes (16 banks) of non volatile memory with the Call Detail option installed. Standard memory size is 32k bytes (4 banks) of non volatile memory. All volatile (not battery backed) memory is also tested.

This command will only test if the RAM is working, it will not test to see if the programming is scrambled. When power is first applied to the Model 48-MAX, it will perform an integrity test of the System and User databases. If the System database fails, it will reset the System database. When the Model 48-MAX checks the User database however, it checks the integrity of each user individually. If a user's data failed, that user will be marked as bad in the statistics. If more than 20 users turn up bad, the Model 48-MAX will reset the User database.

#### **How to execute it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "5" and press ENTER, the Diagnostic Menu will be displayed. Select the item number for *System memory test* and press ENTER. A message will be displayed indicating that a memory test is in progress and which bank is currently being tested. If everything is correct, a message will appear indicating that the memory test passed. If the memory test finds a problem, the failed address will be displayed.

#### **Application note:**

When this command is executed, it does shut down all other operation. If executing this via modem, be aware that dispatch activity will be interrupted for the duration of this command. Upon completion, the Model 48-MAX returns to normal operation.

## Section 5. Feature Set Reference

### **Toll Restrict Menu**

This command actually selects a context sensitive menu, based on the setting of *Toll restrict plan*. When set for one of the North American plans, it holds programming items specific to those plans. When set to “Universal” plan, it holds the two prefix tables.

### **Toll Restrict Plan**

This command sets the system level mode or set of rules by which the dialed digits are monitored. The Model 48-MAX supports both North American and International dialing plans. There are two for North America (“NA Original” and “NA Standard”) and one “Universal” plan. Please see “Enhanced Toll Restriction” in Section 3 for an overall description of this topic.

For most installations in North America, set *Toll restrict plan* to “NA Standard” to support “Interchangeable Central Office codes”. If all 1+ or 0+ calls are 1+10 digits, use “NA Standard”. If it is an older exchange where a 1+ toll call can be 1+7 or 1+10 digits, use “NA Original” to support the older “Non-interchangeable Central Office codes”. The advantage of the North American plans is that the Model 48-MAX knows how many digits are required to complete a phone number based on the digits dialed. No dial in termination digits or time-out timers required. This means that mobile-to-phone audio is cut through as soon as the last digit is dialed.

For International installation or areas where the North American plans will not work, set *Toll restrict plan* to “Universal”. This plan provides two tables of up to 10 prefixes each. One table is of “Allowed” prefixes. The second table is of “Restricted” prefixes. Each prefix can be 2 - 4 digits in length and include wildcards (\*). Using this mode still requires either a termination digit or allow the time-out timer to expire to enable mobile-to-phone audio.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “2” and press ENTER, the Telco System menu will be displayed. Select the item number for *Toll restrict plan* and press ENTER. The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Toll restrict plan* is “NA Standard”.

## Toll Restrictions

This command sets the level of *Toll restrictions* at the user (radio) level. There are five basic levels or degrees of *Toll restrictions* (see Table 5-2). These are also context sensitive based on the setting of *Toll restrict plan*. For either of the North American plans, they are “None”, “0+”, “Local”, “AutoDial” and “PBX inside”. For the “Universal” plan, they are “None”, “TbIA”, “TbIB”, “AutoDial” and PBX inside. Three of the five types have a qualifier of “Blap” or “Thru” indicating whether or not DTMF is allowed to pass “through” from the mobile after a phone number has been dialed (see Table 5-3). Please see “Enhanced Toll Restriction” in Section 3 for an overall description of this topic.

Table 5-2. Toll Restrict Levels

Toll Level	Description
None	“None” is no toll restrictions in effect at any time. This can be configured as “None thru” or “None blap”.
0+	“0+” allows credit card calls to be placed by the mobile. Any toll calls (as defined by the plan in effect) that are not 0+, are toll restricted. This is only valid for the two North American plans. This can be configured as “0+ thru” or “0+ blap”
Local	“Local” allows only non toll calls to be placed. Any toll calls (including 0+) are toll restricted. This is valid for the two North American plans. This can be configured as “Local thru” or “Local blap”.
AutoDial	“AutoDial” disables all manual dialing of telephone numbers by the mobile. The mobile only has access to the autodials defined by <i>Autodial mode</i> . This can be 99, 10 or a forced autodial.
PBX inside	“PBX inside” allows only internal calls to be placed when configured as a PBX connection. When configured as a PSTN line, this is the same as “Local thru”.
TbIA	“TbIA” uses the “Allowed” prefix table to qualify the dialed number. If the dialed digits do not match an “Allowed” prefix, the call is toll restricted. This is valid for the “Universal” plan only. This can be configured as “TbIA thru” or “TbIA blap”.
TbIB	“TbIB” uses the “Restrict” prefix table to qualify the dialed number. If the dialed digits match a “Restrict” prefix, the call is toll restricted. This is valid for the “Universal” plan only. This can be configured as “TbIB thru” or TbIB blap”.

Table 5-3. Toll Restrict Qualifiers

Qualifier	Description
Thru	DTMF from the mobile is allowed to pass “through” untouched once into the conversation mode.
Blap	DTMF from the mobile is not allowed to pass “through” once into the conversation mode. An extra “blap” digit is inserted to sabotage any meaningful dialing.

## Section 5. Feature Set Reference

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "1" and press ENTER, and the Interconnect Menu will appear. Type "4" and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Toll restrictions* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Toll restrictions* is "None blap".

*Toll restrictions* is supported by block or range programming. See "User Range" later in this section for details.

### **Unerase Call Detail Records (SMDR)**

The storage capacity of Call detail records will only hold 4000 records and must be downloaded before it reaches capacity. If the Call detail records are not downloaded, additional calls after record the maximum records will be lost. Once you have downloaded the Call detail records, you need to clear the number of Call detail records in storage. If by chance you do clear the Call detail records, you can use the *Unerase Call detail records* command to undo the erasure. The Unerase command will only work if there haven't been any new entries into the "call detail storage" between the time you cleared it and the time you are attempting to restore it. This command simply restores the number of records. This allows you to download or otherwise extract the billing information from the Model 48-MAX.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "4" and press ENTER, the Accounting Menu will be displayed. Select the item number for *Unerase Call detail records* and press ENTER. The Model 48-MAX will prompt you to confirm that you want to restore the Call detail records. Press "Y" to confirm or "N" to abort and press ENTER.

## Section 5. Feature Set Reference

### **User Range**

*User range* sets the user number whose data is currently displayed in the Interconnect User Menu. This command selects the particular user whose data you wish to view or program. This can be a single user or a block or range of users.

Once a *User range* has been selected, it remains unchanged until you exit or terminate the programming session. This means you can set *User range* to the desired user, and go back to another menu to verify or change a setting. When you return to the User Menu, it will display the same user.

The *User range* may be set to anything, as long as the starting and ending users are within the specified range (1-99 or 750) and the starting user number is lower than the ending user number.

To select a single user, enter the user number at the prompt for “Starting user” and press ENTER. At the second prompt “Ending user” just press ENTER. The Interconnect User Menu will be re-printed with the selected user's data.

To select a range or block of users, enter the lower user number at the prompt for “Starting user” and press ENTER. At the second prompt “Ending user”, enter the higher user number and press ENTER. The Interconnect User Menu will be re-printed using the “Starting user” data.

### **Block or Range programming:**

The Model 48-MAX supports block or range programming of most items in the User menu. You can set them one at a time or set the whole block or range with the same setting.

When you have a range of users specified and select a command that supports block programming, the Model 48-MAX will prompt you as to whether you want to program all of them (in the user range) in one keystroke, or if you would like to review and alter each of them individually. If you elect to let the Model 48-MAX program them all without reviewing them, it will change all of the users in the user range and give you a prompt when it is finished. If you would like to program a certain parameter for a range of users, but you want them to be different, the Model 48-MAX will show you each user one-at-a-time and allow you to change each independently from the other users. If you decide you don't want to continue, press CTRL-C to abort.

The user number that is displayed is the first user in the range. This user is called the “current user”. If you execute a command that can only be programmed one user at a time, only the current user will be changed. The “program all parameters” command will also only change the current user.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, and the Interconnect Menu will appear. Type “4” and press ENTER, the User menu will be displayed using the currently selected user's data. Select the item number for *User range* and press ENTER. The current starting user number will be displayed, along with a prompt instructing you to enter a starting user number. Type the first user number you wish to program and press ENTER. The ending user number will then be displayed, along with a prompt instructing you to enter an ending user number. Type the last user number you wish to program for a block or range OR just press ENTER for a single user (starting user).

The default *User range* is for a single user, user number 1.

**Application note:**

A helpful tool when examining or programming a user can be to step through users one at a time. At the “Select command: “ prompt:

type “N” followed by ENTER to increment the user number by 1  
type “P” followed by ENTER to decrement the user number by 1

If a range had be previously set, it is reset to a single user (current user +/- 1 user) with this command.

A search function by ANI has also been provided. If you know (or think you know) the ANI of a user, but not the user number, you can execute a search. To do this, you just press ENTER for a starting user number (no user number). You will be presented with a prompt to enter an ANI to search for. If it is found, that user's data will be displayed. This also works for *Wild ANI*.

## Section 5. Feature Set Reference

### **Video Mode**

The Model 48-MAX uses ANSI control codes for screen control and cursor positioning during serial programming. The ability to include color information in these codes is possible. This command turns on or off the inclusion of color information in the ANSI control codes. If you have a color monitor on your computer, and the communications software you are using runs in color, set the *Video mode* to “Color”. If you are using a terminal or monochrome monitor on your computer, set the *Video mode* to “Mono” (default).

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “3” and press ENTER, the System Menu will be displayed. Select the item for *Video mode* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Video mode* is “Mono” (monochrome).

The settings for color is White text on a Blue background.

### **Voice Prompts**

The *Voice prompts* option (950-9588) adds the ability to replace several prompt beeps or tones with owner recordable *Voice prompts*. These are used to give instructions or prompts to callers on how to use the interconnect. There are nine slots for recording prompts. Each one has a different maximum time allowed for the message. Experienced users can bypass the messages by entering DTMF at anytime.

Not all of the prompts must be used. Only the prompts that contain messages will be used. For example, if you have programmed a Morse ID and a voice ID, the voice ID will be sent in place of the Morse ID. If there isn't a voice ID recorded, then the Morse ID (tones) will be sent instead.

*Voice prompts* can only be programmed (recorded, erased or played back for verification) by DTMF programming. This can be over the air, over the dial up phone line or over the Local phone.

### **Record Voice Prompt**

Enter the program mode by entering the program mode access code (default is 12048). Enter "130#". You will hear two beeps, enter the message number you want to record followed by "#". At the beep, the Model 48-MAX is recording the message. You can terminate the message (and should) when you are finished by pressing a DTMF "\*". Two beeps mean the Model 48-MAX is no longer recording and the message is over. Use the Play voice prompt command to verify your message.

### **Play Voice Prompt**

This command simply allows the user to listen to one of the recorded messages. This is useful to verify the prompt. You will find that it takes a few tries to get the prompt "just right". This command helps do that.

*To play back a message:* Enter the program mode by entering the program mode access code (default is 12048). Enter "131#". You will hear two beeps, enter the message number you want to listen to followed by "#".

### **Erase Voice Prompt**

Once voice prompts have been entered, the Model 48-MAX will play them instead of issuing beeps to the users. To disable one of the messages and return to beeps, use the "erase voice prompt" command to erase one of the messages.

*To erase a message:* Enter the program mode by entering the program mode access code (default is 12048). Enter "132#". You will hear two beeps, enter the message number you want to erase followed by "#".

## Section 5. Feature Set Reference

Table 5. **FEATURE SET REFERENCE-4** contains a description for each of the voice prompts and when they are played. It is not required to use all of the voice prompts. Only the slots that contain messages will be used. Messages 4, 5, 7 and 9 will be preceded by special information tones (3 tones) when the message is played to the phone line.

*Table 5. FEATURE SET REFERENCE-4 Voice Prompt Messages*

<b>SLOT #</b>	<b>MESSAGE NAME</b>	<b>MAX. LENGTH</b>	<b>MESSAGE DESCRIPTION</b>
1	TELCO WELCOME	7.5 SECONDS	This message is played to the calling telephone party when the Model 48-MAX first answers the telephone. This voice prompt precedes the overdial prompt tone.
2	MOBILE WELCOME	5.0 SECONDS	This message is played to the mobile user who is calling another mobile. This voice prompt precedes the overdial prompt tone sent to the mobile.
3	THANK YOU	5.0 SECONDS	This message is played to the caller when he has made a correct entry (either user number or mobile ANI). There is no tone substitute for this voice prompt.
4	UNABLE TO COMPLETE CALL	3.5 SECONDS	This message is played to the caller when an unsuccessful attempt has been made to call a mobile. This is when the mobile does not answer or the channel remained busy and the Model 48-MAX could not try calling the mobile. There is no tone substitute for this voice prompt.
5	INVALID USER	3.5 SECONDS	This message is played to the caller (phone or mobile) when an incorrect or disabled user number or ANI has been overdialed. This voice prompt replaces normal error tones.
6	AT PROMPT TALK	5.0 SECONDS	This message is played when the destination or called party is has an equipment type of Talkback or Tone and Voice. It precedes the go ahead prompt tone.
7	CHANNEL BUSY	2.5 SECONDS	This message is repeated (with 5 cycles of busy tone in between) to the caller while the channel is busy. This replaces the normal channel busy tone (busy tone or broken ringing).
8	VOICE STATION ID	2.5 SECONDS	This message will be played in place of the station ID.
9	INTERCONNECT NOT AVAILABLE AT THIS TIME	3.7 SECONDS	This message is played to the caller who is attempting to place an interconnect call during the restricted time. There is no tone substitute for this message.

### **Wild ANI**

The Roamer version of the Model 48-MAX supports *Wild ANI*. This feature allows users (radios) from different areas to move or roam around between compatible systems and still have access to mobile originated interconnect privileges.

This command enables or disables *Wild ANI* in the Model 48-MAX. When enabled, the “A” character in an ANI becomes a wild card marker. Any digit will match the wild character when *Wild ANI* is “Enabled”.

See “How to Program ANI's in the Model 48-MAX” and “System Examples” in Section 4 for a discussion and examples of *Wild ANI* systems.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “1” and press ENTER, the Interconnect Menu will be displayed. Type “1” and press ENTER, the Mobile System menu will be displayed. Select the item number for *Wild ANI* press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

#### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 126# (beep beep)

Enter: [0 = disable, 1 = enable] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Wild ANI* is “Disabled”.

## REPEATER PANEL FUNCTIONS

### **Airtime**

The Model 48-MAX keeps an *Airtime* record for each user. *Airtime* is counted in 1-second increments. Each user can be setup as either “Accumulate” (count up) or “Pre-pay” (count down). If you bill for airtime used, then Accumulate mode will work well. If your customers purchase blocks of airtime, Pre-pay mode will accommodate that.

When Pre-pay mode is active for a user, the Model 48-MAX will first check to see if how much airtime is available before allowing the call to proceed. If the *Airtime* count is greater than 2 hours, the call will be proceed as normal. If the *Airtime* count falls below 2 hours but has not reached zero, a warning prompt will alert the mobile that it is time to purchase another block of airtime. The warning prompt will be sent to the mobile each time it unkeys during the transmit hold time. If the *Airtime* count is allowed to go to zero, the user is put into reserved mode. Each time he unkeys he will still get the warning prompt. This lets the mobile know why access has been denied.

Maximum count in an *Airtime* record is 99:59:59 in an “Hours:Minutes:Seconds” format.

At the end of each billing cycle, the *Airtime* records can be downloaded for processing. See “Device Configuration and Billing Data” in Section 4 for information on downloading billing records.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Airtime* followed by ENTER. The current *Airtime* record will appear. Type in the new value for the *Airtime* record and press ENTER when you have finished.

To set a user for Pre-pay, set *Airtime* to a non-zero value.

To set a user for Accumulate, set *Airtime* to zero. This can be done by just pressing the space bar and press ENTER, like any other string variable.

The Default setting for *Airtime* is accumulate.

### **Carrier Squelch Repeat**

When *Carrier squelch repeat* is “Enabled”, the Model 48-MAX will act as a carrier squelch repeater panel. Upon seeing carrier, the Model 48-MAX will key the transmitter and allow repeat audio. If a subaudible tone/code is detected, it will revert to the programming for the detected subaudible tone/code. This allows the Model 48-MAX to be installed where there is a need to support dispatch for both carrier and tone squelch radios. The transmit hold time for *Carrier squelch repeat* is the programmed *Initial Tx hold time*.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, the Repeater Panel Menu will be displayed. Type “1” and press ENTER, the Repeater Panel System Menu will be displayed. Select the item number for *Carrier squelch repeat* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Carrier squelch repeat* is “Disabled”.

## Section 5. Feature Set Reference

### **Courtesy Bip - Tail Bips**

A *Courtesy bip* is a short tone or bip that is transmitted when the mobile unkeys during the transmit hold time. A bip is a 1200 Hz tone with a duration of 50 milliseconds. This is enabled or disabled on a per (user) tone/code basis.

*Courtesy bip* works together with *Tail bips* in the Repeater Panel System menu. When *Tail bips* is “Enabled”, a *Courtesy bip* is sent once every second of the transmit hold time. When “Disabled”, *Courtesy bip* becomes a single “Over” prompt when the mobile unkeys.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

*Courtesy bip* Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select item number for *Courtesy bip* and press ENTER.

*Tail bips* Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “1” and press ENTER, the Repeater Panel System Menu will be displayed. Select item number for *Tail bips* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default for *Courtesy bip* is “Disabled” for all users.

*Courtesy bip* is supported by block or range programming. See “User Range” later in this section for details.

The default for setting for *Tail bips* is “Disabled”.

### **DTMF Repeat**

When the repeater panel is active in a Model 48-MAX, it passes all audio through its repeat path while it is decoding an enabled tone/code. It is also monitoring DTMF as it receives it, looking for a valid Access ANI or program access code. Once the first digit of an ANI is received, the audio is normally muted to prevent an ANI from being repeated on the channel. The *DTMF repeat* command controls this operation on a per tone/code basis. When “Disabled”, it operates as described above, muting the repeat audio while a possible ANI is being received. When “Enabled” it allows all DTMF to be repeated while the repeater panel has control. Once a valid ANI has been received the interconnect takes control and the repeat audio is muted.

#### **How to program it:**

Access the Model 48-MAX through your direct connect PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem. Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will be displayed. Type “2” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *DTMF repeat* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

All users default to “Disabled” for *DTMF repeat*, muting the audio while an ANI is being received.

*DTMF repeat* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **Decode**

The Model 48-MAX has the ability to decode CTCSS and DCS. The first 50 users are CTCSS (67.0 Hz - 254.3 Hz). Users 51 - 154 are DCS codes. All 154 tones and codes are always in the “Decode table” and do not require programming. Airtime records are based on the *Decode* tone or code.

To find the user number for a specific CTCSS tone or DCS code, see “CTCSS Tones” or “Digital Squelch Codes” in Section 8.

### **Encode**

The Model 48-MAX has the ability to encode CTCSS or DCS when it decodes a valid CTCSS tone or DCS code. The most common use is to encode the same tone or code that is being decoded. The Model 48-MAX can do cross-tone or cross-code encoding using this command. When the Model 48-MAX decodes a CTCSS tone or DCS code, it takes the user number (corresponding to the decoded tone or code) and looks up the encode tone or code programmed and then starts encoding that tone or code.

To program the encode for CTCSS, it is not necessary to enter the decimal point (i.e. enter 67 for 67.0 Hz, or 118 for 118.8 Hz), though you may if you wish. When programming the encode for DCS, start the code with a D and then enter the actual DCS code (i.e. D023 for 023). To clear a tone or code, simply type “0” and press ENTER.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User Menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Encode* and press ENTER.

The current setting for *Encode* will appear along with a message instructing you to enter the new encode tone or code. Enter the new encode tone or code and press ENTER when you have finished.

By default, all users 1 to 154 have matching encode tones or codes to the fixed decode tone or code.

*Encode* is supported by block or range programming. See “User Range” later in this section for details.

## **Enabled**

The *Enabled* command is used to turn Repeater panel users on and off. Before a CTCSS tone or DCS code can use the repeater, it must be enabled.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "2" and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item number for *Enabled* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

*Enabled* is supported by block or range programming. See "User Range" later in this section for details.

### **How to program it using DTMF:**

Using DTMF either over the air, on the telephone line, or through the Local telephone port, enter the program mode using the program access code (default is 12048).

Enter: 102# (beep beep)

Enter: [uuu = user number] # (beep beep)

Enter: [0 = disable, 1 = enable] # (beep beep beep beep)

Exit programming mode:

Enter: 99# (beep beep beep beep)

The default setting for *Enabled* is "No" or off for all tones and codes.

### **Application note:**

Customers that have delinquent accounts can be disabled using this command and enabled later. By doing this, you don't have to reprogram the user's parameters, you simply re-enable the user when the account is settled.

## Section 5. Feature Set Reference

### **Encode During TX Hold**

When a user has this function enabled, the encode tone or code will continue for the duration of the transmit hold time. This is sometimes known as Tone-in-tail. A typical use for this feature is in systems that use “channel busy lockout” in the mobiles. When enabled, the mobiles radio will remain unsquelched while the transmitter is keyed. This allows the mobiles involved in the conversation to continue keying and unkeying. It also prevents other mobiles from barging in on the channel.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item number for *Encode during TX hold* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Encode during TX hold* is “Disabled” for all users.

*Encode during TX hold* is supported by block or range programming. See “User Range” later in this section for details.

## Hog Mode

The *Hog mode* works at limiting the maximum continuous time a user can monopolize the channel. This is set with *Hog limit*. A user can reset this timer by allowing the repeater to drop and remain idle for the *Hog idle* time. If a user allows the *Hog limit* timer to expire, he then is penalized and “turned off” for the duration of the *Hog penalty* time. Warning beeps will be sent every 3 seconds, starting 12 seconds before a user is penalized.

*Hog mode* is “Enabled” or “Disabled” on a per (user) tone/code basis.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item for *Hog mode* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Hog mode* is “Disabled” for all users.

*Hog mode* is supported by block or range programming. See “User Range” later in this section for details.

## Hog Idle

This command sets the amount of time that a user must remain off the channel to reset the *Hog limit* timer. The idea is to allow another mobile or user, on a different tone or code, a chance to use the repeater. This timer starts running when the Model 48-MAX drops the transmitter.

### How to program it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “1” and press ENTER, the Repeater Panel System menu will be displayed. Select the item for *Hog idle* and press ENTER. The current setting for *Hog idle* will appear along with a message to enter the new

## Section 5. Feature Set Reference

value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *Hog idle* is 5 seconds.

