

**Interconnected Repeater Panel****FEATURES**

- **Shared radiotelephone interconnect with up to 750 user identities (ANI)**
- **Available in 3 versions: Basic, Selcall, & Roamer**
- **Operation with wide range of simplex or duplex mobile or hand-portable radios**
- **Encodes and decodes 50 CTCSS, 104 DCS**
- **2-tone, 5-tone (PZVEI, EIA, CCIR, EEA), DTMF selective calling**
- **Intersystem roaming capability for wide area coverage (wild ANI)**
- **Interconnect Gateway for switchless, intersite dispatch**
- **Owner-recordable voice prompts (option)**
- **Enhanced toll restriction**
- **PC-programmable with built-in modem**
- **Billing records for up to 4000 calls (option)**
- **99 autodial telephone numbers**
- **Conversation timers with “hog” penalties for both interconnect and dispatch calls**
- **EMC Approval, CE conformity**

**INTRODUCTION**

The Model 48-MAX Interconnected Repeater Panel is the latest, most powerful shared customer interconnect available from Zetron. It is designed for service providers who need the best in performance and reliability in order to compete most effectively when providing mobile communication services.

The 48-MAX may be equipped with previously unavailable capabilities, such as owner-recordable voice prompts, enhanced toll restriction, a telephone line expander, and intersystem roaming for wide-area coverage. These and other features ensure continued profitability and competitiveness for providers of radiotelephone interconnect service.

In addition to service providers, the M48-MAX is also ideal for private, user-owned systems that need a high degree of versatility and numerous convenience features.

Zetron customers will recognize that the 48-MAX is similar to the Zetron Model 48B Repeater Manager but with the addition of many exclusive, high-end features.

For ease of configuration, the M48-MAX is available in three version: Basic, Selcall, and Roamer (see next page).

### **Scheduled Telco Access (Selcall & Roamer Versions)**

With scheduled telco access, the 48-MAX may be programmed such that telephone calls (both incoming and outgoing) occur during certain hours of the day only. The system owner also defines which ANI codes, if any, are allowed to access the telephone line during those periods. The owner may thus charge more for radio users who desire to use the telephone line during the restricted hours.

Scheduled telco access is a good way to preserve more airtime for dispatch (radio-to-radio) traffic. Telephone calls tend to be long, while dispatch calls are shorter in duration. Limiting telephone access during peak hours is a good method of freeing up more dispatch activity—a priority for many service providers.

### **Enhanced Toll Restriction**

The 48-MAX is equipped to restrict telephone calls on both modern and older telephone systems. It takes into account the latest dialing procedures that have evolved within telephone networks worldwide.

The toll restrict methods are designed for both versatility and customization. For instance, a prefix table can be created that specifies valid or invalid three-digit prefixes. This feature is particularly useful in metropolitan areas where it's possible to dial long-distance calls without dialing an area code.

The 48-MAX also “understands” area codes which don't necessarily have 0 or 1 as the second digit.

To support a wide range of applications, any sequence of 2, 3, or 4 digits can be specified as valid or invalid.

Toll restrictions can be applied on a per-user basis. Some users can be restricted to local calls, some users can be provided with full access, and some users can be restricted to dialing pre-set autodial numbers only.

The toll-restrict methods are very versatile. They take into account the latest dialing conventions such as 1-888 calls, 10-digit local calls, long-distance codes (10+ATT, 10-321, etc.) and PBX procedures. For a full description of the toll restrict capability of the 48-MAX contact Zetron.

### **Interconnect Hog Penalty**

Some radio users have learned that when their conversation time runs out they can “hog” an interconnect by hanging up and then quickly dialing another telephone number, before another radio user has a chance to react.

The interconnect hog penalty prevents the same radio user from placing back-to-back calls for a

programmable period of time (0 to 250 seconds). This prevents someone with a speed-dial microphone or control head from beating other users in entering an access code and taking over the system for endless minutes at a time.

### **Radio Call Forwarding**

Radio call forwarding is a feature that comes in handy on many systems.