### **Hog Limit**

This command sets the amount of time that a user can remain on the channel uninterrupted before being penalized. This timer can be reset by allowing the transmitter to drop for the duration of the *Hog idle* time, or another tone or code is decoded.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "1" and press ENTER, the Repeater Panel System menu will be displayed. Select the item for *Hog limit* and press ENTER. The current setting for *Hog limit* will appear along with a message to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *Hog limit* is 5 minutes.

### **Hog Penalty**

This command sets the amount of time that a user will be penalized for allowing the *Hog limit* time expire. In effect, the user is disabled for the duration of the Hog penalty time.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "1" and press ENTER, the Repeater Panel System menu will be displayed. Select the item for *Hog penalty* and press ENTER. The current setting for *Hog penalty* will appear along with a message to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *Hog penalty* is 300 seconds.

### **ID Rate**

This command sets the *ID rate* or interval for the Morse ID of any tone or code enabled in the Repeater Panel. Once this timer has expired, the ID will be sent during the transmit hold time for that tone or code. This timer does not affect the Station ID.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "1" and press ENTER, the Repeater Panel System menu will be displayed. Select the item number for *ID rate* and press ENTER. The current setting for *ID rate* will appear along with a message instructing you enter a new value and the range of valid data. Enter the new data and press ENTER when you are done.

The default setting for *ID rate* is 15 minutes.

## Section 5. Feature Set Reference

### **Initial TX Hold Time - TX Hold Time**

When the Model 48-MAX decodes an enabled subaudible tone or code or *Carrier squelch repeat* is “Enabled”, it keys the transmitter immediately and allows repeat audio. To save the transmitter from keying and unkeying during mobile fading and regular conversation, the transmitter is “held” up for a programmed period of time after decode and/or carrier lost. If the same subaudible is detected again during the hold time, the transmitter will remain keyed until decode and/or carrier goes away and the transmit hold timer expires.

The first time the Model 48-MAX keys the transmitter based on an enabled subaudible tone/code, the *Initial TX hold time* is used to set the transmit hold time. All subsequent times it detects the same enabled subaudible tone/code before the transmit hold time expires, the *TX hold time* of the subaudible tone/code is used to set the transmit hold time.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

**Initial TX hold time** Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “1” and press ENTER, the Repeater Panel System menu will be displayed. Select the item for *Initial TX hold time* and press ENTER. The current setting for *Initial TX hold time* will appear along with a message to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *Initial TX hold time* is 2000 milliseconds.

**TX hold time** Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item for *TX hold time* and press ENTER.

The current setting for *TX hold time* will appear along with a message to enter the new value and the range of values you may enter. Enter the new user number and press ENTER when you have finished.

The default setting for *TX hold time* is 2000 milliseconds. *TX Hold time* is supported by block or range programming. See “user Range” later in this section for details.

#### **Application note:**

It can be useful to set *Initial TX hold time* to be a longer duration (2 - 4 times) than the per user *TX hold time*. This gives the called dispatch radio a chance to respond.

## List Users

This command is found in the User Menu (both Interconnect and Repeater Panel) and will display or list important data for each user specified. *User range* sets the starting and stopping user number that will be displayed by the *List user* command.

Note that when you first enter the User Menu on a Model 48-MAX, *User range* is set to start at “1” and end at “1” (“User range: 1”). Using the *List users* command will only display one user until the *User range* is changed.

The Model 48-MAX supports XON/XOFF protocol. If during listing of data you wish to pause, CTRL-S will stop the listing and CTRL-Q will restart the listing. Be aware that CTRL-S will only pause the listing for 20 seconds. You may also terminate the listing at any time with CTRL-C (a CTRL- command is holding down the CTRL key and pressing the second key).

If you are using communications software that supports a “Log file”, you can “capture to disk” the list that the Model 48-MAX sends you. Simply turn on the “Log file” before executing this command. When the list is complete, turn off or close the “Log file”. Once you have done this, you may print the list or view it with a text editor.

### How to execute it:

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the User Menu will be displayed using the currently selected user's data. Select the item number for *User range* and set the starting and stopping user numbers you wish to list.

Next, select the item number for *List users* (in *User range*) and press ENTER. The Model 48-MAX will start listing the user data beginning with the first (lowest) user number specified in *User range* through the last (highest) user number specified in *User range*.

See also “User Range” later in this section.

See also “Detailed Listing Menu” in Section 4.

## Section 5. Feature Set Reference

### **Morse ID**

Each tone or code in the Model 48-MAX's Repeater Panel can be assigned an individual Morse ID. This can be up to eight characters in length. The interval at which the ID is sent is controlled by the *ID rate* in the Repeater Panel System Menu. The Model 48-MAX will issue the ID during the transmit hold time once the *ID rate* timer has expired. The ID will be sent at 25 wpm.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "2" and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item for *Morse ID* and press ENTER.

The current *Morse ID* will appear along with a message instructing you enter a new ID. Type in the new ID and press ENTER when you are done.

To clear a *Morse ID*, simply type " " (press the space bar) followed by ENTER.

The default for all users is no *Morse ID* programmed.

## **Privacy**

The *Privacy* function prevents another tone or code from “barging in” on the transmitter hold time. The Model 48-MAX will not recognize a new tone or code until the transmitter drops. This allows a user group to keep control of the repeater until their conversation is complete. This becomes important in a system with heavy dispatch traffic.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see “User Range” later in this section). Select the item for *Privacy* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Privacy* is “Disabled” for all users.

*Privacy* is supported by block or range programming. See “User Range” later in this section for details.

## Section 5. Feature Set Reference

### **Reserved**

The *Reserved* function locks out a tone or code from being used on the channel. This is done by keying the transmitter and issuing a reserved tone while the tone or code is being decoded. This is one way of taking non-paying customers out of service without relinquishing their tone or code to another co-channel operator. Another use for the *Reserved* function is to Reserve the tones or codes used for interconnect from being used for dispatch by another co-channel operator.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type "2" and press ENTER, and the Repeater Panel Menu will appear. Type "2" and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the User number you wish to program (see "User Range" later in this section). Select the item for *Reserved* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Reserved* is "Disabled" for all users.

*Reserved* is supported by block or range programming. See "User Range" later in this section for details.

### **Application note:**

For the reserved function to operate, the tone or code must be enabled also.

### **Stuck Mic ID**

The Model 48-MAX has a *TX timeout* timer which will prevent the Model 48-MAX from keeping the transmitter keyed for an extended period of time. The typical cause for this is a field unit whose microphone has gotten “stuck” in transmit. The Model 48-MAX can identify the user number of the tone or code who has timed out the transmitter. This is enabled with the *Stuck mic ID* command.

Once the timer has expired, the Model 48-MAX will unkey the transmitter. Every 15 seconds the Model 48-MAX will keyup and transmit the user number in DTMF. This will continue until the offending “stuck mic” drops carrier.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “1” and press ENTER, the Repeater Panel System menu will be displayed. Select the item for *Stuck mic ID* and press ENTER.

The currently selected mode or state will be shown along with a message instructing you to press the space bar to change the mode or state, and to press ENTER to accept the current mode or state. Each time the space bar is pressed, the mode or state changes. Once the mode or state you desire is displayed, press ENTER to accept it. Note that if you accidentally pass the mode or state you want, keep pressing the space bar and the Model 48-MAX will wrap around (when the last choice is displayed, it will return to the first one).

The default setting for *Stuck mic ID* is “Disabled”.

## Section 5. Feature Set Reference

### **TX Timeout**

The *TX timeout* timer is the maximum continuous time the Model 48-MAX will allow a valid tone or code to key the transmitter. This is to prevent a stuck microphone from burning up or overheating the transmitter. By enabling the *Stuck mic ID* you can also find out who the offending tone or code is.

#### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “1” and press ENTER, the Repeater Panel System menu will be displayed. Select the item number for *TX timeout* and press ENTER. The current setting for *TX timeout* time will appear along with a message instructing you enter a new value and the range of valid data. Type in the new data and press ENTER when you are done.

The default setting for *TX timeout* is 3 minutes.

### **User Range**

*User range* sets the user number whose data is currently displayed in the Interconnect User Menu. This command selects the particular user whose data you wish to view or program. This can be a single user or a block or range of users.

Once a user range has been selected, it remains unchanged until you exit or terminate the programming session. This means you can set *User range* to the desired user, and go back to another menu to verify or change a setting. When you return to the User Menu, it will display the same user.

The *User range* may be set to anything, as long as the starting and ending users are within the specified range (1 to 154) and the starting user number is lower than the ending user number.

To select a single user, enter the user number at the prompt for “Starting user” and press ENTER. At the second prompt “Ending user” just press ENTER. The Repeater Panel User Menu will be re-printed with the selected user's data.

To select a range or block of users, enter the lower user number at the prompt for “Starting user” and press ENTER. At the second prompt “Ending user”, enter the higher user number and press ENTER. The Interconnect User Menu will be re-printed using the “Starting user” data.

### **Block or Range programming:**

The Model 48-MAX supports block or range programming of most items in the User menu. You can set them one at a time or set the whole block or range with the same setting.

When you have a range of users specified and select a command that supports block programming, the Model 48-MAX will prompt you as to whether you want to program all of them (in the user range) in one keystroke, or if you would like to review and alter each of them individually. If you elect to let the Model 48-MAX program them all without reviewing them, it will change all of the users in the user range and give you a prompt when it is finished. If you would like to program a certain parameter for a range of users, but you want them to be different, the Model 48-MAX will show you each user one-at-a-time and allow you to change each independently from the other users. If you decide you don't want to continue, press CTRL-C to abort.

The user that is displayed is the first user in the range. This user is called the “current user”. If you execute a command that can only be programmed one user at a time, only the current user will be changed.

### **How to program it:**

Access the Model 48-MAX through your direct connected PC or terminal, or remotely from your PC connected to a modem via the Model 48-MAX's internal modem.

## Section 5. Feature Set Reference

Once connected to the Model 48-MAX and the Main Menu is on the screen, type “2” and press ENTER, and the Repeater Panel Menu will appear. Type “2” and press ENTER, the Repeater Panel User menu will be displayed using the currently selected user's data. Select the item number for *User range* and press ENTER. The current starting user number will be displayed, along with a prompt instructing you to enter a starting user number. Type the first user number you wish to program and press ENTER. The ending user number will then be displayed, along with a prompt instructing you to enter an ending user number. Type the last user number you wish to program for a block or range OR just press ENTER for a single user (starting user).

The default *User range* is for a single user, user number “1”.

### **Application note:**

A helpful tool when examining or programming user can be to step through users one at a time. At the “Select command: “ prompt:

type “N” followed by ENTER to increment the user number by 1

type “P” followed by ENTER to decrement the user number by 1

If a range had be previously set, it is reset to a single user (current user +/- 1 user) with this command.



## 6. INSTALLATION

INSTALLATION WARNING .....	6-1
GENERAL .....	6-1
REQUIRED TEST EQUIPMENT .....	6-1
TYPICAL CONNECTIONS .....	6-2
INSTALLATION PROCEDURE.....	6-3
RESETTING TO FACTORY DEFAULTS .....	6-5
LOCAL TELEPHONE .....	6-5
TESTS AND ADJUSTMENTS.....	6-6
FINAL CHECKS BEFORE LEAVING THE SITE.....	6-11
OPTIONAL CONNECTIONS .....	6-11
RADIO-SPECIFIC CONNECTIONS .....	6-11
GE MASTR III Base/Repeater .....	6-12
GE MASTR II Base/Repeater.....	6-13
GE Exec II Base.....	6-14
ICOM IC-RP1510 Repeater.....	6-15
E.F. Johnson CR1010 Repeater .....	6-16
E.F. Johnson CR1010 Repeater (Alternate Hookup).....	6-17
E.F. Johnson Viking Universal Station.....	6-18
Kenwood TKR-720 / TKR-820 Repeater .....	6-19
Motorola GR300 Repeater (or Two GM300 Radios).....	6-20
Motorola MTR2000 Stations .....	6-21
Motorola MSF 5000 Analog Repeater.....	6-21
Motorola MSF 5000 Digital Repeater .....	6-23
Motorola MCR-100 / RADIUS R-100 .....	6-24
Tait T800 Series Repeater.....	6-25
Tait T300 Series Radio .....	6-26
IN CASE OF DIFFICULTY.....	6-27
MISCELLANEOUS SERVICE NOTES.....	6-27
Upgrading to a New Version of Software.....	6-28
Installing New EPROMs .....	6-29
Call Detail Option (950-9587) Installation.....	6-30
Voice Prompts Option (950-9588) Installation .....	6-31
Dial Click Option (950-9589) Installation.....	6-32

## 6. INSTALLATION

### INSTALLATION WARNING

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

Installation of the Model 48-MAX Interconnected Repeater Panel should be accomplished by experienced radio and paging system personnel. Specialized knowledge in telephone systems is also important to ensure a smooth interface when connecting with the Telco network.

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

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

### GENERAL

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

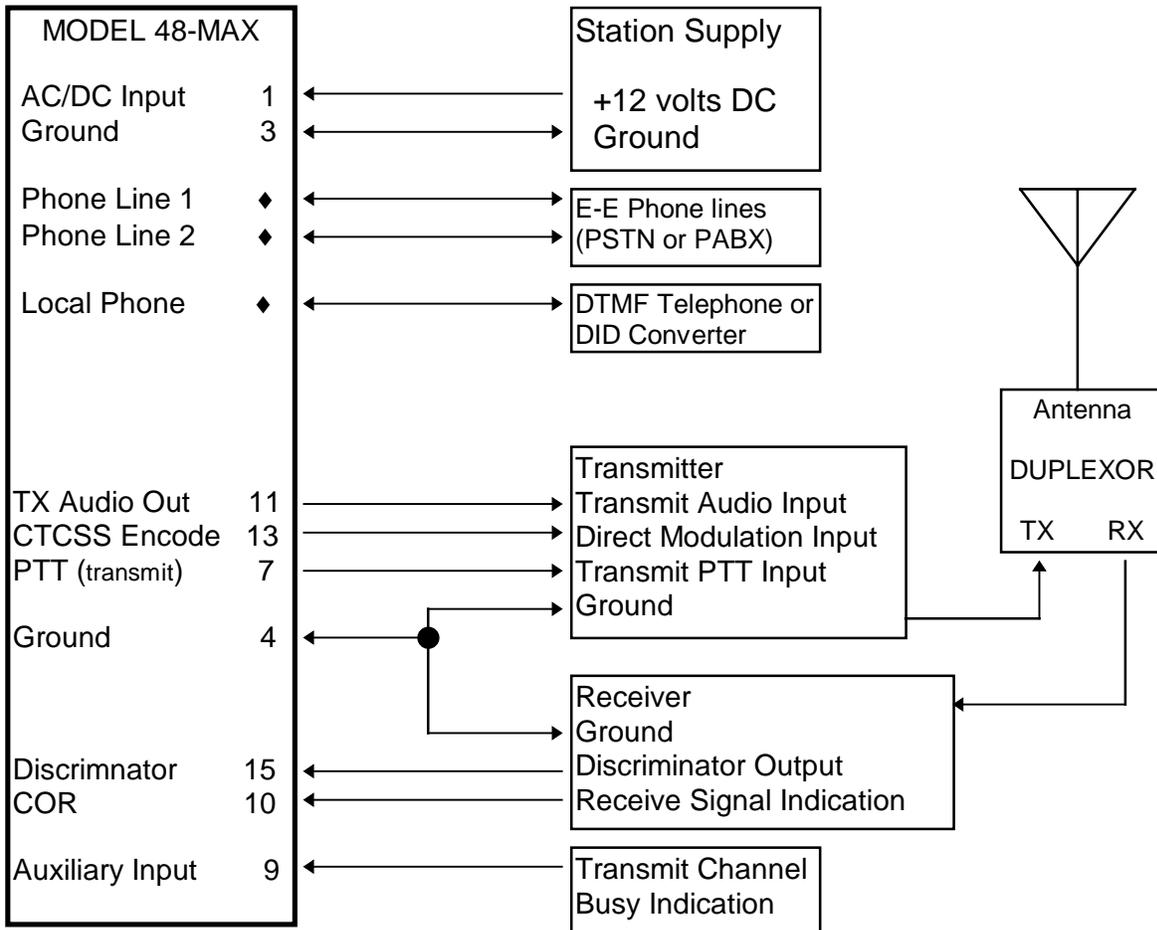
### REQUIRED TEST EQUIPMENT

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

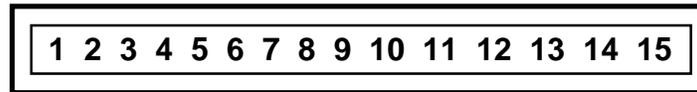
## Section 6. Installation

### TYPICAL CONNECTIONS

Figure 6-1 provides a graphic presentation of a typical Model 48-MAX to transmitter/receiver connection. Figure 6-2 shows the Model 48-MAX cable connector pin numbers and descriptions.



**Figure 6. INSTALLATION-1 Typical Model 48-MAX Installation**



- |                       |                      |
|-----------------------|----------------------|
| 1. 9-12 VAC or +12VDC | 8. Auxiliary output  |
| 2. 9-12 VAC           | 9. Auxiliary input   |
| 3. Power Ground       | 10. COR Input        |
| 4. Ground             | 11. Transmit Audio   |
| 5. PTT N.C.           | 12. TX / Gnd         |
| 6. PTT Common         | 13. CTCSS/DCS Output |
| 7. PTT N.O.           | 14. Disc / Gnd       |
|                       | 15. Receiver Audio   |

**Figure 6. INSTALLATION-2 Model 48-MAX Cable Connector Pin Numbers and Descriptions**

### INSTALLATION PROCEDURE

1. Locate the 15-Pin connector from the accessory bag included with the Model 48-MAX.
2. **GROUND CONNECTION:** Connect a chassis ground wire from pin 4 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 (PTT N.O.) to the PTT input of the transmitter. Note that this output is an open drain FET to ground.
4. **TRANSMITTER AUDIO OUTPUT:** Connect pin 11 (TX) to the mic or line input of the transmitter. Shielded cable must be used for this connection. Connect the braid to pin 12 (TX/GND). Jumper JP25 determines the level of the TX Output. (A= High and B= Low)
5. **CTCSS / DCS ENCODE:** Connect pin 13 (SUB OUT) 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 (DISC) to the discriminator output of the receiver. Shielded cable is must be used for this connection. The shield braid should be connected to pin 14 (DISC/GND). Install jumper JP22 in position A for signals greater than 500mV P-P or in position B for signals less than 500mV P-P. JP23 should be in the A position for CTCSS/DCS decode and in the B position for CTCSS only decode. JP29 should be in the A position.
7. **COR INPUT:** The Model 48-MAX 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.

## Section 6. Installation

**External COR input from the receiver:** The Model 48-MAX 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 JP21 must be in position B, and jumper JP31 will select the COR polarity; position A is for negative (lo = carrier), position B is for positive (hi = 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 JP31. If the LED doesn't change, adjust COR Threshold Pot R121 until a change takes place.

Summary:                    JP21 = COR source, B = external COR  
                                  JP31 = COR polarity, A = negative COR, B = positive COR  
                                  R121 = COR threshold adjustment

**Internal COR:** The Model 48-MAX 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. This circuit requires high frequencies above 6Khz to work, which means discriminator audio. To use the internal COR, JP21 should be in the A position, JP31 should be in the A position, and R121 should be set midpoint. R120 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 R120 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 R59 affects this adjustment, so R120 will need to be readjusted after doing the complete installation. See Tests and Adjustments number 6.

Summary:                    JP21 = COR source, A = Internal COR  
                                  JP31 = COR polarity, A = negative for internal COR  
                                  R121 = COR threshold adjustment, set midpoint  
                                  R120 = Squelch control, adjust for critical squelch



**Figure 6. INSTALLATION-3 Jumper JP31 Settings**

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 16 volts, and capable of at least 700 milliamperes 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, an AC source of 9 - 12VAC, 11 watts can be used. When using an AC source connections should be made to J6 terminals 1 and 2. The Model 48-MAX is internally fused with a 2-ampere fast-blow fuse. Verify that the Power LED lights when power is applied.

## RESETTING TO FACTORY DEFAULTS

There are three ways to reset the Model 48-MAX's System database to factory defaults. The first two require that you know the Program Access code, the third does not.

1. Using CRT or Terminal programming (modem or local terminal).
2. Using DTMF programming.
3. Forcing a reset at power on.

Using CRT or Terminal programming:

- 1) Access the Model 48-MAX (default password is 12048)
- 2) Go to the Diagnostic Menu and select Item 1.

Using DTMF programming:

- 1) Access the Model 48-MAX (default password is 12048)
- 2) Enter command 110# [2 beeps] 12345# to confirm [5 beeps]
- 3) 99# to exit program mode

Forcing a reset at power on:

- 1) Turn off the system power
- 2) Install JP28
- 3) Turn on system power
- 4) When all the LED's come on except Transmit, Carrier, DTMF, and Local remove JP28.

The front panel Power indicator should be on and the Line 1 indicator should blink every 5 seconds.

NOTE: This does not reset the User database or any billing data. The only way to clear the User database and any billing data is by RS-232 programming.

## LOCAL TELEPHONE

Connect a DTMF (Touch-Tone) telephone to the jack marked LOCAL. Pick up the handset and verify that a prompt or beep tone (800mSec) is heard. After hearing the prompt tone, dial 12048. A high pitched tone modem answer tone will be heard. Press a DTMF “#” to stop the modem tones and enter DTMF program mode. After the modem tone has stopped, you will hear programming sequence tones indicating that you are in DTMF program mode. To exit DTMF program mode dial “99#”. This phone will be used for various test procedures during the alignment of the Model 48-MAX.

### TESTS AND ADJUSTMENTS

- All steps using a computer or terminal for the setup and adjustment assume you to be in the Diagnostic menu. From the Main Menu type “5” followed by ENTER. The Diagnostic menu will be displayed.
  - All steps using DTMF from the local phone for setup and adjustment assume you to be in program mode already.
  - Be aware that you cannot be in DTMF programming and CRT or terminal programming at the same time.
1. PTT: Verify proper PTT operation by pressing the Connect button on the front panel. The transmitter should key up at this time. If not, check the wiring between the Model 48-MAX and the transmitter. Press the Connect button again to unkey the transmitter.
  2. TRANSMIT AUDIO: The transmitter deviation must be properly adjusted. If set too low, the transmit audio will be under deviating and sound low. If set too high, you risk over deviation there by degrading overall system performance. Refer to the alignment procedure described in the radio's service manual.

#### *Using a computer or terminal:*

Select “TX signaling gain and pre-emphasis adjust” by typing “5” followed by ENTER. The transmitter will be keyed, and a 250 Hz tone will be generated out the transmitter. Each time a key is pressed, the tone will change to the next one on the list (250, 500, 1K, 2K, 3K).