If a call to a field unit (mobile radio, hand-portable radio) is not answered after a programmable number of rings, the call can automatically be forwarded to a different field unit, including a pager. One of the most convenient applications is allowing a mobile-radio user to receive a call on a lightweight tone or tone-voice pager when away from the vehicle.

When a call is forwarded, the transaction is recorded in the billing database so that the owner may charge extra for the feature if desired.

### **Other Features**

**Call-Alert Beeps:** notifies radio-to-radio talkers that a telephone party is attempting to place a call to a radio. The radio users may then elect to terminate their call so the phone party can get through.

**99 Autodials:** for ease of dialing by the radio users, the owner may create up to ten blocks of autodials. A user is assigned to a block, and an autodial is initiated by \* plus a single digit. If desired, radio users may be limited to autodials only, with no manual dialing privileges.

**PBX Support:** a hookflash signal may be initiated from a radio to manipulate PBX functions. This can give access to many PBX functions such as conference calls or call forwarding.

**XMODEM Support:** the industry standard XMODEM data transfer protocol, available in most off-the-shelf communication programs (e.g. Windows), is all it takes to establish PC communications with the 48-MAX. (Note: the utility ZCU does not support the XMODEM protocol.)

### **Cross-Tone, Cross-Code, and Tone-Code**

**Encoding:** radio users may call radios that operate on other tones/codes. The “crossed” tones/codes may be programmed into the database, or may be initiated with selective calling.

**Two End-to-End Telephone Inputs:** the second telephone input can be used in many ways by the creative system designer. For instance, it provides an easy method of separating users into different levels of telephone access privileges. It also allows one line to be a “priority override” line for emergency calling.

### Simplified Menus

The programmable functions are separated into groupings that have appropriate titles.

All changes to a user can be made from a single screen. It's no longer necessary to search through multiple menus just to bring a new customer on-line.

### High-capacity Billing (option)

The billing-record buffer has a capacity of 4000 calls. Now, it is necessary to download billing data only once a month, even on the busiest systems.

For each call that takes place through the 48-MAX, the buffer stores the number dialed, duration of the call, time of day, date and the ANI of the user making the call. The data may be downloaded into an automatic invoicing program for sorting and for printing bills to mail to the customers.

In order to conserve space in the call-detail buffer, the owner may program the 48-MAX to not record dialing errors, unanswered calls, local calls, incomplete transactions, and calls that don't exceed the "minimum call duration" (as programmed in the accounting menu).

### Prepaid Airtime

If desired, prepaid airtime can be implemented for both interconnect and dispatch calls. A user purchases a block of airtime in advance, which decrements with usage. Warning beeps notify the user to send in another payment. Prepaid airtime can eliminate billing procedures.

#### ACCOUNTING MENU

1. Detailed list menu
  2. Download airtime records
  3. Clear airtime records
  4. Download SYSTEM database
  5. Upload SYSTEM database
  6. Download USER database
  7. Upload USER database
  8. Site Name: Blacknose Mtn WNCR414
  9. Call detail records: 914
  10. Download call detail records
  11. Clear call detail records
  12. Unerase call detail records
  13. Log errors in call detail records: Disabled
  14. Minimum call duration
- <ESC> to exit  
Select a command:

### Versatile ANI Codes

Access to the telephone interconnect is by DTMF, with each user sending a unique ANI. The ANI may be entered manually on the radio's DTMF keypad, or more likely will be preprogrammed into a button on the radio or into a DTMF microphone such as the Zetron ZMX.

Each user's ANI may be programmed to be up to 10 digits in length.

In a typical installation, a radio user would send his unique ANI code, followed by a steering digit. The steering digit specifies the type of access that is desired, such as:

- Line 1 phone call
- Line 2 phone call
- Radio-to-radio call
- Repeater access

If a user is to be provided with only one type of access, e.g. only Line 1 phone calls or only radio-to-radio calls, then a steering digit is unnecessary. The 48-MAX knows which type of access is assigned to the user.

### Short-Sign On

Radio users may access the system using only single digits. For example, the 48-MAX is installed in a factory where billing is not important. The programming can be set up such that a radio user enters digit 1 to obtain dial tone on Line 1, digit 2 for dial tone on Line 2, \* for dial tone for a radio-to-radio call, and # to disconnect any of the above. The programming is so flexible that any digit can be chosen for each of these access types.

## HIGH-PERFORMANCE OPTIONS

### Voice Prompts (option)

The owner of a 48-MAX can create up to nine voice messages. The messages are meaningful greetings and instructions that play to both radio and telephone callers. The voice prompts are recorded in the owner's voice and may be changed at any time from a Touch-Tone telephone or DTMF radio.

### 154-User Expansion and Interconnect Gateway (option)

Both the Basic and Selcall versions can be equipped with a **154-User Expansion**. This allows individual entries in the user database for all 154 CTCSS and DCS codes, not just 99. The expansion is a useful way to increase capacity in a Basic or Selcall version without upgrading all the way into a 750-user Roamer version.

The same option also provides a powerful capability called **Interconnect Gateway** to link multiple sites together for dispatch. No central switch or networking equipment is necessary! A user simply keys up on the right CTCSS subaudible tone (or CTCSS + DTMF). The 48-MAX automatically dials up the distant 48-MAX, and the user may dispatch through the distant site and converse with users there. The user doesn't have to enter any digits or user number. The conversation proceeds as a normal dispatch conversation, with the 48-MAX at the distant site generating the proper CTCSS tone (which may be different than the originating user's). **Interconnect Gateway** is ideal for linking nonoverlapping, conventional tower sites and helps retain customers from moving to trunked SMR or cellular alternatives.

## ENHANCED AUDIO PERFORMANCE

### True Squelch-tail Elimination

Zetron repeater panels have true squelch-tail elimination, using CTCSS reverse phase-burst and two-way DCS turn-off codes.

A squelch-tail is the noise burst heard when a radio user releases the push-to-talk button. The noise is raw, unfiltered audio straight off the radio channel, possibly including voices of co-channel transmissions. The length of a squelch tail is directly related to how quickly the tone panel reacts to the absence of a radio's PTT signal.

With the 48-MAX, squelch tails are not a factor. The 48-MAX detects and acts upon the radio's CTCSS reverse phase burst or DCS turn-off code as soon as the PTT button is released.

Inferior tone panels that compensate for poor decoding sensitivity by relying only upon "CTCSS /DCS

hold delays," are unable to eliminate squelch tails. When a radio is unkeyed, the noisy squelch tail is heard for the duration of the hold delay, which can be up to 3 seconds in length.

### ToneLock Decoding Sensitivity

ToneLock is Zetron's exclusive method of decoding CTCSS tones and DCS codes from the radio channel.

The range of a repeater system is directly related to the decoding sensitivity of the tone panel. The 48-MAX will reliably decode a CTCSS tone even when the signal fades to as low as 3 dB SINAD. The bottom line is that radio users will be able to stray farther from the repeater, will enjoy better coverage in obstructed areas, and will not suffer from "talkdown" (where the frequency makeup of a loud voice masks the subaudible tone).

## WILD ANI CODES FOR INTERSYSTEM ROAMING

A wild ANI code is an easy, innovative method of allowing intersystem roaming between different, even competing carriers. In its noblest implementation, multiple carriers across several regions join together as a team to fight the onslaught of cellular and trunking technologies.

With wild ANI roaming, there is less fear of abuse. Carriers may protect themselves from unwanted roamers by excluding particular ANIs from the database. Full accountability is built into the software so that carriers can easily bill each other for the roaming activity. Each carrier realizes an increase in revenue, not a decrease.

The Roamer Version of the 48-MAX already has a 750-user ANI database. The wild ANI feature expands the capacity to an almost unlimited extent.