#### *Using a DTMF telephone:*

Using the phone plugged into the local phone jack, enter the DTMF programming mode as explained earlier. Take the phone off hook and dial “12048”. Enter the transmitter setup tests by entering the function code “111#”. The transmitter will be keyed, and a 250 Hz tone will be generated out the transmitter. Each time any DTMF digit is pressed other than “#” or “\*”, the Model 48-MAX will cycle to the next tone in the list (250, 500, 1K, 2K, 3K).

#### *Adjusting TX audio level:*

Press a key twice to jump to the 1Khz tone. Adjust R60 (TX AUD) for 60% of maximum channel deviation (3Khz typical). JP25 can be used to increase or decrease the output if needed. JP25 in position A increases the output and decreases it in position B. Once you have the level set for a 1Khz tone, cycle through the tones and verify a flat response. JP24 can be used to set the tones for a flat response. If the TX audio injection point is “Mic audio” or another pre-emphasized input, JP24 should be placed in position B (de-emphasis). If the TX audio injection point is “Flat TX” or similar input, JP24 should be placed in position A (flat).

#### *Using a computer or terminal:*

Press ENTER to leave the test.

*Using a DTMF telephone:*

Press “#” to leave the test mode.

3. CTCSS/DCS ENCODE: To set the CTCSS/DCS modulation level

*Using a computer or terminal:*

Select “CTCSS/DCS encode gain and pre-emphasis adjust” by typing “6” followed by ENTER. This will cause the transmitter to key up with the CTCSS tone 67.0 Hz encoded. Each time a key is pressed, it will advance to the next tone in the list (67.0, 136.5, 250.3 D023).

*Using a DTMF telephone:*

Using the phone plugged into the local phone jack, enter the DTMF programming mode as explained earlier. Take the phone off hook and dial “12048”. Enter the transmitter setup tests by entering the function code “112#”. This will cause the transmitter to key up with the CTCSS tone 67.0 Hz encoded. Each time any DTMF digit is pressed other than “#” or “\*”, the Model 48-MAX will cycle to the next tone in the list (67.0, 136.5, 250.3 D023).

*Adjusting CTCSS/DCS level:*

Press any key once to get to 136.5 Hz. Adjust R63 (SUBOUT) for 750 Hz deviation on the channel. Next, check the lower and upper tones for the proper deviation by cycling through the tones. Verify a flat response (CTCSS at 750Hz, DCS at 1Kz). JP27 can be used to increase or decrease the output if needed. JP27 in position A increases the output and decreases it in position B. JP26 can be used to set the tones for a flat response. JP26 in position B de-emphasizes the sub-audible tones. JP26 in position A sends the sub-audible out flat.

*Using a computer or terminal:*

Press ENTER to leave the test.

*Using a DTMF telephone:*

Press “#” to leave the test mode.

4. DISCRIMINATOR INPUT: Adjust the receiver audio level by supplying a full quieting signal to the receiver. This signal should have a 1kHz tone at 60% of maximum deviation (3kHz typical). Adjust R59 for 375mVrms (1.0 Volt P-P) at TP4 measured with an oscilloscope. Verify DTMF decoding with a handheld or service monitor with DTMF encoding capability. Note digits 1, 5, 9 and D cover all 8 tones. The DTMF LED should light with each digit.
5. REPEAT AUDIO ADJUSTMENT: If the Model 48-MAX is used on a repeater or full-duplex base station, R59 can be fine tuned using the Repeat Audio test.

## Section 6. Installation

*Using a computer or terminal:*

Select "Repeat audio adjust" by typing "7" followed by ENTER.

*Using a DTMF telephone:*

Enter the correct function code 113#.

*Adjusting Repeat audio:*

The Model 48-MAX now keys up and remains keyed for the duration of the test. The repeat audio path is gated with COR detection. R59 should now be used to adjust the repeat audio for unity gain through the Model 48-MAX. DO NOT adjust R60 during this procedure. It was already set to the proper level in step 2.

First, generate a 1 kHz tone at 60% of maximum deviation (typically 3kHz) on the same frequency as the receiver connected to the Model 48-MAX. This can be done with a service monitor or a handheld using Touch-Tone instead of a 1 kHz tone. If you are using a handheld, measure the Touch-Tone deviation before continuing. Measure the transmitter audio with a service monitor and adjust R59 for unity gain (3 kHz in = 3 kHz out) through the repeat path. This completes the adjustment of R59.

If using internal COR, it should now be re-adjusted as outlined in "Installation Procedure," step 7, earlier in this section.

*Using a computer or terminal:*

Press ENTER to leave the repeat audio adjust test.

*Using a DTMF telephone:*

Press "#" to leave the test mode.

6. TELEPHONE ADJUSTMENTS: The transmit and receive levels to and from the telco circuit are factory set and should not be adjusted. Proper setup for unity gain through the repeat path (steps 2, 4 and 5) will result in proper levels with the telco circuit.

The Model 48-MAX Telco output levels for regenerated DTMF, modem tones and call progress tones are fixed and cannot be adjusted. The audio from the receiver is factory set for proper levels into the phone line and should not require adjustment. With R115 (PHONE TX) set at 12:00 (mid-point), 60% deviation on the receive channel (375mVrms at TP4) should produce -10.5dBm signal level into the telco circuit.

The Telco input level is also set at the factory so that a -20.0dBm receive signal level from the telco circuit will produce 60% deviation on the transmit channel. The AGC circuit used by the Model 48-MAX for phone input will compensate for any low levels experienced on the phone lines.

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. R119 (DTONE) 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 R119 if needed.

8. **HYBRID BALANCE ADJUSTMENT:** This purpose of this adjustment is to balance or match the impedance of Model 48-MAX to the phone circuit to which it will be connected. This is to adjust for maximum return loss (minimize reflected signal) of the transmit and receive audio signals. How well the modem works is directly dependent on this adjustment. This must be done at the site on the phone circuit with which the Model 48-MAX will be used.

To perform this test requires establishing a telephone connection through the local Central Office. The Model 48-MAX provides two ways of accomplishing this, answering an incoming call and starting the test or taking in a phone number, dialing it and starting the test. The Model 48-MAX then generates 400 Hz, 1000 Hz and 2225 Hz into the phone line, keys the transmitter and opens the audio path from the telco to the transmitter. Caution the person at the other end to watch their ears!

*Using a computer or terminal:*

Select the "Hybrid balance adjust" by typing "8" followed by ENTER. The Model 48-MAX will ask you to select which method should be used to establish a telephone connection, press any key to toggle through the choices, press ENTER to select.

*Using a DTMF telephone:*

Enter the correct function code 114# followed by the hybrid tones. Watch your ears!

*Using a DTMF equipped radio:*

Keyup and enter DTMF programming mode (12048 default). Enter the correct function code 114# [2 beeps], then select which method should be used to establish a telephone connection, 1# to dial out on line 1, 2# to dial out on line 2 or 3# to wait for an incoming ring.

*Adjusting hybrid:*

Monitor the transmit channel with a service monitor or alternately probe the cathode (banded) side of CR16 with an oscilloscope. Adjust R116 and R117 for minimum signal. This may take several times back and forth to work the signal down.

*Using a computer or terminal:*

Press ENTER to leave the Hybrid balance adjust test. The Model 48-MAX will then terminate the phone connection.

*Using a DTMF telephone or radio:*

Press "#" to leave Hybrid balance adjust test. The Model 48-MAX will then terminate the phone connection.

9. **DIAL CLICK ADJUSTMENTS:** If you do not have the Dial Click option (950-9589) installed in your Model 48-Max you can skip performing this adjustment.

To perform this test requires establishing a telephone connection through the local Central Office. The Model 48-MAX provides two ways of accomplishing this, answering an incoming call and starting the test or taking in a phone number, dialing it and starting

## Section 6. Installation

the test. It will require an assistant at the distant connection with a rotary phone to perform this test.

### *Using a computer or terminal:*

Select the "Dial click decode" by typing "12" followed by ENTER. The Model 48-MAX will ask you to select which method should be used to establish a telephone connection, press any key to toggle through the choices, press ENTER to select. Your assistant should start dialing a pre-determined sequence or pattern of digits with a rotary phone. You should see the digits as they are decoded on the CRT. Adjust R6 on the Dial Click card (702-9424) to increase or decrease the sensitivity of the decoder card. Once you are satisfied with the decoding, press ENTER to exit the test. The Model 48-MAX will then terminate the phone connection.

### *Using a DTMF equipped radio:*

Enter the correct function code 115# [2 beeps], then select which method should be used to establish a telephone connection, 1# to dial out on line 1, 2# to dial out on line 2 or 3# to wait for an incoming ring. Your assistant should start dialing a pre-determined sequence or pattern of digits with a rotary phone. The Model 48-MAX will key the transmitter and send the decoded digits out in slow Morse code. Adjust R6 on the Dial Click card (702-9424) to increase or decrease the sensitivity of the decoder card. Once you are satisfied with the decoding, press "#" to exit the test. The Model 48-MAX will then terminate the phone connection.

## **FINAL CHECKS BEFORE LEAVING THE SITE**

1. Have someone call the unit and access the modem programming. Verify errors are not present during modem communication.
2. Place a mobile to telephone call through the Model 48-MAX and verify the audio levels are set correctly. Place a telephone to mobile call also to verify level setting and DTMF decoding in both directions.
3. Have someone call the Model 48-MAX and place a call using a rotary phone. Verify proper operation and decoding of the pulses.
4. Verify that the Model 48-MAX will decode CTCSS and DCS (if used). Using your terminal or PC direct connected to the local RS-232 port, verify CTCSS/DCS decode. This can be done in real time by selecting item 11 in the Diagnostic Menu (CTCSS/DCS decode). All the CTCSS tones and DCS codes should decode without being enabled. If the DCS code does not decode, try inverting the DCS decode polarity in the System Menu.

## **OPTIONAL CONNECTIONS**

1. **AUXILIARY INPUT:** J5 pin 9 is the auxiliary input connection. It is internally pulled up to +12VDC through a 47K ohm resistor. It is an active low input for connection to a logic signal or relay contacts. This input can be programmed for either Transmit Channel busy indication or Site status indication. See “Auxiliary Input” in Section 3 for more information.
2. **AUXILIARY OUTPUT:** J5 pin 8 is the auxiliary output connection. It is an open drain FET to ground. It will provide a logic signal to ground when active. If relay contacts are required for your application, K2 and JP15 can be installed after removing JP14. This provides a set of relay contacts and JP15 provides the selection for NO or NC operation. The common contact is still to ground. See “Auxiliary Output” in Section 3 for more information. Order Relay kit # 950-9752.
3. **PTT RELAY:** If your installation requires that the Model 48-MAX provide relay contacts for PTT connection (the transmitter requires +V to key), K1 can be installed after removing JP16. This provides a set of relay contacts on J5 pins 5 (NC), 6(COM), 7(NO). Order Relay kit # 950-9752.

## **RADIO-SPECIFIC CONNECTIONS**

The following provides information for connecting specific radios to the Model 48-MAX.

## Section 6. Installation

### GE MASTR III Base/Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX  
 To: GE MASTR III base/repeater  
 Using: 709-7112 Generic radio cable

ZETRON END			RADIO END	
Function	Pin	Color	Connection / notes	
12 volts AC/DC in	1	Red	←	P5.1 (A+ / DC Power)
12 volts AC input	2	---		
DC ground	3	Black	←	P2.2, P2.3 (Power ground)
Ground	4	Drain	●	No Connection
PTT NC	5	---		
PTT COM	6	Jmpr	└─┘	
PTT NO	7	Orange	→	P2.13 (Repeat PTT In)
Aux relay	8	---		
Sense/alarm	9	---		
COR input	10	Yellow	←	P3.5 (CAS)
Tx audio	11	Blue	→	P5.8 (Repeat Audio)
Ground	12	---		
CTCSS/DCS encode	13	Green	→	P3.14 (CTCSS Encode)
Ground	14	Brown	→	P4.2
Discriminator in	15	White	←	P2.5 (Demodulated Audio)

#### MASTR III Configuration:

1. Connectors P2, P3, P4, and P5 are located on the GE Mastr III backplane.
2. Cut the printed wire pattern at JP-1 on the T/R Shelf's backplane 19d902948.
3. Program the base station using the standard PC programming software. For proper operation, the station firmware must be 344A3307G12 (Group 12) or higher (Mastr III System Board - U4).
4. Program the following parameters in the Mastr III:
  - a) Repeater (Single Channel only)
  - b) Repeater Panel option
  - c) RF duplex
  - d) No TX CG or RX CG (leave blank)
  - e) Set the TX Pot to 200.
  - f) Set the Cg pot to 255.
  - g) No CCT or DODT Timers (set to 0)
  - h) Remote Control optional
5. Set the repeat and CTCSS modulation levels by adjusting the Zetron unit. See the Tests and Adjustments subsection.

**GE MASTR II Base/Repeater**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX  
 To: GE MASTR II base/repeater  
 Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	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
Ground	12	---	Pin 4 on NEW IDA
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.
- If DCS decode is required, discriminator audio **MUST** be connected to J606 on the IF/Audio/Squelch board. If only CTCSS tone decode is required, discriminator audio may be connected to Volume Squelch Hi (J932 Pin 3).
- 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.

## Section 6. Installation

### GE Exec II Base

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: GE Exec II base

Using: 709-7112 Generic radio cable

ZETRON END			RADIO END	
Function	Pin	Color	Connection / notes	
12 volts AC/DC in	1	Red	←	J904 pin 8
12 volts AC input	2	---		
DC ground	3	Black	←	J904 pin 5
Ground	4	Drain	●	No Connect
PTT NC	5	---		
PTT COM	6	Jmpr	—	
PTT NO	7	Orange	→	H6 or J907 pin 10
Aux relay	8	---		
Sense/alarm	9	---		
COR input	10	Yellow	←	Q923 collector (CAS)
Tx audio	11	Blue	→	J902 pin 4
Ground	12	---		
CTCSS/DCS encode	13	Green	→	J902, pin 9 (CG Hi)
Ground	14	Brown	→	J904 pin 5
Discriminator in	15	White	←	J907, pin 8 (vol. hi)

### GE Exec II Configuration:

To modify the radio for full duplex (repeater) operation, make the following changes on the System Audio Squelch board:

1. Remove Q905, or disconnect Q905 collector.
2. Install a wire jumper from Q908 emitter to Q908 collector.
3. Short CR901 cathode to CR902 cathode.
4. Care should be taken not to damage the transmitter PA due to continuous duty operation.

**ICOM IC-RP1510 Repeater**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: ICOM IC-RP1510 repeater

Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	Connections/Notes
12 volts AC/DC in	1	Red	← Anode DC, power bus
12 volts AC input	2	---	
DC ground	3	Black	← J2 pin 1, GND (logic board)
Ground	4	Drain	● No connection
PTT NC	5	---	
PTT COM	6	Jmpr	└─┘
PTT NO	7	Orange	→ J2 pin 5, PTT (logic board)
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	← P5 pin 2, Sqlsw (green wire rx unit)
Tx audio	11	Blue	→ Junction of R49 and C20 (logic board)
Ground	12	---	
CTCSS/DCS encode	13	Green	→ Right side of R43 (logic board)
Ground	14	Brown	→ J2 pin 3, GND (logic board)
Discriminator in	15	White	← Negative side of C32 (logic board)

**Radio Configuration:**

1. Remove R22 (22K) to isolate PTT indication to control logic.
2. Isolate PTT control line from control logic by cutting trace next to J2 pin 6 (PTT).
3. Remove C20 (0.1uf) to isolate voice audio from summing amp.
4. Change R43 to 10K ohm, and cut trace between IC8 pin 7 and R43.
5. Remove C32 (0.47uf) to isolate discriminator output from logic board.

**Operational Notes:**

1. Squelch control on front panel sets COR for tone panel and speaker.
2. Front panel speaker will monitor all channel activity.
3. Microphone set on front panel will still function.
4. This transmitter is not capable of DCS encode.

## Section 6. Installation

### E.F. Johnson CR1010 Repeater

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson CR1010

Using: 709-7112 Generic radio cable

ZETRON END			RADIO END	
Function	Pin	Color	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, 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:

1. Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).
2. NOTE: This configuration uses the limiter and high-pass filter in the exciter. Since the Zetron unit 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 Zetron unit or the exciter.

**E.F. Johnson CR1010 Repeater (Alternate Hookup)**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson CR1010, alternate hookup

Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END (LOGIC DRAWER) 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 PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	← Logic Drawer Pin 19, Fast squelch
Tx audio	11	Blue	→ Logic Drawer Pin 18, Tx tone CG
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:**

1. Remove the brown wire from receiver going to the exciter transmit audio (Pin 1).
2. 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 hookup on the previous page.

## Section 6. Installation

### E.F. Johnson Viking Universal Station

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: E.F. Johnson Viking Universal Station

Using: 709-7112 Generic radio cable

ZETRON END Function	Pin	Color	RADIO END Connection / notes
12 volts AC/DC in	1	Red	← J2-23, +15_ACC
12 volts AC input	2	---	
DC ground	3	Black	← J2-21, Ground
Ground	4	Shield	● No Connect
PTT NC	5	---	
PTT COM	6	Jmpr	└─┘
PTT NO	7	Orange	→ J2-7, PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	← J2-4, SQUELCH
Tx audio	11	Blue	→ J2-5, TX_AUDIO
Ground	12	---	
CTCSS/DCS encode	13	Green	→ J2-6, TX_DATA
Ground	14	Brown	→ J2-22, Ground
Discriminator in	15	White	← J2-2, WB_DISC

#### Radio Configuration:

1. The radio requires the Third Party Interface Card.

**Kenwood TKR-720 / TKR-820 Repeater**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Kenwood TKR-720 / TKR-820 repeater

Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	Connection / notes
12 volts AC/DC in	1	Red	← Pin 7 SB
12 volts AC input	2	---	
DC ground	3	Black	← Pin 11 Ground
Ground	4	Shield	● No Connect
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	→ Pin 8 PTT
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	← Pin 13 CO
Tx audio	11	Blue	→ Pin 5 L1
Ground	12	---	
CTCSS/DCS encode	13	Green	→ Pin 3 D1
Ground	14	Brown	→ Pin 6 SG
Discriminator in	15	White	← Pin 4 DE
			PTT enable Pin 1 HK
		jumper	┌→ Pin 2 LG
			└→ Speaker enable Pin 9 SI
		jumper	┌→ Pin 12 SO
			└→

**Radio Modifications:**

Note: These modifications may not apply to all versions of the TKR-radio. Refer to the Kenwood service manual and schematic diagram.

1. On the TX/RX Unit board, foil side: Cut the trace leading to CN3-8 (AFO). Add a jumper wire between CN3-8 and CN6-9 (DET). This corrects a foil error found in older Kenwood units. Cut the trace between CN7-1 (tone) and R68. This isolates the tone board injection point when the Zetron device keys the repeater.
2. On the Display Unit board, foil side: Remove J14, and add a jumper wire between CN8-4 (DE) and CN2-6 (DET). This bypasses C22 on the display board for DCS decode capability.
3. Set the switches for:
  - Takeover = Off / disabled
  - Repeat = Off / full duplex transceiver
  - Monitor = DC

## Section 6. Installation

### Motorola GR300 Repeater (or Two GM300 Radios)

For: Zetron Model 38, 39-MAX, 45B, 48B, 48-MAX

To: Motorola GR300 repeater or a pair of GM300 mobiles

Using: 709-7264 Interface Cable

ZETRON END			RECEIVE GM 300	
Function	Pin	Color	Connection / notes	
12 volts AC/DC in	1	Red	STATION POWER SUPPLY	
DC ground	3	Black		
Ground	4	Shield	AUX Pin 9, Emergency Alert	
COR input	10	Yellow	AUX Pin 8, CSQ Detect	
Discriminator in	15	White	AUX Pin 11, Disc audio	
Ground	12	Brown	AUX Pin 7, Ground	
		Green	AUX Pin 14, Alternate CSQ	
		Speaker enable jumper	AUX Pin 15, Internal speaker	
			AUX Pin 16, External speaker	

ZETRON END			TRANSMIT GM 300	
Function	Pin	Color	Connection / notes	
Ground	4	Jmpr		
PTT NC	5	---		
PTT COM	6	Jmpr		
PTT NO	7	Orange	AUX Pin 3, Microphone PTT	
Aux relay	8	---		
Sense/alarm	9	---		
Tx audio	11	Blue	AUX Pin 2, Microphone audio	
Ground	4	Shield	AUX Pin 9, Emergency Alert	
CTCSS/DCS encode	13	Green	AUX Pin 5, Flat Tx audio	
Ground	14	Brown	AUX Pin 7, Ground	
		White	AUX Pin 8, CSQ Detect	
		Speaker enable jumper	AUX Pin 15, Internal speaker	
			AUX Pin 16, External speaker	

### Radio Configuration:

- Set radio jumpers as follows:
  - JU551 position A, flat/unmuted discriminator audio
  - JU651 position A, Tx audio gain selection
  - JU701 position B, flat Tx audio limiter bypass (16ch only)
- Program both radio accessory connectors (with the RSS) as follows:

ACCESSORY CONNECTOR CONFIG					
INT Accessory: None		EXT Accessory:		General I/O	Custom: Y
PIN#	DESCRIPTION	DATA DIR	DEBOUNCE	ACT LEVEL	
4	NULL 2	Output	No	High	
6	NULL 1	Input	No	High	
8	CSQ Detect	Output	No	Low	
9	NULL 1	Input	No	High	
12	NULL 1	Input	No	High	
14	NULL 1	Input	No	High	

- Install the cable (709-7264) from the 15-pin connector on the 48-MAX to the appropriate 16-pin connectors on the rear of the Radius mobiles. Remove the power cable from the mobile being used as a receiver. **CAUTION!** Observe correct polarity (wire colors) while connecting power cables. Connect the "TO RADIO" plug on the Zetron power cable to the receive radio, and connect the remaining plug to the station power supply cable.

**Motorola MTR2000 Stations**

For: Zetron Model 38, 39-MAX, 45B, 48-MAX, 735, 748

To: Motorola MTR2000 Station

Using: 950-9919 MTR2000 Interface kit

**Radio Configuration:**

1. On the rear of the MTR2000, remove the screw centered under the SYSTEM J5 connector. Remove the connector strain relief / fuse access plate.
2. Connect the Zetron supplied interface cable to the MTR2000 "J5" backplane connector. Use caution when installing the cable so as not to damage the equipment with ESD.