### Roamer Exclusion

To prevent access to problem roamers, specific ANIs may be programmed as invalid. Thus, while a wild ANI like \*500AAAA allows access to all roamers whose codes begin with \*500, if the individual roamer \*5001117 is undesired, that specific ANI may be excluded from the 48-MAX.

### Roaming Agreements

A roaming agreement between a group of carriers requires a certain degree of coordination. The carriers need to agree on a standard length of ANI code, the prefixes (e.g. \*169) used by each carrier, and possibly some rules and rates for intersystem billing. Contact Zetron for assistance or for names of existing carriers utilizing the wild ANI function.

### SAMPLE ANI CONFIGURATION

User Number	ANI Code	Status	Explanation
1	*1690001	On	These are the normal, local users of the interconnect. They may both place and receive telephone calls. One of the codes (*1690005) is currently turned off because the user is behind in payments.
2	*1690002	On	
3	*1690004	On	
4	*1690005	Off	
5	*1690021	On	
6	*1690023	On	
7	*1690027	On	
8	*1690006	On	
281	*5001117	Off	These are unwanted or "excluded" roamers that belong to the systems below. They are barred from using this system.
282	*5001113	Off	
283	*4552213	Off	
740	*500AAAA	On	These are the wild ANIs. Each supports all the users from a different carrier. The roamers may place (but not receive) telephone calls through the system.
745	*123AAAA	On	
746	*528AAAA	On	
747	*455AAAA	On	

This list of ANI codes, if programmed into a 48-MAX Roamer Version, would allow the patch to support both normal users (top) and roamers from other systems (bottom). The wild ANIs are intentionally placed last in the database to allow the excluded codes (middle) to be effective.

A = Wild Marker

## MODEL 48-MAX INTERCONNECTED REPEATER PANEL

### Basic Version

- 99 DTMF user identities (ANI)
- 50 CTCSS, 104 DCS
- 1200/2400 baud modem

### Selcall Version

- 2-tone, 5-tone (PZVEI, EIA, CCIR, EEA), DTMF selective calling
- Scheduled telco access
- All features of Basic version

### Roamer Version

- 750 DTMF ANI codes
- Wild ANI support
- All features of Selcall version

### Options

- User-recordable voice prompts
- Billing records for up to 4000 calls
- Dial-click decoder board for pulse telephone systems
- 154 User/Interconnect Gateway (Basic and Selcall versions only)
- 600-ohm balanced audio option (factory install)
- Relays for PTT and aux out