*Note: The component side of the Zetron interface circuit board should be facing up. If not, the MTR2000 is an older revision (J5 connector is upside-down) and SHOULD NOT BE USED! Reference Motorola PSB # 793, December 1996.*

3. Re-install the connector strain relief / fuse access plate.
4. Configure the radio using the MTR2000 RSS as follows:
  - Personality: Station Configuration: Station Options:  
Base Operation  
System Type = Conventional.
  - Personality: Channel Information:  
Option Audio: Analog Audio Activation: = Carrier (for repeater controllers), or PL/DPL (if required for interconnects)  
Option Audio: Audio Control:  
De-Emphasis = off  
Pre-Emphasis = off  
Noise Canceller = off  
Compander = off  
Rx Signal Inversion = off  
Option PTT:  
External PTT Mapping = Aux. Audio  
Option Encoder:  
TX PL: Type = None  
*Note: The station will not generate PL/DPL encode from external PTT.*  
Option Decoder:  
RX PL: Type = None (for repeater controllers), or PL/DPL (if required for interconnects)
5. Connect the interface cable to the Zetron equipment.
6. Configure the Zetron product as follows:  
Rx audio: Discriminator (raw detector audio, unfiltered)  
Tx audio: Microphone (assume radio does pre-emphasis)  
CTCSS/DCS/LTR: Flat Tx (true FM)  
Carrier detect: External, active hi  
Decode validation: Active hi (during PL/DPL decode)

**Special instructions for Model 45B applications requiring PL/DPL decode:**

1. On the Model 45B screw terminal connector, move the brown wire from pin 14 to pin 9 (sense 1).
2. On the MTR station interface board, move the brown wire from J6 to J12.
3. On the solder side of the MTR station interface board, add a jumper wire from P2 pin 4 to the MTR connector pin C2.

**Motorola MSF 5000 Analog Repeater**

## Section 6. Installation

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX  
 To: Motorola MSF 5000 analog (older) repeater  
 Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	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 connection
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 33 KΩ
CTCSS/DCS encode	13	Green	→ Wiper of R889 IDC pot(3vpp = 750 kHz)
Ground	14	Brown	→ No connection
Discriminator in	15	White	← Test Point 3 (3kHz=1vpp)

### MSF 5000 Configuration:

1. Make all connections to the Station Control Module PCB.
2. Set "AccDis" switch UP.

**Motorola MSF 5000 Digital Repeater**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MSF 5000 “digital capable” station

Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	Connection / notes
12 volts AC/DC in	1	Red	R8121, side closest to center of PCB
12 volts AC input	2	---	
DC ground	3	Black	TP2
Ground	4	Drain	No connection
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	SW800 (pin closest to outer edge of PCB)
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	U1552, pin 1
Tx audio	11	Blue	U814, pin 2
Ground	12	---	Both 33 K $\Omega$
CTCSS/DCS encode	13	Green	U831, pin 3
Ground	14	Brown	TP2
Discriminator in	15	White	Test point 3

**MSF 5000 Digital Capable Station Configuration:**

1. Drill a cable access hole in the rear of the Station Control Module plastic housing, about mid point. Install a cable access hole grommet and strain relief.
2. Make all connections to the Station Control Module PCB.
3. Set “AccDis” switch UP.
4. **CAUTION!** The front panel SQUELCH control (on the MSF) will set the CARRIER threshold for the Zetron unit.

## Section 6. Installation

### Motorola MCR-100 / RADIUS R-100

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

To: Motorola MCR-100 / Radius R-100

Using: 709-7112 Generic radio cable, or 709-7109

ZETRON END			RADIO END (DB-25P)	
Function	Pin	Color	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 patch	11	Blue	→	JAUX Pin 5, Audio from phone
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:

1. 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.
2. 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.
3. Program the R-100 for carrier squelch operation and disable repeater operation using the RPTR Disable Switch on the RPT Control Board.
4. Order the R-100 with the DPL Option if DPL is to be used. 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.
5. Repeat audio from the Zetron unit will be heard in the local speaker if the 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.

**Tait T800 Series Repeater**

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B

To: Tait T800 Series Repeater

Using: 709-7112 Generic radio cable

<b>ZETRON END</b>			<b>RADIO END</b>
Function	Pin	Color	Connection / notes
12 volts AC/DC in	1	Red	TB1-13 +13.8V
12 volts AC input	2	---	TB1-14 -VE (ground jumper)
			TB1-10 SP- (ground jumper)
			TB1-10 (ground jumper)
			TB1-8 (ground jumper)
DC ground	3	Black	TB1-8 TX LINE (ground)
Ground	14	Brown	TB1-8 (ground)
Ground	4	Shield	No Connection
PTT NC	5	---	
PTT COM	6	Jmpr	
PTT NO	7	Orange	TB1-12 TX KEY
Aux relay	8	---	
Sense/alarm	9	---	
COR input	10	Yellow	TB1-11 RX GATE
Tx audio	11	Blue	TB1-5 TX LINE
Ground	12	---	
CTCSS/DCS encode	13	Green	TB2-9 CTCSS
Discriminator in	15	White	TB2-11 (Rx audio)
			TB1-2 RX LINE CT (jumper)
			TB1-3 RX LINE CT (jumper)
			TB1-6 TX LINE CT (jumper)
			TB1-7 TX LINE CT (jumper)

**Radio Configuration:**

1. Move the Violet wire from TB2-9 to TB2-11. The Violet wire (Rx Audio 2) is flat receive audio, separated out to TB2-11.
2. Set the jumpers in the receiver as follows;
  - a) PL101: 1-2. Flat audio.
  - b) PL105: 1-2 and 4-5. Routes flat Rx audio to "audio 2".
  - c) PL106: 1-2. Routes flat Rx audio to "audio 2".
3. Disable the transmitter timeout timer by removing R257 (near IC202 on bottom of PCB).

Default levels: Tx-audio = 0.11vrms = 3 kHz deviation

CTCSS/DCS = 0.32vrms = 700 Hz deviation

COR = +12vdc SQ., 0vdc USQ

Rx-audio = 0.77vrms = 3 kHz deviation, flat 3-3000 Hz. Do not use with noise detector.

## Section 6. Installation

### Tait T300 Series Radio

For: Zetron Model 38, 38-MAX, 39, 39-MAX, 45B, 48B, 48-MAX

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	Gray	← 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:

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

## IN CASE OF DIFFICULTY

In case of difficulty, call Zetron Model 48-MAX Applications Engineering Department at (425) 820-6363. 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, often the problem can be solved over the phone.

## MISCELLANEOUS SERVICE NOTES

1. When the unit is reset or powered on, an automatic memory test will be executed. If greater than 20 memory errors are detected in the user programming, the unit will reset all of the user database to the default settings. Any user with bad checksum will be marked as such and can be displayed under System Statistics in the Diagnostic menu.
2. If the audio does not sound correct, perform an audio sweep test by generating an audio signal on the RF input of the repeater (of known deviation), and monitor the repeater output deviation. The deviation should be fairly flat from 300 to 2500 Hz.
3. When using the internal noise detector for COR, if the COR polarity switch seems backward, the audio input from the receiver may not have enough high frequency content (greater than 6Khz) for the noise detector to operate. It is usually caused by low pass filtering of the discriminator signal. An alternate connection point must be found in the receiver which provides unfiltered audio, or a receiver generated COR signal must be connected.
4. The Carrier LED MUST follow carrier activity on the channel. It must be lit with carrier present, and extinguished when carrier is absent. If it is always off, the Model 48-MAX will not function correctly.
5. The Carrier and DTMF LED's are hardware controlled. The drive for these LED's are also the inputs to the microprocessor. When trying to troubleshoot an installation, you can use these as indicators of what the software is seeing.
6. If the unit is non-operational and the AUX LED on the front of the unit slowly pulses, contact Zetron Applications for further assistance.
7. The hybrid balance adjustment is even more important with the Voice Prompts option installed. If the hybrid is misadjusted, you may not be able to over dial DTMF through the Welcome prompt.

## Section 6. Installation

### **Upgrading to a New Version of Software**

From time to time, new revisions of software are released. These can range from significant changes adding new or enhanced features to minor changes correcting documented defects. The procedure outlined below will allow you to perform a successful upgrade and retain your existing programming.

1. Make a current archive of your existing programming. See “Device Configuration and Billing Data” in Section 4.
2. Install the new EPROMs. See “Installing new EPROMs” on page 6-29.
3. Access the unit by the most convenient method and reset all programming from the Diagnostic Menu (items 2 and 3). This ensures that any new changes to the database will be properly initialized.
4. Upload your archived programming. This will restore your existing programming and any new items will be initialized to default.
5. Place some calls and verify proper operation.

Whenever upgrading to a new or later version of software, resetting all programming with the new software ensures any new or changed features are properly initialized.

### **Installing New EPROMs**

Most changes to the Model 48-MAX are made only to the controlling software. Whenever a change is made to the Interconnected Repeater Panel, new EPROMs 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. Carefully note the orientation notch on the end of the old EPROMs.
4. Remove the old EPROMs from the board.
5. Install the new ICs 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 Model 48-MAX 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 EPROMs to Zetron in the protective shipping material in which the new EPROMs were shipped.

## Section 6. Installation

### Call Detail Option (950-9587) Installation

These installation instructions describe installing the Call Detail option (950-9587) into a Model 48-MAX. You should find the following parts included with the kit:

Quantity	Part Number	Description	Location
1	321-0751	601-0661 (ASIC)	U35
1	321-1001	128K x 8 RAM	U22
1	416-1218	Battery-Clock socket	U22

This option kit is serial number specific. The invoice should indicate which serial number the kit was ordered for. If you are installing multiple upgrade kit, you will need to match the kits to the units before beginning the upgrades. If the AUX LED slowly flashes, this is the problem.

### CAUTION

**ALL PROGRAMMING WILL BE LOST!** If you have not made an archive of your database do so before proceeding. Refer to Device configuration and Billing records in Section 4.

- 1) Verify you have a current archive of your programming to prevent loss of data.
- 2) Remove power from the unit.
- 3) Remove the top cover from the unit.
- 4) Locate U22 (behind the Connect switch, middle of the board, on the left side), cut off the tie-wrap (used for shipping purposes only). Remove the battery socket and RAM (in top of the battery socket) from U22.
- 5) Install new battery socket (32 pins) in U22 being careful to align the orientation notch and watch out for bent pins.
- 6) Install new RAM (32 pin) in top of the battery socket in U22 being careful to align the orientation notch and watch out for bent pins.
- 7) Locate U35 (directly behind the connect switch), remove it and set it aside.
- 8) Install the new ASIC in U35 being careful to align the orientation notch and watch out for bent pins.
- 9) Connect a local terminal to the unit and apply power. Enter the program mode, go to the Diagnostic menu and perform a Memory test. Verify that all 16 banks of U22 are tested (a noticeable pause as each bank is tested). If any of the banks appear to have been skipped (no pause as bank is tested) remove power from the unit and look for a bent pin.
- 10) Go back to Main menu and then select options, verify that Call Detail option appears on the list.
- 11) Upload your archived databases into the unit or reprogram the unit.

**Voice Prompts Option (950-9588) Installation**

These installation instructions describe installing the Voice Prompts option (950-9588) into a Model 48-MAX. You should find the following parts included with the kit:

Quantity	Part Number	Description	Location
1	220-0106	#4-40 x 5/16 pan Philips	
1	321-0751	601-0661 (ASIC)	U35
1	415-9433	Voice card insulator	Inside top cover
1	702-9236	Voice Prompts card	J6

This option kit is serial number specific. The invoice should indicate which serial number the kit was ordered for. If you are installing multiple upgrade kits, you will need to match the kits to the units before beginning the upgrades. If the AUX LED slowly flashes, this is the problem.

- 1) Remove power from the unit.
- 2) Remove the top cover from the unit.
- 3) Locate J6 (just to the left of the phone circuits as viewed from the front of the unit).
- 4) Install Voice Card (702-9236) into J6 using the standoff near U11 for support. Secure the card to the standoff with the #4-40 x 5/16 screw.
- 5) On the inside of the top cover, install the insulator above the Voice Card.
- 6) Remove the battery insulator from the Voice Card (702-9236).
- 7) Locate U35 (directly behind the connect switch), remove it and set it aside.
- 8) Install the new ASIC in U35 being careful to align the orientation notch and watch out for bent pins.
- 9) Connect a local terminal to the unit's serial port and apply power to the unit. Enter into the program mode, at the Main menu select Options and verify the Voice Prompts option appears on the list.
- 10) Exit the program mode and refer to Voice Prompts in Section 5 of this manual for programming instructions.

## Section 6. Installation

### Dial Click Option (950-9589) Installation

These installation instructions describe installing the Dial Click option (950-9589) into a Model 48-MAX. You should find the following parts included with the kit:

Quantity	Part Number	Description	Location
1	220-0106	#4-40 x 5/16 pan Philips	
1	321-0751	601-0661 (ASIC)	U35
1	702-9242	Dial Click card	J7

This option kit is serial number specific. The invoice should indicate which serial number the kit was ordered for. If you are installing multiple upgrade kit, you will need to match the kits to the units before beginning the upgrades. If the AUX LED slowly flashes, this is the problem.

- 1) Remove power from the unit.
- 2) Remove the top cover from the unit.
- 3) Locate J7 (between the AUX and TRANSMIT LEDs) on the main board.
- 4) Install the Dial Click card (702-9242) into J7 using the standoff on the other side of the POWER LED for support. Secure the card to the standoff with the #4-40 x 5/16 screw.
- 5) Locate U35 (directly behind the connect switch), remove it and set it aside.
- 6) Install new the ASIC in U35 being careful to align the orientation notch and watch out for bent pins.
- 7) Connect a local terminal to the unit's serial port and apply power to the unit. Enter the program mode, at the Main menu select Options and verify that the Dial Click decode option appears on the list.
- 8) From the Main menu, select the Diagnostic menu. Select the item for the Dial Click decode test. If an error tone is given when you try to select this item, remove power from the unit and try re-installing the card (the software cannot find it).

Refer to the Dial Click adjustments under the Installation procedure in this section to complete the installation.



## 7. REPAIR

MODEL 4X-MAX AUDIO BLOCK DIAGRAM (006-0075A) .....	7-2
MODEL 4X-MAX CONTROL BOARD (702-9710D) .....	7-3
Parts List .....	7-3
Schematic .....	7-9
Silkscreen .....	7-14
MODEL 4XB VOICE CARD (702-9236F) .....	7-15
Parts List .....	7-15
Schematic .....	7-17
Silkscreen .....	7-18
MODEL 4XB DIAL CLICK BOARD (702-9242E) .....	7-19
Parts List .....	7-19
Schematic .....	7-21
Silkscreen .....	7-22

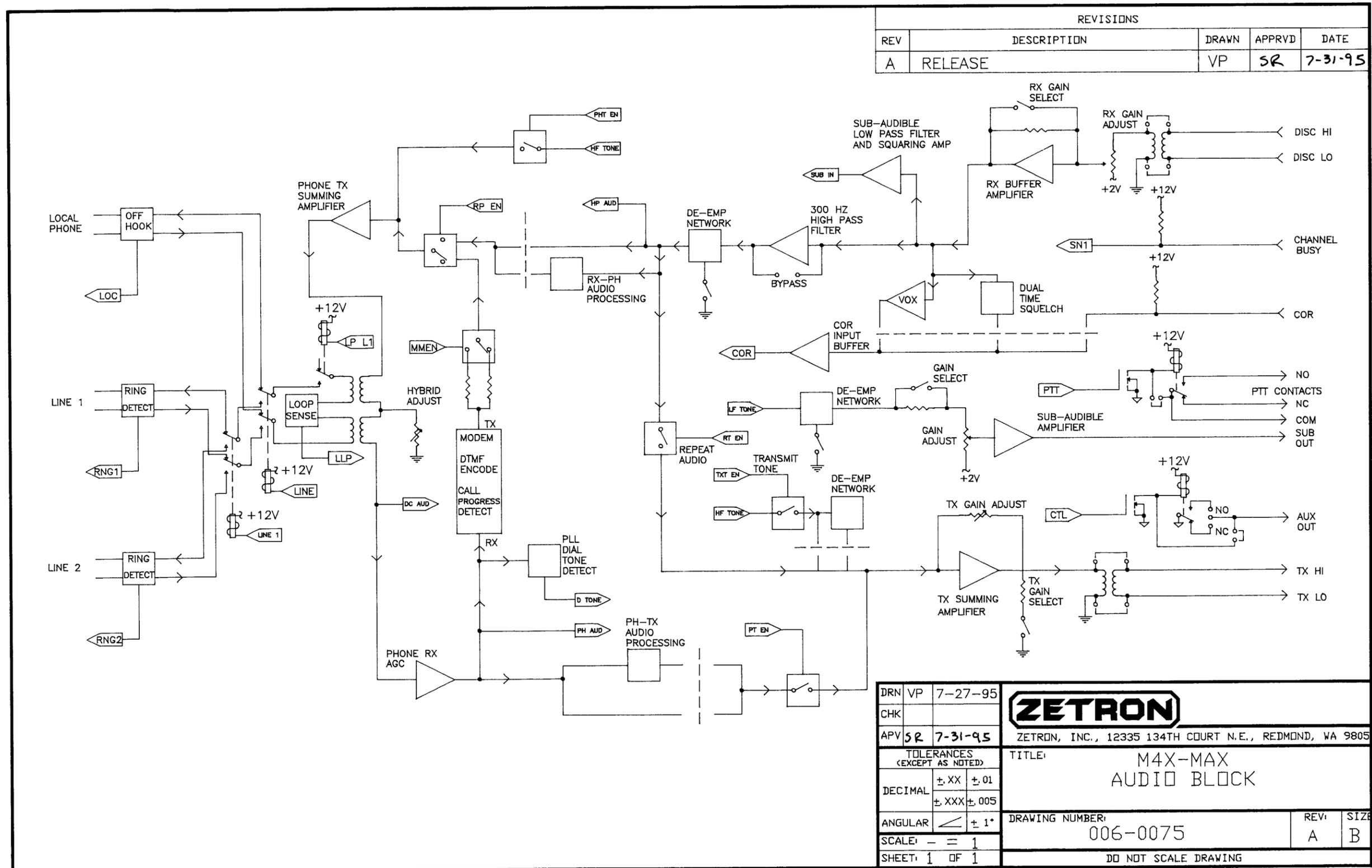
## **7. REPAIR**

In case of installation difficulty, call Zetron Model 48-MAX Applications Engineering Department at (425) 820-6363. 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-MAX Service Department at (425) 820-6363. If the call is made from the installation site by a radio technician, and a spare parts kit is on hand, the problem can usually be solved over the phone. If a determination is made that a problem cannot be resolved in the field, the unit can be return to Zetron for servicing with a RMA number.

Units return to Zetron for servicing must be accompanied with an Return Material Authorization number (RMA #). This can be obtained by calling Zetron Applications at (425) 820-6363, at which time the nature of the problem can be reported. A quote will also be given based on the current lead time for repairs by the Service Department.

MODEL 4X-MAX AUDIO BLOCK DIAGRAM (006-0075A)



REVISIONS				
REV	DESCRIPTION	DRAWN	APPRVD	DATE
A	RELEASE	VP	SR	7-31-95

DRN	VP	7-27-95	<b>ZETRON</b>	ZETRON, INC., 12335 134TH COURT N.E., REDMOND, WA 98052	
CHK				TITLE: M4X-MAX AUDIO BLOCK	
APV	SR	7-31-95	TOLERANCES (EXCEPT AS NOTED)		DRAWING NUMBER: 006-0075
DECIMAL			±.XX	±.01	REV: A
			±.XXX	±.005	SIZE: B
ANGULAR			± 1°		
SCALE: - = 1			DO NOT SCALE DRAWING		
SHEET: 1 OF 1					

# MODEL 4X-MAX CONTROL BOARD (702-9710D)

## Parts List

LEGEND:

# = NOT INSTALLED

^ = INSTALLED ON HIGHER ASSY

+ = OPTION (INSTALLED PER CUSTOMER ORDER)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
1	1	R18	101-0033	RESISTOR, 22 OHM, 1/4W, 5%, CARBON FILM	22
2	5	R45,R46,R49,R77,R88	101-0047	RESISTOR, 47 OHM, 1/4W, 5%, CARBON FILM	47
3	3	R83,R131,R169	101-0049	RESISTOR, 100 OHM, 1/4W, 5%, CARBON FILM	100
4	1	R107	101-0051	RESISTOR, 120 OHM, 1/4W, 5%, CARBON FILM	120
5	12	R1,R2,R3,R48,R138,R183, R184,R185,R186,R187,R188, R189	101-0057	RESISTOR, 220 OHM, 1/4W, 5%, CARBON FILM	220
6	1	R95	101-0059	RESISTOR, 270 OHM, 1/4W, 5%, CARBON FILM	270
7	2	R191,R190	101-0061	RESISTOR, 330 OHM, 1/4W, 5%, CARBON FILM	330
8	1	R93	101-0065	RESISTOR, 470 OHM, 1/4W, 5%, CARBON FILM	470
9	12	R28,R32,R36,R37,R39,R40#, R78,R89,R90,R111,R132, R134,R167	101-0066	RESISTOR, 510 OHM, 1/4W, 5%, CARBON FILM	510
10	1	R108	101-0067	RESISTOR, 560 OHM, 1/4W, 5%, CARBON FILM	560
11	0	R79#	101-0069	RESISTOR, 680 OHM, 1/4W, 5%, CARBON FILM	680
12	18	R8,R13,R19,R23,R62,R82, R100,R106,R125,R130#, R143,R144,R153,R164,R168, R171,R179,R182,R192	101-0073	RESISTOR, 1.0K OHM, 1/4W, 5%, CARBON FILM	1.0K
13	1	R21	101-0074	RESISTOR, 1.2K OHM, 1/4W, 5%, CARBON FILM	1.2K
14	3	R65,R69,R86,R124#	101-0075	RESISTOR, 1.5K OHM, 1/4W, 5%, CARBON FILM	1.5K
15	7	R9,R12,R50,R52,R61,R84, R110	101-0081	RESISTOR, 2.2K OHM, 1/4W, 5%, CARBON FILM	2.2K
16	1	R154	101-0083	RESISTOR, 2.7K OHM, 1/4W, 5%, CARBON FILM	2.7K
17	3	R103,R140,R142	101-0085	RESISTOR, 3.3K OHM, 1/4W, 5%, CARBON FILM	3.3K
18	2	R177,R68	101-0087	RESISTOR, 3.9K OHM, 1/4W, 5%, CARBON FILM	3.9K
19	8	R5,R16,R17,R29,R33,R56, R98,R135	101-0089	RESISTOR, 4.7K OHM, 1/4W, 5%, CARBON FILM	4.7K
20	1	R129	101-0090	RESISTOR, 5.1K OHM, 1/4W, 5%, CARBON FILM	5.1K
21	1	R92	101-0094	RESISTOR, 7.5K OHM, 1/4W, 5%, CARBON FILM	7.5K
22	12	R25,R58,R72,R73,R74,R94, R123,R151,R152,R159,R160, R173	101-0097	RESISTOR, 10K OHM, 1/4W, 5%, CARBON FILM	10K
23	2	R87,R85	101-0099	RESISTOR, 12K OHM, 1/4W, 5%, CARBON FILM	12K
24	1	R158	101-0100	RESISTOR, 13K OHM, 1/4W, 5%, CARBON FILM	13K
25	3	R81,R136,R181	101-0101	RESISTOR, 15K OHM, 1/4W, 5%, CARBON FILM	15K
26	1	R156	101-0102	RESISTOR, 16K OHM, 1/4W, 5%, CARBON FILM	16K
27	2	R127,R128	101-0103	RESISTOR, 18K OHM, 1/4W, 5%, CARBON FILM	18K
28	3	R112,R113,R155	101-0104	RESISTOR, 20K OHM, 1/4W, 5%, CARBON FILM	20K
29	6	R20,R57,R122,R157,R162, R166	101-0105	RESISTOR, 22K OHM, 1/4W, 5%, CARBON FILM	22K
30	1	R165	101-0106	RESISTOR, 24K OHM, 1/4W, 5%, CARBON FILM	24K
31	1	R145	101-0107	RESISTOR, 27K OHM, 1/4W, 5%, CARBON FILM	27K
32	1	R114	101-0108	RESISTOR, 30K OHM, 1/4W, 5%, CARBON FILM	30K
33	7	R22,R137,R139,R172,R174, R178,R195	101-0109	RESISTOR, 33K OHM, 1/4W, 5%, CARBON FILM	33K

## Section 7. Repair

### MODEL 4X-MAX CONTROL BOARD (702-9710D)

#### Parts List (Continued)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
34	4	R7,R11,R15,R163	101-0111	RESISTOR, 39K OHM, 1/4W, 5%, CARBON FILM	39K
35	12	R4,R43,R44,R66,R67,R70, R71,R105,R147,R148,R170, R175	101-0113	RESISTOR, 47K OHM, 1/4W, 5%, CARBON FILM	47K
36	2	R180,R96	101-0115	RESISTOR, 56K OHM, 1/4W, 5%, CARBON FILM	56K
37	5	R6,R10,R14,R161,R194	101-0117	RESISTOR, 68K OHM, 1/4W, 5%, CARBON FILM	68K
38	1	R38	101-0118	RESISTOR, 75K OHM, 1/4W, 5%, CARBON FILM	75K
39	1	R133	101-0119	RESISTOR, 82K OHM, 1/4W, 5%, CARBON FILM	82K
40	10	R41,R42,R64,R75,R76,R99, R102,R149,R176,R193	101-0121	RESISTOR, 100K OHM, 1/4W, 5%, CARBON FILM	100K
41	1	R80	101-0123	RESISTOR, 120K OHM, 1/4W, 5%, CARBON FILM	120K
42	1	R24	101-0129	RESISTOR, 220K OHM, 1/4W, 5%, CARBON FILM	220K
43	3	R27,R55,R91	101-0131	RESISTOR, 270K OHM, 1/4W, 5%, CARBON FILM	270K
44	1	R141	101-0133	RESISTOR, 330K OHM, 1/4W, 5%, CARBON FILM	330K
45	2	R26,R126	101-0137	RESISTOR, 470K OHM, 1/4W, 5%, CARBON FILM	470K
46	3	R97,R101,R150	101-0145	RESISTOR, 1.0M OHM, 1/4W, 5%, CARBON FILM	1.0M
47	1	R109	101-0148	RESISTOR, 2.0M OHM, 1/4W, 5%, CARBON FILM	2.0M
48	1	R146	101-0150	RESISTOR, 2.7M OHM, 1/4W, 5%, CARBON FILM	2.7M
49	1	R104	101-0160	RESISTOR, 10M OHM, 1/4W, 5%, CARBON FILM	10M
50	1	R47	102-0471	RESISTOR, 470 OHM, 1/2W, 5%, CARBON FILM	470 1/2W
51	2	RV2,RV1	105-0001	VARISTOR, 250VAC, 70J	250VAC
52	4	R30,R31,R34,R35	106-0047	RESISTOR, FUSIBLE, 4.7 OHM, 1/2W, 5%	4.7-1/2F
53	1	R54	106-0115	RESISTOR, 15 OHM 1/2W 5% FUSING RESISTOR	15-1/2F
54	2	R53,R51	106-2231	RESISTOR, 22K 1/2W 5% FLAME RESISTANT	22K-1/2FP
55	1	R117	107-0501	POT, 5K OHM, 1 TURN	5K
56	6	R59,R60,R63,R116,R119, R121	107-0502	POT, 50KOHM, 1 TURN	50K
57	2	R115,R118#,R120	107-3085	POT, 10K OHM, 1 TURN	10K
58	1	RP4	119-0005	R-NETWORK, 3.3K OHM x 9, BUSSED, 10-PIN SIP	3.3K
59	1	RP3	119-0008	R-NETWORK, 10K OHM x 7, BUSSED, 8-PIN SIP	10K
60	1	RP2	119-0025	R-NETWORK, 10K OHM x 4, ISOLATED, 8-PIN SIP	10K
61	1	RP1	119-0026	R-NETWORK, 2K OHM x 4, ISOLATED, 8-PIN SIP	2K
62	2	C12,C13	150-0096	CAPACITOR, 1000pF, 1KV, 10%, CERAMIC DISC, Y5P	.001 1KV
63	5	C7,C8,C9,C10,C11	150-0471	CAPACITOR, 470pF, 3KV, 10%, CERAMIC DISC, Y5P	470pF 3KV
64	2	CX1	151-0020	CAPACITOR, .001UF, 100V, 10%, CERAMIC X7R	.001
		CX2			
				<b>NOTE 12</b>	
65	6	C86,C87,C114,C115,C139, C140	151-0022	CAPACITOR, 22pF, 100V, 10%, CERAMIC NPO	22pF
66	2	C117,C65	151-0047	CAPACITOR, 470pF, 100V, 10%, CERAMIC NPO	470pF
67	1	C41	151-0080	CAPACITOR, .0022UF, 100V, 10%, CERAMIC X7R	.0022
68	1	C141	151-0085	CAPACITOR, .22UF, 50V, 20%, CERAMIC Z5U	.22
69	5	C54,C55,C94,C124,C128	151-0120	CAPACITOR, .01UF, 50V, 10%, CERAMIC X7R	.01
70	42	C1,C3,C4,C5,C6,C14,C15, C24,C25,C30,C40,C42,C44, C57,C58,C59,C60,C61,C64, C66,C68,C71,C72,C73,C74, C84,C85,C88,C91,C92,C93, C96,C97,C99,C101,C110, C111,C112,C118,C119,C121, C123	151-0180	CAPACITOR, .1UF, 50V, 20%, CERAMIC Z5U	.1
71	1	C95	151-0181	CAPACITOR, .1UF, 50V, 10%, CERAMIC X7R	.1

## MODEL 4X-MAX CONTROL BOARD (702-9710D)

## Parts List (Continued)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
72	3	C77,C79,C125	<b>NOTE 14</b> 151-0199	CAPACITOR, .47uF, 50V, 5%, POLYESTER	.47
73	9	C51,C75,C103,C108,C109, C116,C122,C132,C138	152-0012	CAPACITOR, .1uF, 50V, 5%, POLYESTER	.1
74	2	C34,C35	152-0021	CAPACITOR, .47uF, 250V, 10%, POLYESTER	.47 250V
75	1	C47	152-0033	CAPACITOR, 3.3uF, 50V, 20%, NON-POLAR ELECTROLYTIC, RADIAL	3.3
76	1	C48	152-0040	CAPACITOR, 4.7uF, 50V, 20%, NON-POLAR ELECTROLYTIC, AXIAL	4.7
77	4	C31,C33,C83,C104	152-0080	CAPACITOR, .22uF, 50V, 5%, POLYESTER	.22 50V
78	10	C21,C37,C38,C67,C76,C102, C134,C135,C137,C144	152-0085	CAPACITOR, .01uF, 50V, 5%, POLYESTER	.01
79	9	C20,C22,C36,C81,C82,C120, C129,C133,C136	152-0089	CAPACITOR, .001uF, 50V, 5%, POLYESTER	.001
80	1	C45	152-0224	CAPACITOR, 0.22uF, 630VDC, 10%, POLYESTER, 945V SURGE	0.22K 630V
81	3	C80,C100,C105	152-0250	CAPACITOR, .047uF, 50V, 5%, POLYESTER	.047
82	2	C106,C142	154-0022	CAPACITOR, 22uF, 16V, 10%, TANTALUM	22 TANT
83	3	C56,C69,C78	154-0025	CAPACITOR, 1uF, 35V, 10%, TANTALUM	1 TANT
84	2	C62,C63	154-0035	CAPACITOR, 2.2uF, 25V, 10%, TANTALUM	2.2 TANT
85	2	C50,C49	154-0050	CAPACITOR, 4.7uF, 16V, 10%, TANTALUM	4.7 TANT
86	17	C2,C16,C17,C18,C19,C26, C27,C28,C29,C32,C98,C107, C113,C126,C127,C130,C143	<b>NOTE 13</b> 155-0015	CAPACITOR, 2.2uF, 100V, 20%, AXIAL, ALUMINUM ELECTROLYTIC	2.2
87	2	C131,C70	155-0052	CAPACITOR, 10uF, 35V, 20%, RADIAL, ALUMINUM ELECTROLYTIC	10
88	2	C23,C43	155-0077	CAPACITOR, 100uF, 25V, 20%, RADIAL, ALUMINUM ELECTROLYTIC	100
89	3	C52,C53,C90	155-0083	CAPACITOR, 470uF, 10V, RADIAL, ALUMINUM ELECTROLYTIC	470 10V
90	1	C89	155-0120	CAPACITOR, 2200uF, 25V, +-20%, AXIAL, ALUMINUM ELECTROLYTIC	2200 25V
91	1	C46	155-0140	CAPACITOR, 3300uF, 25V, +50%/-10%, AXIAL, ALUMINUM ELECTROLYTIC	3300 25V
92	1	C39	305-0001	BEAD, 3B FERRITE, W/LEADS	
93	2	E4,E5	305-0306	FILTER, EMI, .01 Z5U, 100V 6A MAX	.01 Z5U
94	14	E1,E2,E3,E6,E7,E8,E9,E10, E11,E12,E13,E14,E15,E16	305-0600	XFMR, 600:600 DRY TELCO, 1500 VAC HIPOT	
95	0	T1#,T2#	305-1540	XFMR, TELCO HYBRID, SMALL SIZE	
96	1	T3	311-0011	LED, RED, FLUSH	
97	10	DS1,DS2,DS3,DS4,DS5,DS6, DS7,DS8,DS9,DS10	311-0012	LED, GREEN, FLUSH	
98	1	DS11	311-1001	OPTO ISOLATOR, BI-POLAR	H11AA1
99	3	U8,U17,U18	316-0004	SWITCH-CAP FILTER, 4-POLE LOW-PASS	MF4
100	3	U3,U4,U5	316-0232	IC, RS232 DRIVER +5V CMOS, 2KV ESD TEST	232
101	1	U1	316-0324	IC, OP-AMP, BIPOLAR, 358 EQUIVALENT, QUAD	324
102	3	U7,U21,U43	316-0358	IC, OP-AMP, BIPOLAR, DUAL	358
103	4	U19,U20,U39,U42	316-0567	PLL, TONE DECODER	567
104	1	U41	316-3307	IC, OP-AMP, LOW BIAS CURRENT, DUAL	34072M
105	2	U40,U33	316-7805	REGULATOR, +5V, 1.5A	7805
106	2	VR1,VR2	321-0204	IC, RECEIVER, DIMF	75T204
107	1	U36	321-0224	IC, MODEM, 2400 BAUD, SINGLE CHIP MODEM	73K224
108	1	U31	321-0751	ASIC 001	
109	1	U35	<b>NOTE 6</b> 321-1001	IC, SRAM, 128K x 8, 100ns, 50uA, 0 TO 70C	128Kx8 SRAM
110	0	U22	<b>NOTE 3</b> 321-6812	IC, MICRO, W/EEPROM	68HC11A1
111	1	U26	<b>NOTE 2</b> 321-6840	PROGRAMMABLE TIMER MODULE, 0-70C, 2MHZ	68B40
112	2	U10,U14	<b>NOTE 7</b> 321-8256	IC, SRAM, 32K x 8, 100ns, 50uA, 0 TO 70C	32Kx8
113	0	U13	<b>NOTE 6</b> 322-7256	IC, EPROM, CMOS, 32K x 8, 250ns	27C256 EPROM
114	1	U9	<b>NOTE 6</b> 322-7512	IC, EPROM, 64K x 8, 120ns	27C512
115	1	U2	<b>NOTE 6</b>		

## Section 7. Repair

### MODEL 4X-MAX CONTROL BOARD (702-9710D)

#### Parts List (Continued)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
116	1	U32	323-4053	ANALOG SWITCH, TRIPLE SPDT	4053
117	1	U38	323-4066	QUAD ANALOG SWITCH	4066
118	3	U15,U16,U25	324-4138	DECODER 1 OF 8	74HC138
119	1	U24	324-4139	DUAL 2-4 IN DECODER	74HC139
120	3	U6,U23,U27	324-4259	LATCH, 8 BIT ADDRESSABLE	74HC259
121	1	U30	324-4373	OCTAL LATCH	74HC373
122	1	U11	324-7400	IC,NAND, HC, QUAD	74HC00
123	1	U37	324-7414	IC, HEX SCHMIDT, MOTOROLA THRESHOLDS	74HC14
124	1	U29	324-7474	IC, FLIPFLOP, D, HC, DUAL	74HC74
125	2	U34,U28	325-4374	74HCT374	
126	1	Q3	340-0172	XSTR, PNP, 3A, 80V, BETA>30, 12.5W, TO-126	MJE172
127	1	Q4	340-0182	XSTR, NPN, 3A, 80V, BETA>30, 12.5W, TO-126	MJE182
128	1	U12	340-2003	RELAY DRIVER 50V/.5A	2003
129	1	Q19	340-3821	XSTR, JFET, N-CHANNEL, FOR 2V BIAS AGC	MPF3821
130	10	Q1,Q7,Q9,Q10,Q11,Q12,Q13, Q14,Q15,Q16	340-3904	XSTR, NPN, 40V/200MA, TO92	2N3904
131	1	Q20	340-3906	XSTR, PNP, 40V/200MA, TO92	2N3906
132	1	Q8	340-5460	XSTR, JFET, P-CHAN, 40V, 5MA, TO92 PKG	2N5460
133	5	Q2,Q5,Q6,Q17,Q18	340-7000	XSTR, MOSFET, N-CHANNEL, 60V/ 0.2A, 5 OHMS, TO-92	2N7000
134	4	CR8,CR9,CR14,CR15	342-0001	DIODE, SILICON, 1A, 100V	1N4002
135	1	CR4	342-0103	DIODE, SCHOTTKY, 0.37V @ 1MA TYP	SD103A
136	9	CR1,CR2,CR3,CR5,CR6,CR18, CR19,CR20,CR21	342-3009	DIODE, SILICON, 100V, 250MW	1N4148
137	4	CR10,CR11,CR12,CR13	342-3011	DIODE, SILICON, 1A ,1000V	1N4007
138	1	CR22	343-3017	DIODE, ZENER, 6.2V, 1/2W, 5%	6.2V 1/2W
139	1	CR7	343-3029	DIODE, 1W 5.1V +-5% MOTOROLA ONLY	5.1V
140	2	CR17,CR16	343-3035	DIODE, ZENER, 12V, 1W, 5%	12V
141	1	SW1	371-0024	SPST RA PWB MNT MOM PB	
142	1	Y2	376-0358	XTAL, 3.579545MHZ, CL=18pF, HC-49	3.58MHZ
143	1	Y1	376-0737	XTAL, 7.3728MHZ, CL=18, 20pF, HC-49	7.3728MHZ
144	1	Y3	376-1106	XTAL, 11.0592MHZ, CL=18pF, HC-49	11.0592MHZ
145	1	Y4	376-1600	XTAL, 16.000 MHZ, CL=18,20pF, HC-49	16.000MHZ
146	0	K2#	380-0001	RELAY, SPDT, 12V, 150K OP@1A, 24VDC	
147	3	K1#,K3,K4,K5	380-0030	RELAY, DPDT MINI-DIP, 12 V COIL	
148	1	J5	401-0059	CONN, 15-POS MALE HEADER, PC-RA 0.200"	
149	2	J2,J3	401-0080	6-PIN LO PRO R/A TELCO	
150	1	J4	401-0239	RJ11, 6 PIN, JACK, PC-RA, FERRITE BLOCK	
151	1	J1	401-0663	CONN, D-SUB, 9-PIN FEMALE, PC-MOUNT R/A, METAL-SHELL	
152	1	P2	401-2648	8-POS MALE .156" CTRS SQR	
153	1	J6	401-6001	10-POS FEMALE	
154	1	J7	401-6005	6-POS FEMALE	
155	0	TP9#	403-0001	1 OF 401-0052	
156	1	JP4#,JP5#,JP6#,JP7#,JP8#, JP9#,JP10#,JP11#,JP12#, JP13#,JP17#,JP18#,JP19#, JP20#,JP28	403-0002	2 OF 401-0052	
157	9	JP1,JP2,JP15#,JP22,JP23, JP24,JP25,JP26,JP27,JP29, JP30#	403-0003	3 OF 401-0052	
158	0	P1#	403-0015	15 OF 401-0052	

## MODEL 4X-MAX CONTROL BOARD (702-9710D)

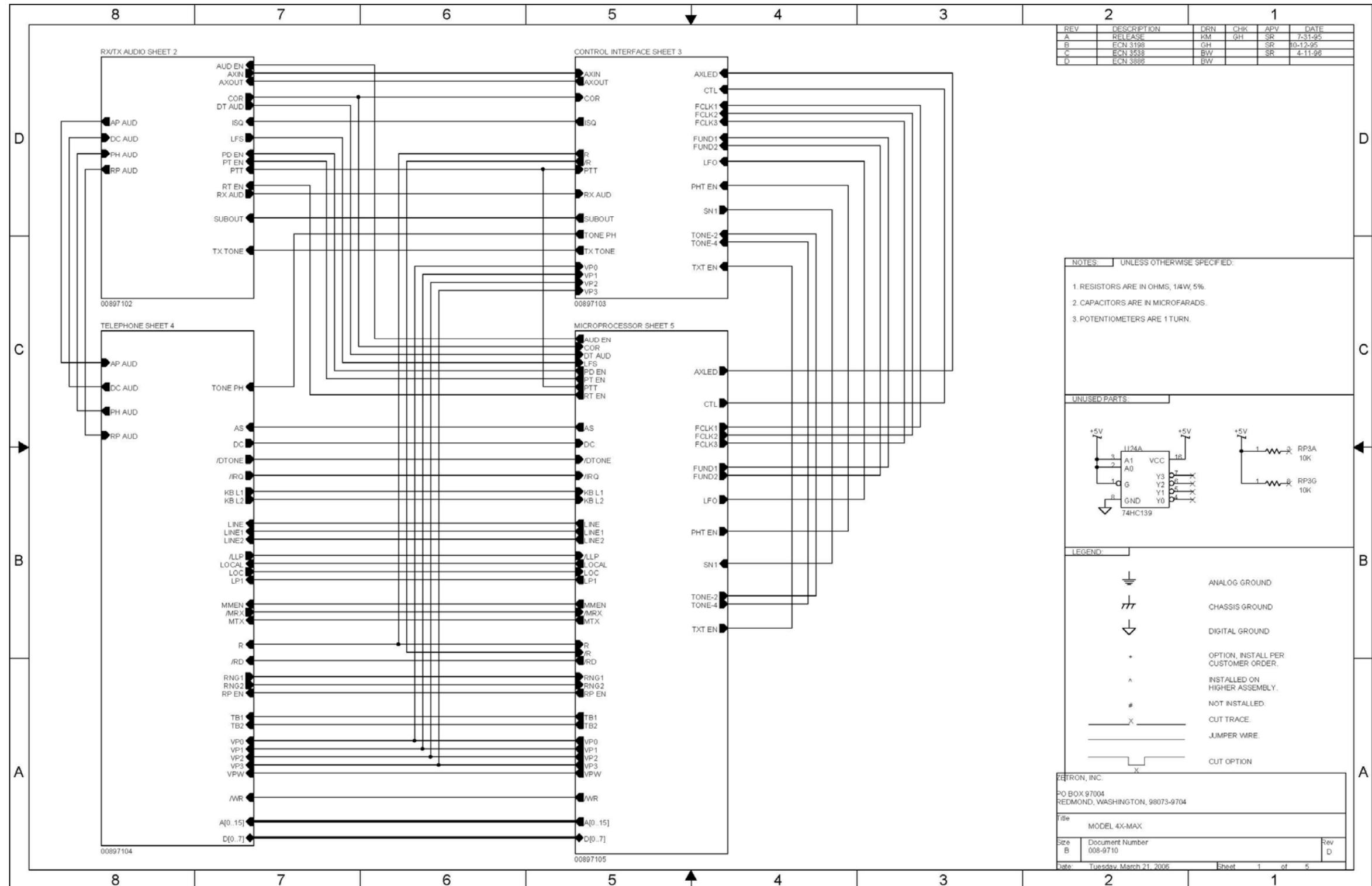
## Parts List (Continued)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	PART REFERENCE
158	0	P1#	403-0015	15 OF 401-0052	
159	1	JP31	403-0202	4 OF 401-0052 [2x2]	
160	2	JP21,JP32	403-0203	6 OF 401-0052 [2x3]	
161	4	TP1#,TP2#,TP3#,TP4,TP5, TP6,TP7,TP8#	404-1001	1 OF 401-1364	
162	1	PB4	404-1008	8 OF 401-1364	
163	2	P3,PA4	404-1010	10 OF 401-1364	
164	2	JP3#,JP14,JP16	408-0001	WIRE JUMPER (24GA WIRE .35)	
165	1	F1	416-1202	FUSE AGC 2A FAST-BLOW	2A
166	5	XVR1,XVR2,STANDOFFS	210-0001	KEPT NUT PLATED	
167	1	XVR1	220-0102	440 X 3/8 PAN PHILLIPS	
168	1	XVR2	220-0108	440X1/4 PAN PHILLIPS	
169	2	<b>NOTE 5</b>	250-0104	STANDOFF, 440 X 1/2, W/STUD	
170	1	<b>NOTE 10</b>	250-0107	STANDOFF, 440 X 7/16, W/STUD	
171	10	XR30,31,34,35,54 <b>NOTE 8</b>	305-0090	BEAD, 4S2 FERRITE, 0-394 SLEEVE, NO LEADS	
172	1	XU13 <b>NOTE 7</b>	321-6264	8K X 8 RAM 150NS (ONS WRITE HOLD)	
173	1	XU22 <b>NOTE 3</b>	321-8256	SRAM, 32K X 8, 100NS, 50UA FROM 0-70C	
174	1	XRV1	381-0010	HEATSINK, TO-220, BLK	
175	14	XJP1,2,22-27,29 (POS A) XJP21 (POS B) XJP31 (POS A & A) XJP32 (POS A & D)	402-3040	MINI JUMPER	
176	3	XU8,17,18	407-0006	SKT, 06 PIN DIP	
177	10	XU3,4,5,19,20,33,39-42	407-0008	SKT, 08 PIN DIP	
178	8	XU7,11,21,29,36-38,43	407-0014	SKT, 14 PIN DIP	
179	10	XU1,6,12,15,16,23,24,25, 27,32	407-0016	SKT, 16 PIN DIP	
180	3	XU28,30,34	407-0020	SKT, 20 PIN DIP	
181	1	XU35	407-0023	SKT, 24 PIN SKINNY DIP	
182	6	XU2,9,10,13,14,31	407-0028	SKT, 28 PIN DIP	
183	1	XU22	407-0032	SKT, 32 PIN DIP	
184	1	XU26	407-0052	SKT, 52 PIN PLCC	
185	1	XJP30 (POS A)	408-0001	WIRE JUMPER	
186	2	XF1	416-3040	FUSE CLIP	
187	10	XDS2-11	417-0010	LED MOUNT RA	
188	1	PCB	410-9710A	MAX MAX CONTROL BOARD	
189	A/R	XRV1	561-0001	THERMAL COMPOUND	