## STANDARD FEATURES - ALL VERSIONS

### Interconnect Features

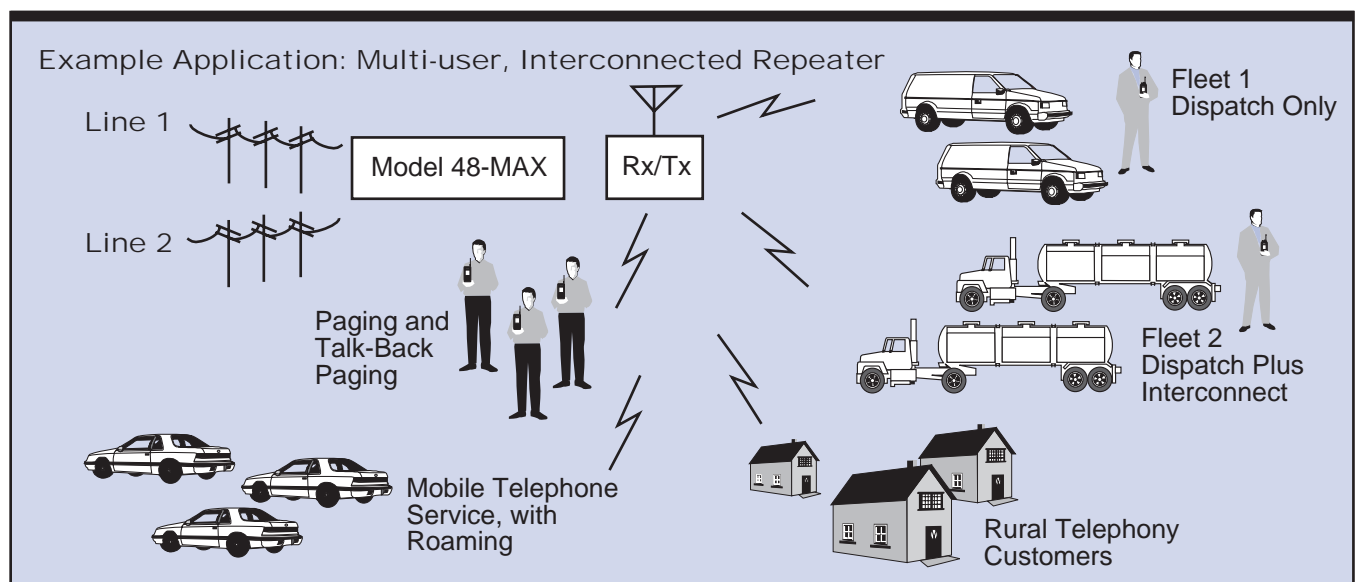
- Two end-to-end telephone inputs with automatic line selection for connection to public subscriber lines or PABX extensions
- One local telephone input for testing and for connection to a DID converter
- Radio-to-telephone access based on DTMF ANI only, or combined DTMF ANI plus CTCSS/DCS
- Billing records per ANI
- Accumulated and pre-pay airtime
- Radio call forwarding
- Interconnect timer and "hog" penalty
- 99 autodials
- Call-alert beeps
- Enhanced toll restriction
- Four different ringout sounds

### Dispatch (Tone Panel) Features

- 50 CTCSS, 104 DCS
- Billing records per tone/code
- Accumulated and pre-pay airtime
- Airtime timers and "hog" penalty
- ToneLock decoding sensitivity
- Squelch-tail elimination
- Cross-tone encoding
- Privacy mode prevents barge-ins

### General Features

- RS-232 port
- Built-in modem (1200/2400 baud)
- Simplified PC programming menus
- Limited DTMF programming
- XMODEM support
- Operates with simplex or duplex radios





## SPECIFICATIONS

### PHYSICAL SPECIFICATIONS

Power	10.5-16V DC, 700 mA or 9-12 VAC, 11 watts
Temperature	0 to 65° C (32 to 149° F)
Size	Rackmount: 487 mm x 186 mm x 45 mm (19" x 7.25" x 1.75")
Weight	1.8 kg (2 lb.)

### 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 codes can be used

### ACCOUNTING

Interconnect	Airtime record per ANI 99:59:59 maximum. Accumulate or pre-pay
Dispatch	Airtime record per tone/code 99:59:59 maximum. Accumulate or pre-pay
Call detail option	Logs detailed call information 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

### DECODER SPECIFICATIONS

Frequency range	67 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 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 for PSTN subscriber or PBX extension. One local phone port for connection to desk set
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Connector	RJ11-C modular jack
Progress tones	Dial tone, ringing, double ring, busy
Call progress tones	Dial tone, ringing, interrupted ringing, busy, and reorder
End-To-End for PSTN	subscriber or PBX extension:
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, call limit, mobile activity timers, loss of loop current
Local phone input:	
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 input	Closure input from secondary receiver COR

### ADDITIONAL SPECIFICATIONS

Modem	Automatic detection of 1200 baud Bell 212, CCITT V.22 and 2400 baud CCITT V.22 bis
Indicators	Line1, Line 2, Local, VOX, DTMF, Decode, Carrier, Transmit, Aux, Power
Switch	Connect
Station ID	Morse code, fixed 1200 Hz frequency and programmable call sign (1-9 characters)
Equipment types	Tone-only pager, tone+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 1200/2400 baud 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 years with no power
Secondary protection	On end to end lines
Auxiliary output	FET pull to ground



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See Zetron price list for option pricing.

Specifications subject to change without notice.

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