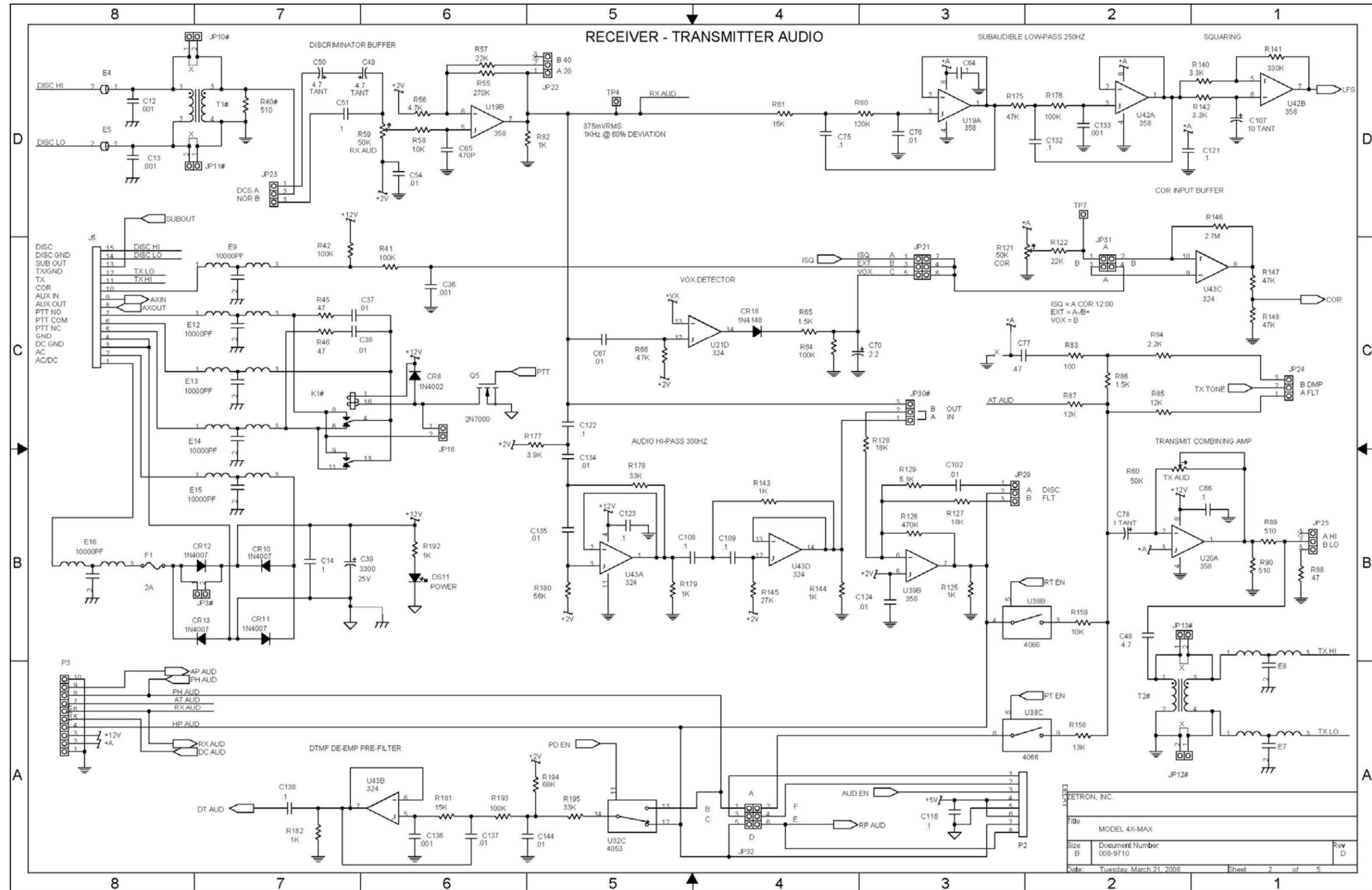
Notes: Notes are for production use only.

MODEL 4X-MAX CONTROL BOARD (008-9710D) Sheet 1 of 5

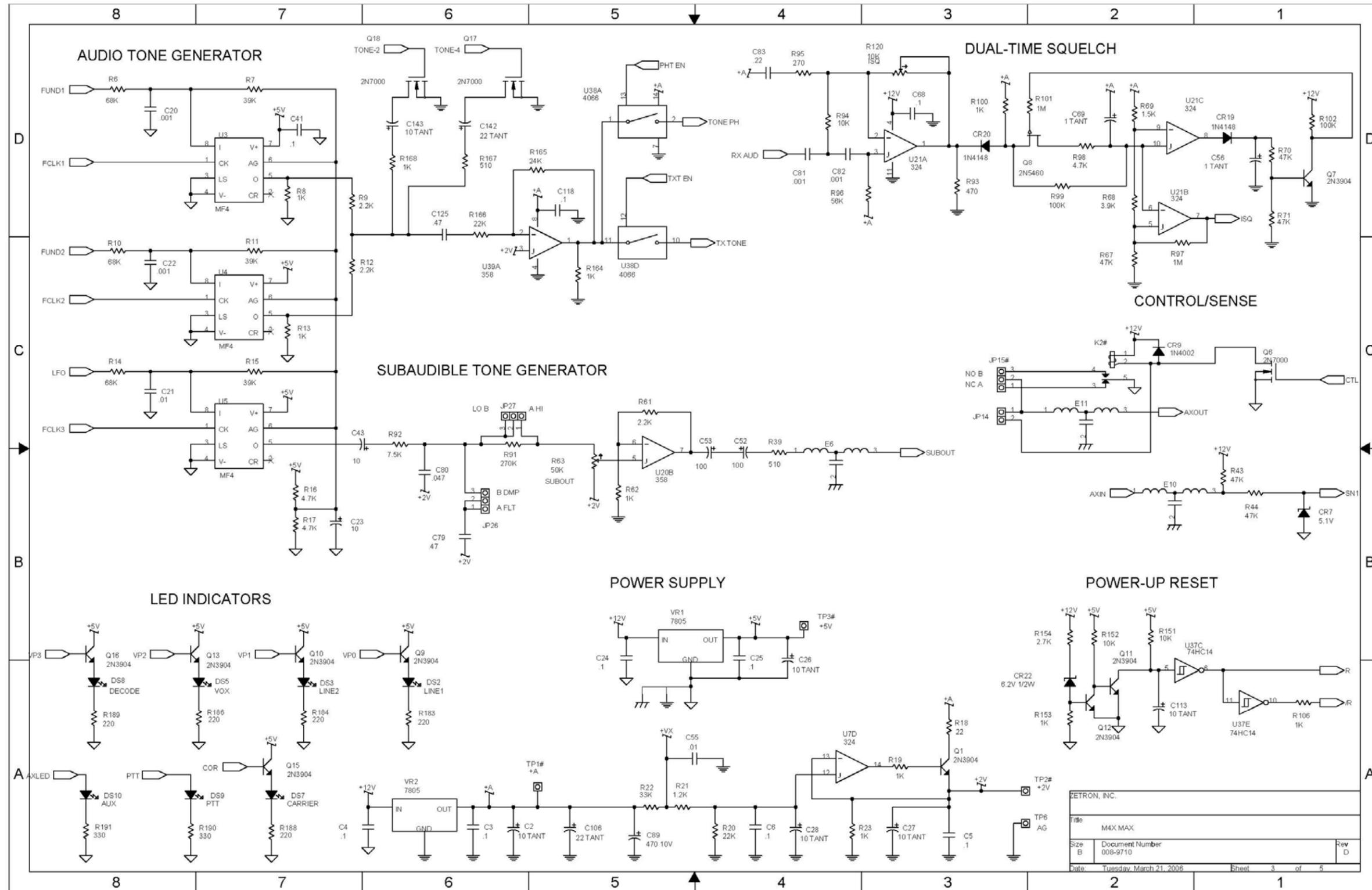
Schematic



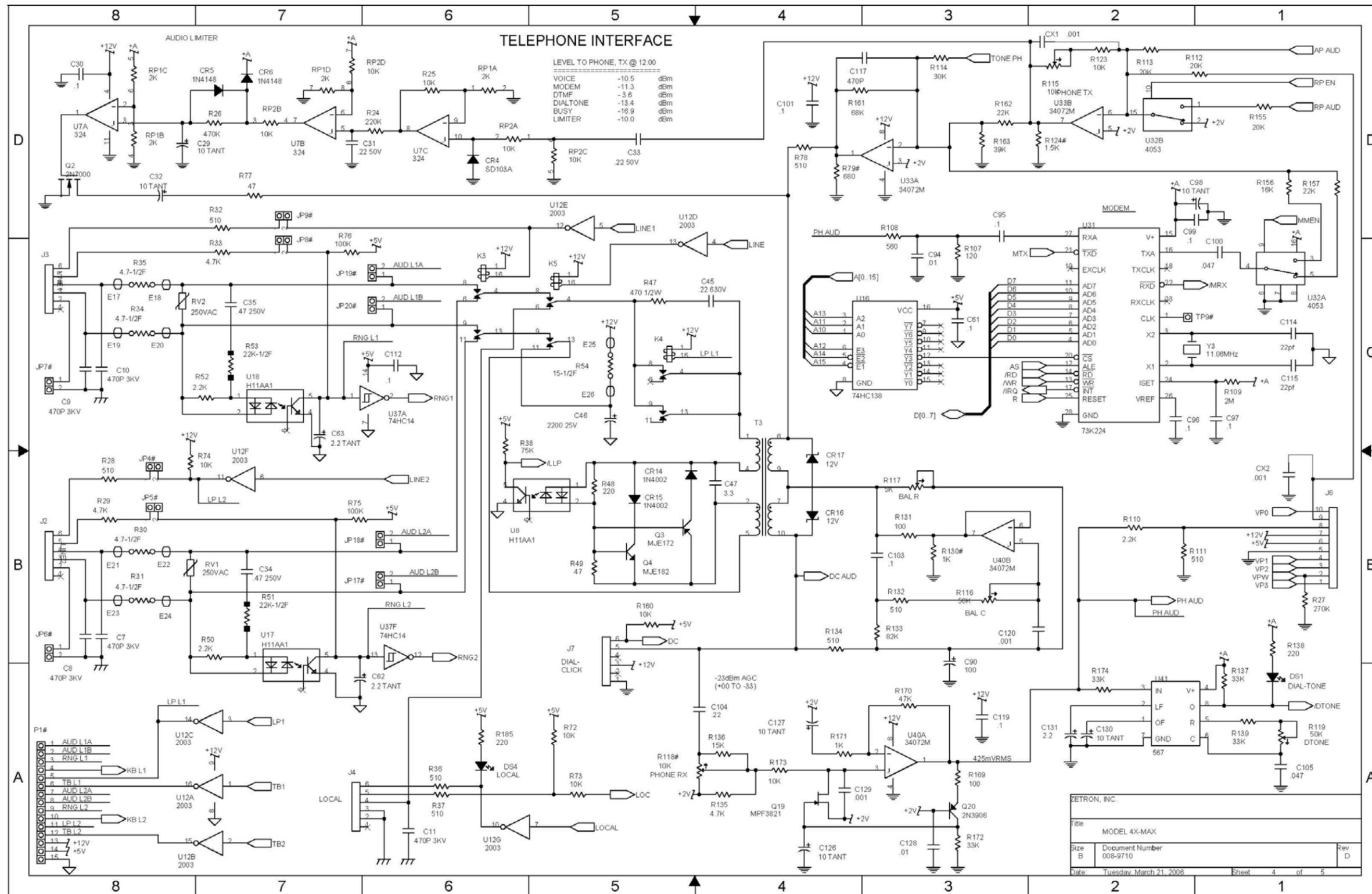
MODEL 4X-MAX CONTROL BOARD SCHEMATIC (008-9710D) Sheet 2 of 5



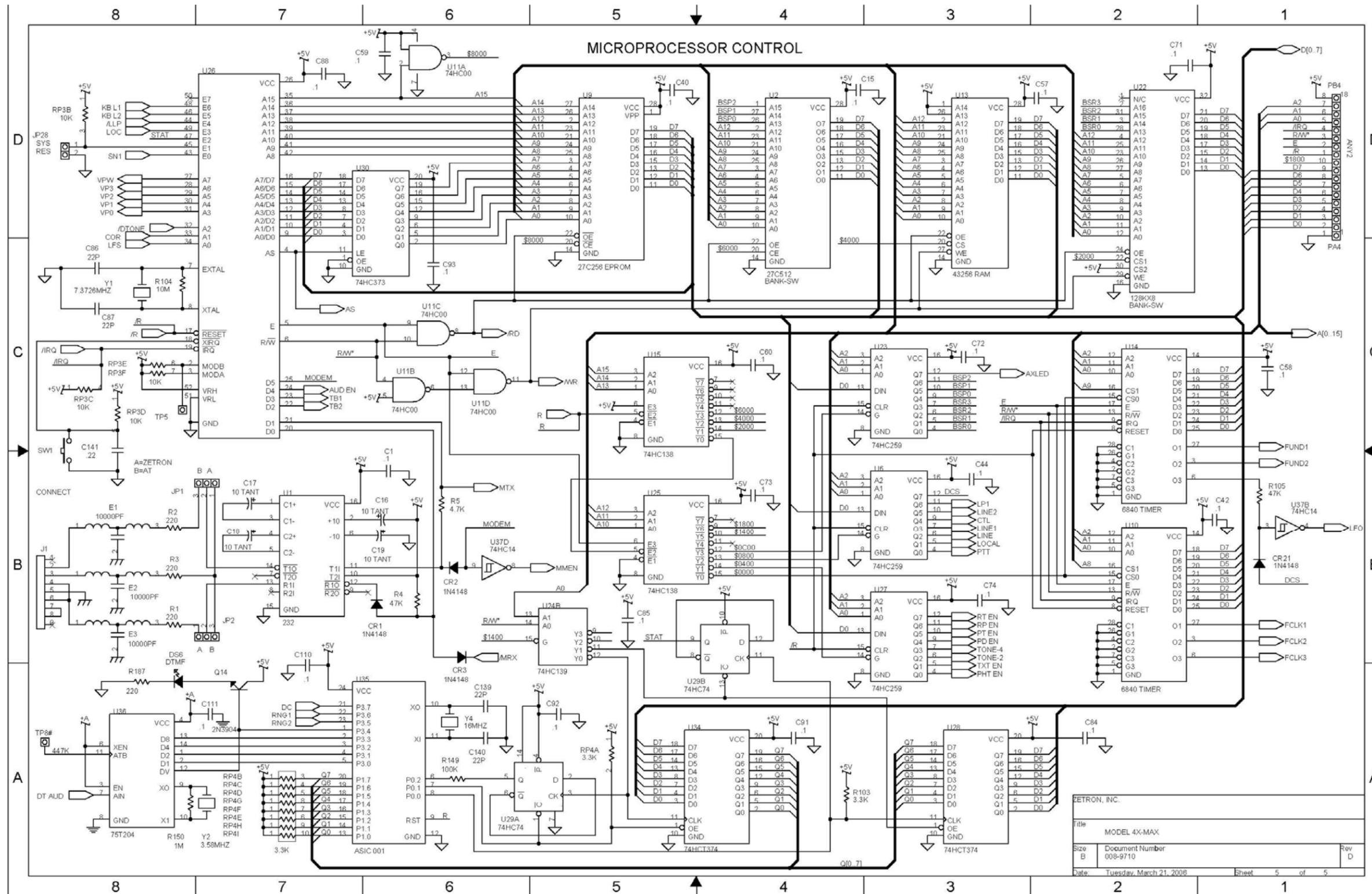
MODEL 4X-MAX CONTROL BOARD SCHEMATIC (008-9710D) Sheet 3 of 5



MODEL 4X-MAX CONTROL BOARD SCHEMATIC (008-9710D) Sheet 4 of 5

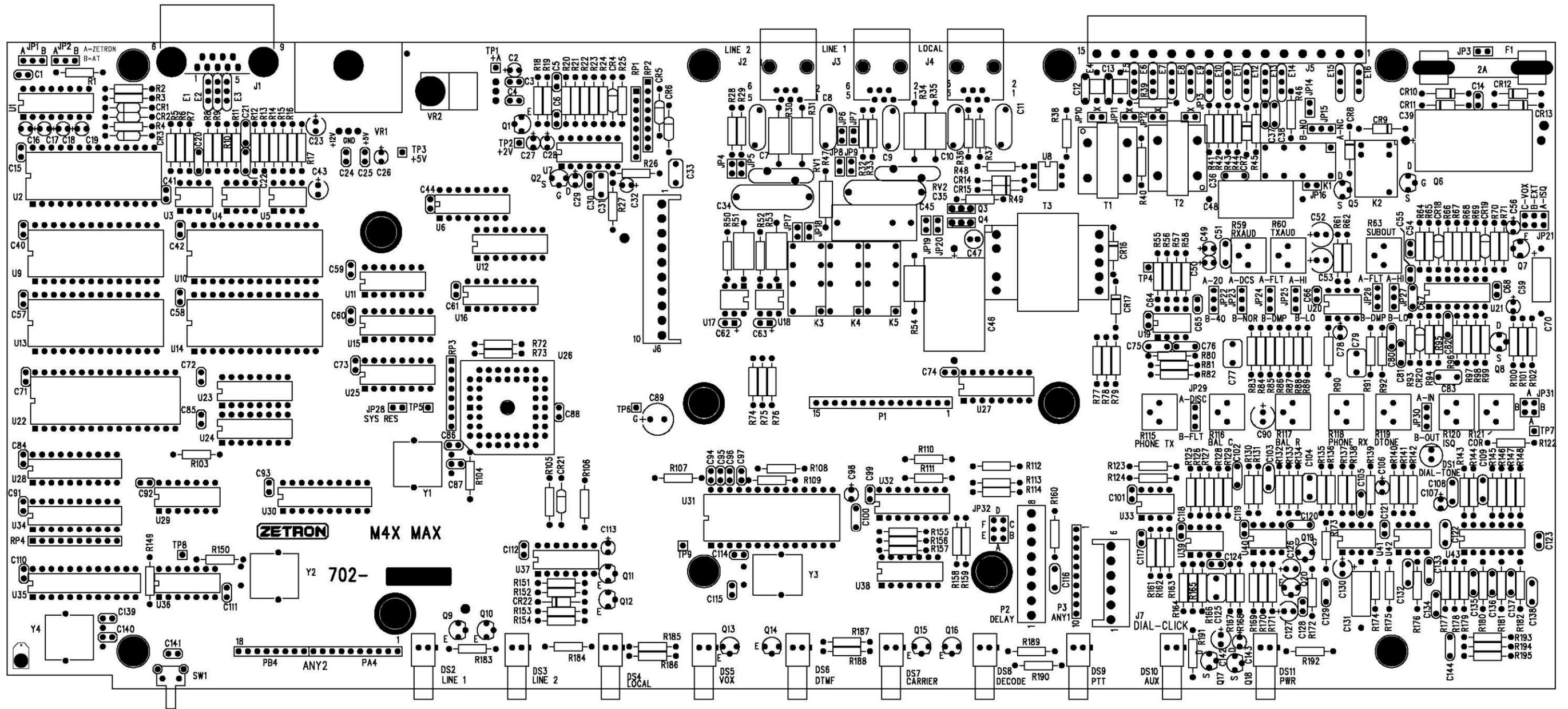


MODEL 4X-MAX CONTROL BOARD SCHEMATIC (008-9710D) Sheet 5 of 5



MODEL 4X-MAX CONTROL BOARD (702-9710D)

Silkscreen



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

## Parts List

LEGEND:

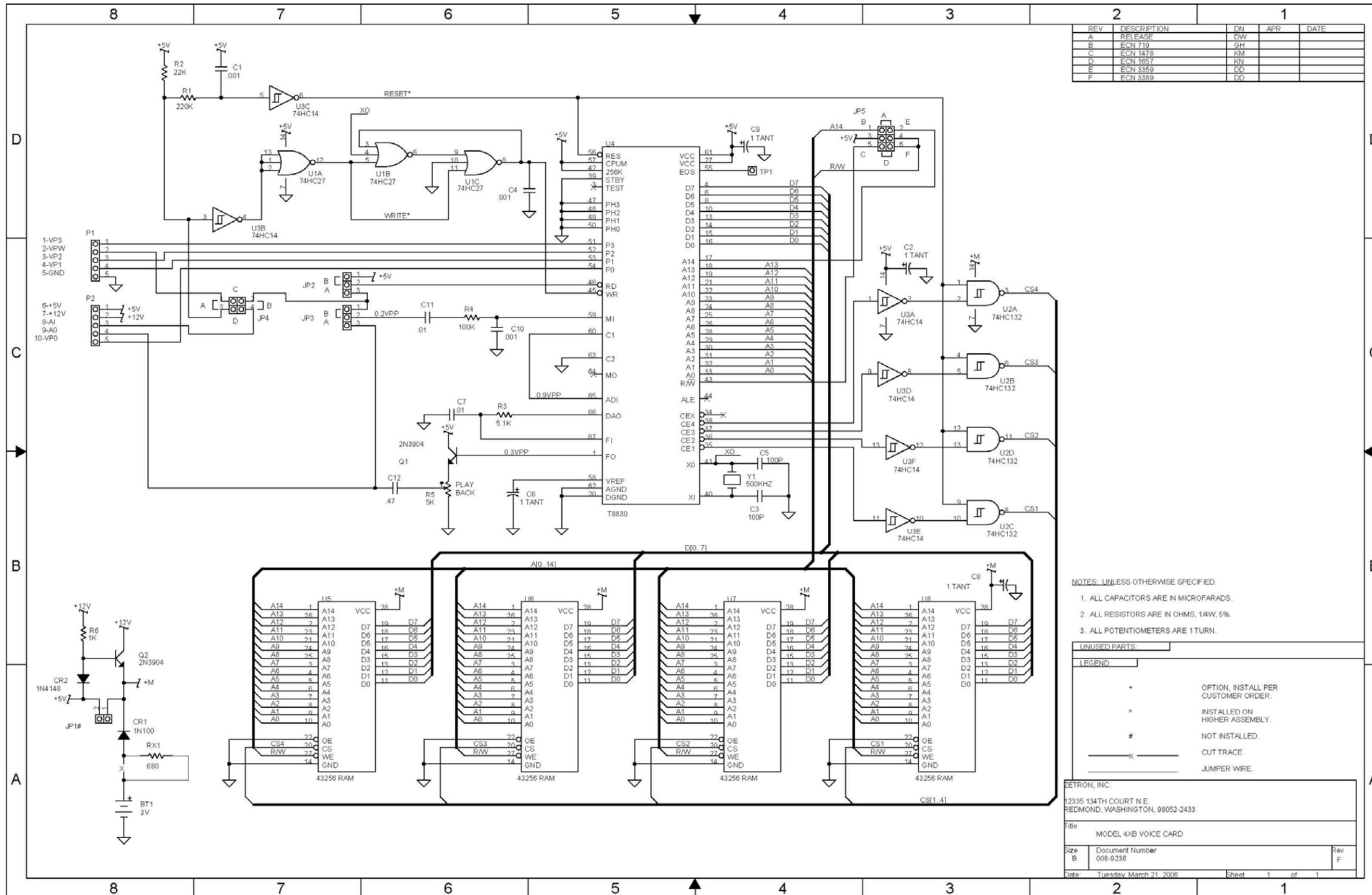
^ = INSTALLED ON HIGHER ASSEMBLY  
 # = NOT INSTALLED  
 + = OPTION, INSTALL PER CUSTOMER ORDER

Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	1	RX1 <b>NOTE 5</b>	101-0069	680 OHM 1/4W 5% CARBON FILM	
2	1	R6	101-0073	1K 1/4W 5% CARBON FILM	
3	1	R3	101-0090	5.1K 1/4W 5% CARBON FILM	
4	1	R2 <b>NOTE 2</b>	101-0105	22K 1/4W 5% CARBON FILM	
5	1	R4	101-0121	100K 1/4W 5% CARBON FILM	
6	1	R1 <b>NOTE 2</b>	101-0129	220K 1/4W 5% CARBON FILM	
7	1	R5	107-0501	5K POT 1 TURN	3386P-1-502
8	2	C3,C5	151-0010	100 PF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C101K
9	1	C12	151-0199	.47 UF 50V +-5% POLYESTER	ECQVIH474JZ
10	2	C7,C11	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-V1H103JZ
11	3	C1 <b>NOTE 2</b> , C4,C10	152-0089	.001 UF 50V +-5% POLYESTER	ECQB1H102JZ
12	4	C2,C6,C8,C9	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
13	4	U5,U6,U7,U8	321-8256	32K X 8 RAM LP	HPD43256-15L
14	1	U4	323-8830	STATIC VOICE REC/PLAY LSI	T8830
15	1	U2	324-4132	QUAD NAND SCHMIDT	MCH74HC132
16	1	U3	324-7414	HEX SCHMIDT	74HC14
17	1	U1	324-7427	TRIPLE 3 INPUT NOR	74HC27
18	2	Q1,Q2	340-3904	NEP 40V/200MA	2N3904
19	1	CR1 <b>NOTES 5,6</b>	342-3008	DIODE, GERMANIUM	1N100
20	1	CR2	342-3009	DIODE, SILICON 100V 250MW	1N4148
21	1	Y1	376-0500	500 KHz CER RESONATOR	CSB500E
22	2	P1,P2 <b>NOTE 1</b>	401-6008	5-POS MALE ROUND	26-51-0051
23	1	TP1	403-0001	1 OF 401-0052	
24	0	JP1#	403-0002	2 OF 401-0052	
25	1	BT1	416-0002	LITH CELL BATT	BR2325
26	1	<b>NOTE 3</b>	251-1240	440X.062 FIBER	
27	3	XU1,XU2,XU3	407-0014	SKT, 14 PIN DIP	
28	4	XU5,XU6,XU7,XU8	407-0028	SKT, 28 PIN DIP	
29	6	XJP2,XJP3 (POS B) XJP4 (POS A & B) XJP5 (POS A & D)	408-0001	WIRE JUMPER	
30	1	PCB	410-9193C.1	VOICE CARD	
31	1	XBT1 <b>NOTE 4</b>	415-9432A	BATTERY INSULATOR	
32	1	XBT1	416-0001	LITH COIN BATT HOLDER	EH906
33	A/R	<b>NOTE 3</b>	561-0010	TAK PAK	

NOTES: Notes are for production use only.

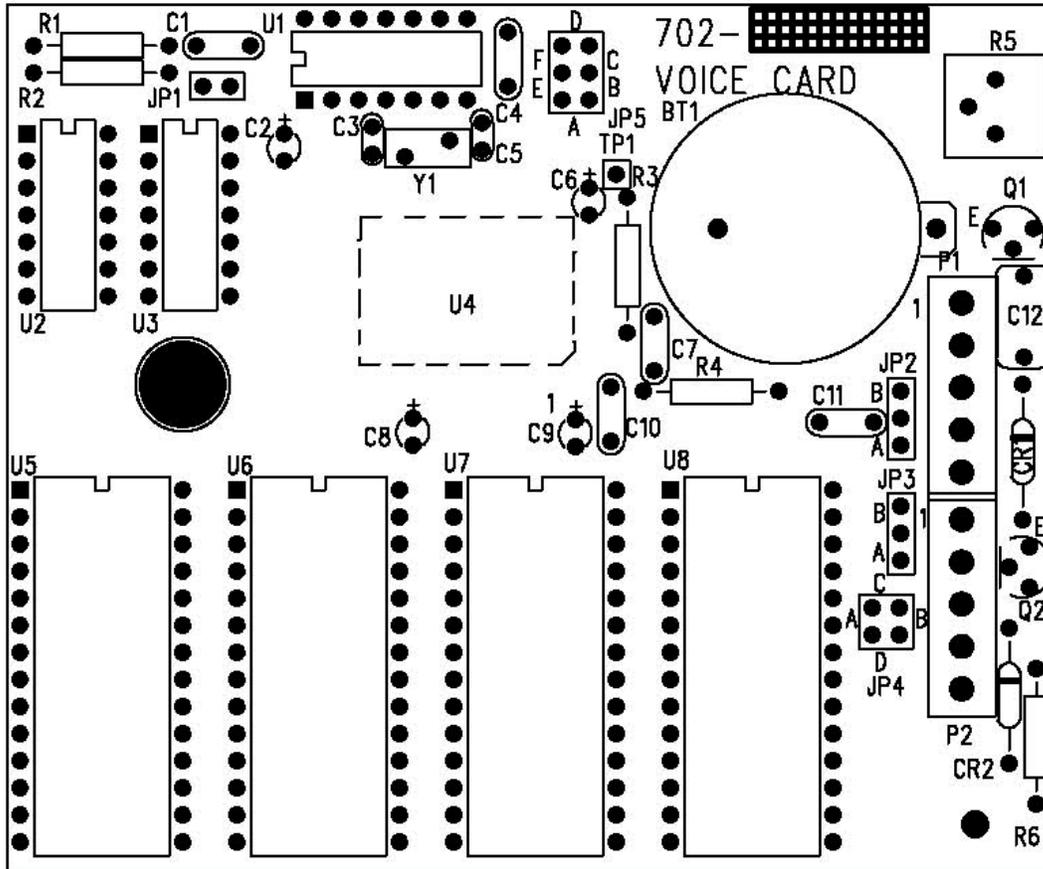
# MODEL 4XB VOICE CARD (008-9236F)

## Schematic



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

## Silkscreen



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

### Parts List

LEGEND:

# = NOT INSTALLED

^ = INSTALLED ON HIGHER ASSY

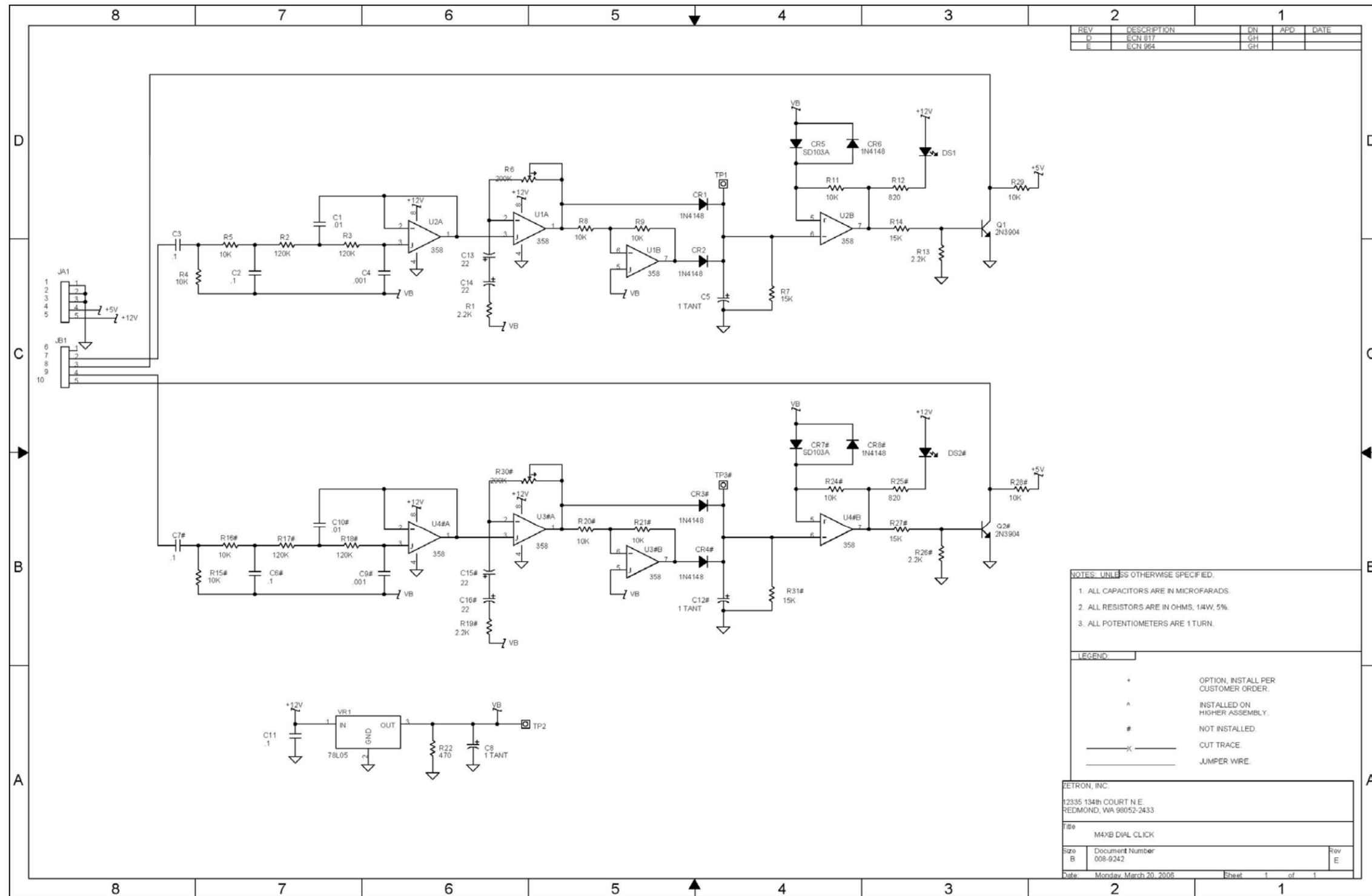
+ = OPTION (INSTALLED PER CUSTOMER ORDER)

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	MANUFACTURE P/N
1	1	R22	101-0065	470 OHM 1/4W 5% CARBON FILM	
2	1	R12,R25#	101-0071	820 OHM 1/4W 5% CARBON FILM	
3	2	R1,R13,R19#,R26#	101-0081	2.2K 1/4W 5% CARBON FILM	
4	6	R4,R5,R8,R9,R11,R15#, R16#,R20#,R21#,R24#,R28#, R29	101-0097	10K 1/4W 5% CARBON FILM	
5	2	R7,R14,R27#,R31#	101-0101	15K 1/4W 5% CARBON FILM	
6	2	R2,R3,R17#,R18#	101-0123	120K 1/4W 5% CARBON FILM	
7	1	R6,R30#	107-0504	200K POT 1 TURN	3386P-1-204
8	1	C4,C9#	151-0020	.001 UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C102K
9	1	C1,C10#	151-0120	.01 UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C103K
10	3	C2,C3,C6#,C7#,C11	151-0180	.1 UF 50V +-10% CERAMIC, UNSTABLE	AVXSR205E104MAA
11	2	C5,C8,C12#	154-0025	1 UF 35V TANTALUM	ECS-F-35E1
12	2	C13,C14,C15#,C16#	155-0055	22 UF 25V +50%-10% AXIAL ALUMINUM ELECTROLYTIC	TLBIE220M
13	1	DS1,DS2#	311-0010	LED RED LAMP	HLMP3300
14	1	VR1	316-0005	REGULATOR 5V LOW POWER	LM78L05
15	2	U1,U2,U3#,U4#	316-0358	OP-AMP, DUAL	LM358N
16	1	Q1,Q2#	340-3904	NEPN 40V/200MA	2N3904
17	1	CR5,CR7#	342-0103	SCHOTTKIKEY .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: Notes are for production use only.

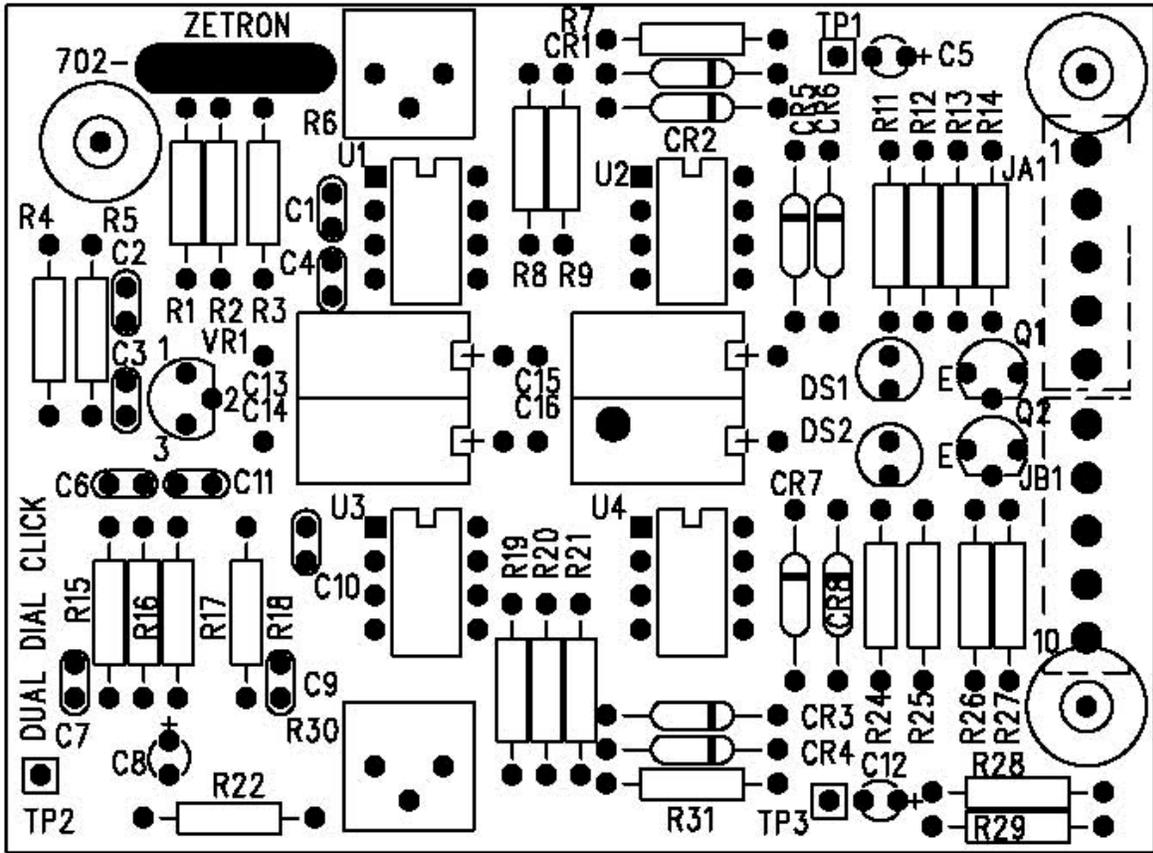
# MODEL 4XB DIAL CLICK BOARD (008-9242E)

## Schematic



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

Silkscreen



## 8. QUICK REFERENCE

CTCSS TONES .....	8-1
DIGITAL SQUELCH CODES.....	8-2
DTMF-t SIGNALING .....	8-3
TWO-TONE SIGNALING.....	8-4
Two-Tone Timing.....	8-4
Two-Tone Tone Groups.....	8-5
Two-Tone Codeplans.....	8-6
FIVE-TONE SIGNALING.....	8-7
Five-Tone Groups/Timing .....	8-7
VOICE PROMPTS .....	8-8
DTMF COMMANDS.....	8-9
EXPERT COMMANDS.....	8-11
MODEL 48-MAX PROGRAMMING MENU TREE.....	8-13

## 8. QUICK REFERENCE

### CTCSS TONES

The Model 48-MAX is capable of encoding or decoding any of the 50 CTCSS tones in this table. When programming, tones are entered directly in Hz. You can include the decimal point if you wish, although it is not required. The Repeater Panel User number is also included. The CTCSS/DCS decode for each of the 154 User groups in the Repeater Panel User database is pre-set. For example to enable CTCSS tone 100.0 Hz for decode in the Repeater Panel, go to User# 13 in the Repeater Panel User menu.

Number	Frequency (Hz)	Number	Frequency (Hz)
01	67.0	26	156.7
02	69.4	27	159.8
03	71.9	28	162.2
04	74.4	29	165.5
05	77.0	30	167.9
06	79.7	31	171.3
07	82.5	32	173.8
08	85.4	33	177.3
09	88.5	34	179.9
10	91.5	35	183.5
11	94.8	36	186.2
12	97.4	37	189.9
13	100.0	38	192.8
14	103.5	39	196.6
15	107.2	40	199.5
16	110.9	41	203.5
17	114.8	42	206.5
18	118.8	43	210.7
19	123.0	44	218.1
20	127.3	45	225.7
21	131.8	46	229.1
22	136.5	47	233.6
23	141.3	48	241.8
24	146.2	49	250.3
25	151.4	50	254.1

## Section 8. Quick Reference

### DIGITAL SQUELCH CODES

The following table is a list of the Digital Coded Squelch (DCS) codes the Model 48-MAX can encode or decode. The inverted code for each is also listed. When entering in a DCS code, precede the code with a “D”. For DCS code 023, enter “D023”. The Repeater Panel User number is also included. The CTCSS/DCS decode for each of the 154 User groups in the Repeater Panel User database is pre-set. For example to enable DCS code D031 for decode in the Repeater Panel, go to User# 54 in the Repeater Panel User menu.

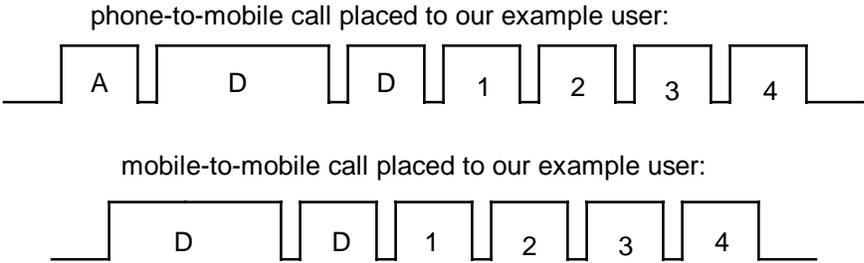
Normal Code	Invert Code	User #	Normal Code	Invert Code	User #	Normal Code	Invert Code	User #
023	047	51	223	134	86	445	043	121
025	244	52	225	122	87	446	255	122
026	464	53	226	411	88	452	053	123
031	627	54	243	351	89	454	266	124
032	051	55	244	025	90	455	332	125
036	172	56	245	072	91	462	252	126
043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

**DTMF-t SIGNALING**

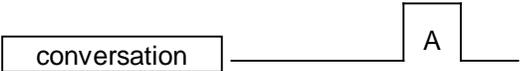
DTMF-t is an form of DTMF signaling that is compatible with most older forms of scan based DTMF trunking. Both the Collect and Reset digits and timing are programmable in the Model 48-MAX. The Reset digit and the timings for both are system wide settings. The Collect digit is part of the Selcall capcode (the first digit of the capcode) when using this format. The default settings for this format are:

- DTMF-t Reset time: 1000msecs
- DTMF-t Collect time: 2500msecs
- DTMF-t Reset digit: A

If a mobile has an decoder address of 1234, and the system is using a Collect digit of “D”, the Selcall capcode would be “D1234”. Here is an example page using DTMF-t as the format, and D1234 as the Selcall capcode.



On disconnect, the Reset digit will be sent to “reset” all the decoders on the channel. The Reset digit will be sent also if the user receives a phone-to-mobile call, on disconnect of the call.



## Section 8. Quick Reference

### TWO-TONE SIGNALING

The format for entering a Two-Tone Selcall capcode is:

TCCABCX: T = Timing (1-8 Two-Tone Timing table)  
CC = Codeplan (1-24 Two-Tone Codeplan table)  
A = Pager Cap-Code (0-9 Two-Tone Codeplan table)  
B = Tone 1 (actual first tone sent)  
C = Tone 2 (actual second tone sent)  
X = 0=Group, 1=Diagonal 1, 2=Diagonal 2

The timing is determined from the Two-Tone Timing table and specifies the timing for particular type of signaling. The codeplan is from the Two-Tone Codeplans table, and determines the column in which the tone set is located. The pager capcode is the actual entry (row) in the codeplan table to determine the sets of tones to be used for Tone 1 and Tone 2. Tone 1 and Tone 2 are the actual tones in the Two-tone Tone Groups table.

### Two-Tone Timing

For two-tone timing, select a number from the following table, 1 through 8. This table should be used for both 100- and 1000-call two-tone programming.

Timing	1st	Gap	2nd	Group Call	Type
1	1.0	0	3.0	8.0	GE std, Motorola std Tone+Voice
2	0.4	0	0.8	8.0	Motorola 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

Section 8. Quick Reference

**Two-Tone Tone Groups**

This table should be used to select the two-tone tone groups for Model 48-MAX 100-call programming. Use the Zetron group number, from 1 to 12 as shown.

<b>Zetron Group Number</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>Mfr. Tone Groups</b>	<b>Mot 1</b>	<b>Mot 2</b>	<b>Mot 3</b>	<b>Mot 4</b>	<b>Mot 5</b>	<b>Mot 6</b>	<b>Mot A</b>	<b>Mot B</b>	<b>Mot Z</b>	<b>GE A'</b>	<b>GE B'</b>	<b>GE C'</b>
T 0	330.5	569.1	1092.4	321.7	553.9	1122.5	358.9	371.5	346.7	682.5	652.5	667.5
O 1	349.0	600.9	288.5	339.6	584.8	1153.4	398.1	412.1	384.6	592.5	607.5	712.5
N 2	368.5	634.5	296.5	358.6	617.4	1185.2	441.6	457.1	426.6	757.5	787.5	772.5
E 3	389.0	669.9	304.7	378.6	651.9	1217.8	489.6	507.0	473.2	802.5	832.5	817.5
4	410.8	707.3	313.0	399.8	688.3	1251.4	543.3	562.3	524.8	847.5	877.5	862.5
N -												
U 5	433.7	746.8	953.7	422.1	726.8	1285.8	602.6	623.7	582.1	892.5	922.5	907.5
M 6	457.9	788.5	979.9	445.7	767.4	1321.2	668.3	691.8	645.7	937.5	967.5	952.5
B 7	483.5	832.5	1006.9	470.5	810.2	1357.6	741.3	767.4	716.1	547.5	517.5	532.5
E 8	510.5	879.0	1034.7	496.8	855.5	1395.0	822.2	851.1	794.3	727.5	562.5	577.5
R 9	539.0	928.1	1063.2	524.6	903.2	1433.4	912.0	944.1	881.0	637.5	697.5	622.5
Diagonal	569.1	979.9	569.1	569.1	979.9	979.9	979.9	979.9	979.9	742.5	742.5	742.5

## Section 8. Quick Reference

### Two-Tone Codeplans

These tables should be used when programming two-tone codeplans into the Model 48-MAX. Note: "Z 5" indicates Zetron codeplan number 5 (codeplan G), use this number when programming the Model 48-MAX codeplan.

Zetron Code-plans	Z 0	Z 1	Z 2	Z 3	Z 4	Z 5	Z 6	Z 7	Z 8	Z 9	Z 10	Z 11	Z 12
Mfr. Code-plans	Mot B	Mot C	Mot D	Mot E	Mot F	Mot G	Mot H	Mot J	Mot K	Mot L	Mot M	Mot N	Mot P
Pager Cap-code	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups
0xx	2+4	N/A	4+2	4+2	4+2								
1xx	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	2+3	2+3	2+3
2xx	2+2	2+2	2+2	2+2	1+3	1+3	1+3	1+4	1+4	1+5	2+2	2+2	2+2
3xx	3+3	1+2	1+2	1+2	3+3	3+3	3+3	4+1	4+1	5+1	3+3	3+3	3+3
4xx	1+2	4+4	1+5	2+1	4+4	3+1	3+1	4+4	4+4	1+6	4+4	3+2	3+2
5xx	1+3	1+4	5+5	1+6	3+1	5+5	1+6	5+5	1+6	5+5	3+2	5+5	2+6
6xx	2+1	2+1	2+1	6+6	1+4	1+5	6+6	1+5	6+6	6+6	2+4	2+5	6+6
7xx	3+1	4+1	5+1	6+1	4+1	5+1	6+1	4+5	6+1	6+1	4+2	5+2	6+2
8xx	2+3	2+4	2+5	2+6	3+4	3+5	3+6	5+4	4+6	5+6	3+4	3+5	3+6
9xx	3+2	4+2	5+2	6+2	4+3	5+3	6+3	5+1	6+4	6+5	4+3	5+3	6+3
Groups:	1,2,3,4	1,2,4	1,2,5	1,2,6	1,3,4	1,3,5	1,3,6	1,4,5	1,4,6	1,5,6	2,3,4	2,3,4,5	2,3,4,6

Zetron Code-plans	Z 13	Z 14	Z 15	Z 16	Z 17	Z 18	Z 19	Z 20	Z 21	Z 22	Z 23	Z 24
Mfr. Code-plans	Mot Q	Mot R	Mot S	Mot T	Mot U	Mot V	Mot W	Mot Y	Mot MT	GE X	GE Y	GE Z**
Pager Cap-Code	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups	Groups
0xx	4+2	4+2	4+2	4+2	4+2	4+2	4+2	N/A	4+2	A'+A'	B'+B'	A'+A'
1xx	2+4	2+4	2+5	3+4	3+4	3+5	4+6	A+A	1+1	B'+A'	C'+B'	C'+A'
2xx	2+2	2+2	2+2	4+3	4+3	5+3	6+4	B+B	2+2	B'+B'	C'+C'	C'+C'
3xx	4+2	4+2	5+2	3+3	3+3	3+3	5+6	Z+Z	1+2	A'+B'	B'+C'	A'+C'
4xx	4+4	4+4	2+6	4+4	4+4	3+6	4+4	A+B	4+4	C'+C'	N/A	N/A
5xx	5+5	2+6	5+5	5+5	3+6	5+5	5+5	A+Z	5+5	C'+A'	N/A	N/A
6xx	2+5	6+6	6+6	3+5	6+6	6+6	6+6	B+A	2+1	C'+B'	N/A	N/A
7xx	4+5	6+2	6+2	4+5	6+3	6+3	4+5	Z+A	4+5	A'+C'	N/A	N/A
8xx	5+4	4+6	5+6	5+4	4+6	5+6	5+4	B+Z	5+4	B'+C'	N/A	N/A
9xx	5+2	6+4	6+5	5+3	6+4	6+5	6+5	Z+B	2+4	N/A	N/A	N/A
Groups:	2,4,5	2,4,6	2,4,5,6	2,3,4,5	2,3,4,6	4,5,6	2,4,5,6	A,B,Z	1,2,4,5	A',B',C'	B',C'	A',C'

Notes \*\*: G.E. 100-call plan Z is tone groups C'+C'; use (100-Call programming). For cap-codes ending in double-digits using tone group twice, (example: 122 in code plan C), use diagonal as one of the tones.

**FIVE-TONE SIGNALING**

The five-tone formats are easier to use than the Two-tone format. The format for a five-tone call code is:

- P12345X: P = Preamble (optional)
- 1-5 = Capcode (digits 0-9,G,B,C,D,R,F)
- X = Second address (1=No address, 2=2nd address)

The Model 48-MAX supports 4 five-tone formats, EIA, CCIR, PZVEI and EEA. The tones and timing are different for each; refer to the “Five-Tone Group/Timings” table for a list of the individual tones and timings. Programming the call code is identical however.

**Five-Tone Groups/Timing**

This table indicates the five-tone frequency and tone timing values for the three available tone plans. Note that the “C” tone is used for the “X” tone or 2nd address when specified.

Zetron Group number	0	1	2	3
<b>Tone series</b>	EIA	CCIR	PZVEI	EEA
<b>Tone number</b>	Tone frequencies are in Hz.			
0	600	1981	2400	1981
1	741	1124	1060	1124
2	882	1197	1160	1197
3	1023	1275	1270	1275
4	1164	1358	1400	1358
5	1305	1446	1530	1446
6	1446	1540	1670	1540
7	1587	1640	1830	1640
8	1728	1747	2000	1747
9	1869	1860	2200	1860
Group “G” tone	2151	2400	970	1055
B	2433	930	810	930
2nd Addr “C” tone	2010	2247	2800	2400
D	2292	991	885	991
Repeat “R” tone	459	2110	2600	2110
F	1091	1055	680	2247
<b>TIMING</b>	Tone timings are in milliseconds			
Preamble	690	690	690	690
Gap	65	65	65	65
Tone	33	100	70	40
X Tone	65	100	70	40

## Section 8. Quick Reference

### VOICE PROMPTS

The following is a description of each of the voice prompts and when they are played. It is not required to use all of the voice prompts. Only the slots that contain messages will be used. Messages 4, 5, 7 and 9 will be preceded by special information tones (3 tones) when the message is played to the phone line.

<b>SLOT #</b>	<b>MESSAGE NAME</b>	<b>MAX. LENGTH</b>	<b>MESSAGE DESCRIPTION</b>
1	TELCO WELCOME	7.5 SECONDS	This message is played to the calling telephone party when the Model 48-MAX first answers the telephone. This voice prompt precedes the over dial prompt tone.
2	MOBILE WELCOME	5.0 SECONDS	This message is played to the mobile user who is calling another mobile. This voice prompt precedes the over dial prompt tone sent to the mobile.
3	THANK YOU	5.0 SECONDS	This message is played to the caller when he has made a correct entry (either user number or mobile ANI). There is no tone substitute for this voice prompt.
4	UNABLE TO COMPLETE CALL	3.5 SECONDS	This message is played to the caller when an unsuccessful attempt has been made to call a mobile. This is when the mobile does not answer or the channel remained busy and the 48-MAX could not try calling the mobile. There is no tone substitute for this voice prompt.
5	INVALID USER	3.5 SECONDS	This message is played to the caller (phone or mobile) when an incorrect or disabled user number or ANI has been overdialed. This voice prompt replaces normal error tones.
6	AT PROMPT TALK	5.0 SECONDS	This message is played when the destination or called party is has an equipment type of Talkback or Tone and Voice. It precedes the go ahead prompt tone.
7	CHANNEL BUSY	2.5 SECONDS	This message is repeated (with 5 cycles of busy tone in between) to the caller while the channel is busy. This replaces the normal channel busy tone (busy tone or broken ringing).
8	VOICE STATION ID	2.5 SECONDS	This message will be played in place of the station ID.
9	INTERCONNECT NOT AVAILABLE AT THIS TIME	3.7 SECONDS	This message is played to the caller who is attempting to place an interconnect call during the restricted time. There is no tone substitute for this message.

## DTMF COMMANDS

All the DTMF programming command are listed here. They are limited in scope and are intended to be used mainly for Initial setup and adjustment, and diagnostics. The ability to turn on and off a user via DTMF has also been included.

Access to DTMF programming is done with the full 5 digit program access code, 12048 (default).

### *Over the air:*

Keyup a DTMF equipped radio on the same frequency as the Model 48-MAX. Have the radio set for monitor (prompt tones from the Model 48-MAX are not tone protected). Enter the program access code(12048 default) and unkey, the Model 48-MAX will keyup and issue 5 short beeps to confirm access.

### *From the Telephone:*

Call up the Model 48-MAX's phone number (line 1 or line 2), or take the Local phone (a 2500 series DTMF desk set) off hook. When prompted by the Model 48-MAX (800 Hz beep) to over dial a user number or ANI, enter in the program access code (12048 default). Caution you will hear Modem tone scream in your ear! Once you get the modem tones, enter a DTMF '#', this will stop the Model 48-MAX from looking for a modem. You should then hear 5 short beeps to confirm access.

DTMF commands work very much like they do in Model 38 or Model 39. The basic format is:

“Command Number” + “#” the Model 48-MAX will keyup and send 2 short beeps.

“Data” + “#” the Model 48-MAX will keyup and send 5 short beeps.

*Note: if programming from the phone, the Model 48-MAX doesn't keyup.*

The “#” is used as a termination digit. It lets the Model 48-MAX know that all the digits (command or data) have been entered, please process them.

Command	Function	Range (Default)
99#	EXIT PROGRAM MODE	No range
<i>User programming:</i>		
101# UUU# N#	USER ENABLE/DISABLE (0=DISABLED, 1=ENABLED) where UUU = user number	0-1 (0) 001-750
102# UU# N#	TONE ENABLE/DISABLE (0=DISABLED, 1=ENABLED) where UU = user number	0-1 (0) 01-154

## Section 8. Quick Reference

Command	Function	Range (Default)
99#	EXIT PROGRAM MODE	No range
<i>Setup and adjustment:</i>		
110#	RESET SYSTEM PROGRAMMING	12345# to
confirm		
111#	SET TX AUDIO LEVEL	# TO STOP
112#	SET CTCSS/DCS LEVEL	# TO STOP
113#	SET REPEAT LEVEL	# TO STOP
114#	N# ADJUST HYBRID NULL	# TO STOP
	1# DIAL OUT LINE 1 (REGENERATES PHONE NUMBER)	
	2# DIAL OUT LINE 2 (REGENERATES PHONE NUMBER)	
	3# ANSWER RINGING LINE (1 OR 2)	
115#	N# DIAL CLICK DECODE (IN SLOW MORSE CODE)	# TO STOP
	1# DIAL OUT LINE 1 (REGENERATES PHONE NUMBER)	
	2# DIAL OUT LINE 2 (REGENERATES PHONE NUMBER)	
	3# ANSWER RINGING LINE (1 OR 2)	
116#	MONITOR RX FROM PHONE (TELCO PROGRAMMING ONLY)	# TO STOP
120#	N# DCS ENCODE POLARITY (0=NORMAL, 1=INVERTED)	0-1 (0)
121#	N# DCS DECODE POLARITY (0=NORMAL, 1=INVERTED)	0-1 (0)
122#	N# RS-232 LOCAL PORT BAUD RATE	0-4 (3)
	0# 300 BAUD	
	1# 1200 BAUD	
	2# 2400 BAUD	
	3# 4800 BAUD (DEFAULT)	
	4# 9600 BAUD	
124#	NNN# SET CORDLESS PHONE USER	0-750 (0)
125#	N# FAST ANI (0=DISABLED,1=ENABLED)	0-1 (0)
126#	N# WILD ANI (0=DISABLED,1=ENABLED)	0-1 (0)
<i>Voice Prompts:</i>		
130#	N# RECORD VOICE PROMPT IN SLOT N	1-9
131#	N# PLAY VOICE PROMPT IN SLOT N	1-9
132#	N# ERASE VOICE PROMPT IN SLOT N	1-9
<i>System programming:</i>		
140#	N# PERIODIC MORSE ID (0=DISABLED, 1=ENABLED)	0-1 (0)
141#	N# OVERDIAL PROMPT (0=BEEP,1=DIALTONE)	0-1 (0)
142#	N# STEERING DIGIT PROMPT (0=BEEP,1=DIALTONE)	0-1 (1)
143#	N# CALL ALERT BEEPS (0=DISABLED,1=ENABLED)	0-1 (0)
144#	N# DISCONNECT ON BUSY (0=DISABLED, 1=ENABLED)	0-1 (1)
145#	N# 2ND DIAL TONE DETECT (0=DISABLED, 1=ENABLED)	0-1 (1)
<i>Dialing plan / Toll restriction:</i>		
146#	NN# MINIMUM NUMBER OF REGENERATED DIGITS	2-7 (4)
147#	NN# MAXIMUM NUMBER OF REGENERATED DIGITS	7-30 (15)
148#	NN# NUMBER OF CREDIT CARD DIGITS FOR 0+ DIALING	10-18 (14)

*Auxiliary I/O:*

150#		AUXILIARY INPUT STATE (OFF=500HZ,ON=1500HZ)	No range
151#	N#	AUXILIARY OUTPUT STATE (OFF=500HZ,ON=1500HZ)	0-1
		(0)	
155#	NN#	LINE 1 CONSTANT RING TO ANSWER (100 MSEC INCREMENTS)	0-20 (0)
156#	NN#	LINE 2 CONSTANT RING TO ANSWER (100 MSEC INCREMENTS)	0-20 (0)
157#	N#	LINE 2 PRIORITY OVERRIDE (ENABLE/DISABLE)	0-1 (0)

**EXPERT COMMANDS****CAUTION:**

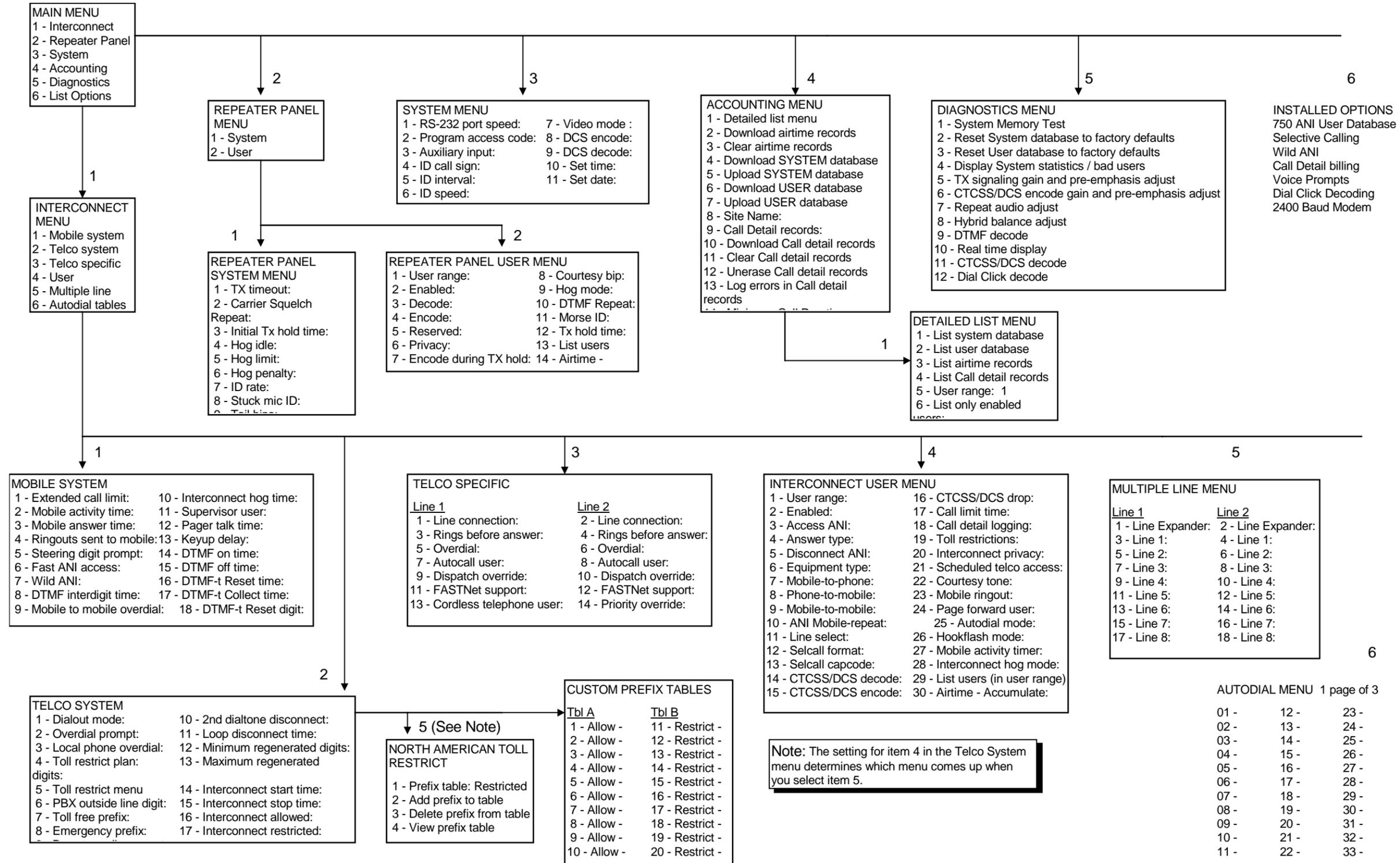
Before using these commands, you should verify their effect by calling Zetron Applications first. These commands are here for reference only. There is no other description of them in this manual.

Command	Function	Range (Default)
99#	EXIT PROGRAM MODE	No range
201#	NNN# COURTESY TONE FREQUENCY (400HZ - 2500 HZ)	40-250 (120)
202#	NN# CHANNEL BUSY TO TELCO (0=BUSY,1=BROKEN RING)	0-1 (0)
203#	N# COR QUIET TIME (100 MSEC INCREMENTS)	1-99 (30)
204#	N# DISCONNECT ON LOSS OF VOX (PAGERS)(0=OFF, 1=ON)	0-1 (1)
205#	N# PROGRAM ACCESS PROMPT	0-1 (1)
206#	N# MAXIMUM CHANNEL BUSY RINGS	1-255 (255)
207#	N# DISCONNECT IF NO DIAL TONE (0=OFF, 1=ON)	0-1 (1)
208#	NNN# AUTODIAL PAUSE TIME (100MS INCREMENTS)	10-250 (25)
209#	NNN# DISCONNECT ON LOSS OF LOOP (1MS INCREMENTS)	10-255 (255)
210#	N# 100MSEC WINK ON LINE 1 (ON/OFF)	0-1 (0)
211#	N# 100MSEC WINK ON LINE 2(ON/OFF)	0-1 (0)
212#	CLEAR RESET COUNTS	No range
213#	NN# MINIMUM RING OFF TIME (100 MSEC INCREMENTS)	5-40 (15)
214#	NNN# MAXIMUM RING OFF TIME (100 MSEC INCREMENTS)	50-150 (60)
215#	NNN# PREPAY WARNING, INTERCONNECT (1 MIN INC)	15-250 (120)
216#	NNN# PREPAY WARNING, REPEATER PANEL (1 MIN INC)	15-250 (120)
217#	N# CCITT OR BELL ANSWER MODE (ON/OFF)	0-1 (0)
218#	N# FORCE 2400 BAUD CONNECT (ON/OFF)	0-1 (0)
219#	NN# MORSE ID SPEED IN WPM	10-25 (20)
222#	N# BEEPS DURING DTMF REGENERATION (ON/OFF)	0-1 (1)
223#	NN# MINIMUM BUSY TONE CYCLE (100 MSEC INCREMENTS)	2-20 (4)
224#	NN# MAXIMUM BUSY TONE CYCLE (100 MSEC INCREMENTS)	2-20 (6)
225#	N# MUTE SINGLE RINGOUT ON TALKBACK (ON/OFF)	0-1 (0)
226#	N# LONG “#” TO ABORT REGENERATION (0=ANY/1=LONG)	0-1 (0)
227#	N# USE PRECISE DIAL TONE DETECT (ON/OFF)	0-1 (0)

## Section 8. Quick Reference

*This page is intentionally left blank.*

# MODEL 48-MAX PROGRAMMING MENU TREE



**Note:** The setting for item 4 in the Telco System menu determines which menu comes up when you select item 5.