TRA

TELEPHONE TO RADIO ADAPTER

INSTRUCTION MANUAL

Manual Revision: 2006-10-31

Software Version: 4.2 & Higher

1. SPECIFICATIONS

General	
Operating Voltage	11 - 16 VDC
Standby Current	22 mA
Off-hook Current	50 mA
Ringing Current	400 mA
Inputs	
Receive Input Level	50 mV RMS minimum
Receive Input Impedance	100 KW
Dynamic Range	25 dB
Frequency Range	280-2800 Hz
Sinad Ratio	<8 dB
DTMF Twist	10 dB
Band Width DTMF	±2.5%
Band Width Five Tone	See Table 2
Band Width Motorola Two Tone	±1.3%
Band Width General Electric Two Tone	±1.6%
Band Width Reach	±1.7%
COR Click Counter	1 - 9
Click Timeout	.0 - .9 seconds
Outputs	
Ringing Output	33 Hz, 70V RMS
Ringing Period	2 sec on, 4 sec off
Call Reminder Ring	160 msec
Call Queuing Ring	160 msec
Busy Tone	500 msec on, 500 msec off
PTT Output Current	200 mA
Audio Output Level	1 Volt Peak to Peak
Audio Output Impedance	1KΩ/27KΩ
Scanning	
Channel Stepper	1 - 10 channels/second
Mechanical	
Standard Dimension	4.25" x 3.25" x 2.00"
Operating Temperature	-30° to +60° C

Installation Instructions

Midian products utilize CMOS integrated circuits, which are susceptible to damage from high static charges. Be sure to follow standard anti-static procedures when handling, including using grounded work stations and soldering irons and wearing grounding bracelets. Please be careful when selecting wire colors. It is sometimes difficult to distinguish between the grey, black, and brown wire colors under fluorescent lighting. We suggest using Color-Bright/Color-Corrected or incandescent lighting. If in doubt, compare wire positions on board layout for correct color code.

Wire	Function	Instructions
Black	Ground (P1 Pin 1)	Connect to nearest ground point.
Red	11-16 VDC (P1 Pin 9)	Connect to switched B+ in radio.
Grey	COR/COS Busy Lockout (P1 Pin 3)	Connect to point in Squelch or CTCSS circuit that changes logic level when a carrier is received. Program desired polarity in **System Parameters**. A radio whose squelch circuit provides a logic low or a logic high can readily turn the COR transistor on and off.
Orange	RX/Tone Input (P1 Pin 11)	Normally connect to a squelched point in the receiver. Alternately connect to an unsquelched audio point, usually the high side of the volume control or discriminator output, if squelch input is used.
Light brown	Squelch Output (P1 Pin 5)	Optional. Connect to point in radio's squelch circuit that normally changes logic level with carrier. The polarity is set by selecting polarity of squelch diode D3 using JU7. Resistor R88 can be changed to provide more or less current. Do not conflict with grey lead. This lead is not necessary for the TRA to function. The TRA has its own internal squelch/mute to block earpiece audio to the telephone.
Yellow	TX Mod Audio Out (P1 Pin 8)	Connect to modulator circuit. Use high impedance point in radio. Low-Z will cause low frequency rolloff across tone output coupling cap C39 and tone output resistor R59. In Low-Z mic circuits, it might be necessary to short out resistor R59 with jumper JU6.
Dark Brown	PTT Out (P1 Pin 7)	Connect to the radio's PTT switch. The micro now has control of PTT, time out timer, and busy lockout. The VOX controls the micro which controls PTT output.
Violet	Scan (P1 Pin 2 Step or Binary LSB)	Connect to synthesizer push button channel stepper switch (select desired channel scan type in **Decoding Parameters**). For binary, connect to Least Significant Bit (first bit) on radio's binary address line.
White	Binary Scan (P1 Pin 6 Binary Second Bit)	Connect to second bit on radio's binary address line.
Blue	Binary Scan (P1 Pin 12 Binary MSB)	Connect to Most Significant Bit (third bit) on radio's binary address line.
Green	Horn (P1 Pin 4)	Provides a 0-9 second momentary ground through FET transistor Q10.
	RJ11 Connector (2 in parallel)	Plug in any standard single line phone or cordless phone. Phones can be plugged into both of these and connected throughout the house in rural phone applications. Note: The hybrid adjustment pot in the TRA must be set to match the characteristics of a particular type of phone.

2. OPERATION

Midian's TRA is a telephone to radio adapter that can be used in a wide variety of situations, including: mobile telephone, rural telephone, in-plant telephone systems, interfacing office telephones to tone & DC remotes, interconnect, and mobile to mobile telephone applications. The TRA has three decode numbers, ANI, 10-number memory dial and last number redial. The TRA will output in both two-tone and five-tone formats.

2.1. Controls and Indicators

The TRA is controlled by the **Off Hook Condition** and the Keypad of any Touch Tone® telephone, including cordless phones. When the phone is taken off hook, the TRA checks for an open channel and then sends ANI if that is programmed. Dial tone is heard in the earpiece unless the channel is busy, in which case a busy tone will be heard. Upon receipt of dial tone, the user can begin dialing.

2.2. Making Calls

In all cases in this section, to make a call, take the phone off the hook. A dial tone should be heard, unless the channel is busy, in which case a busy tone will be heard. Incorrect entries can be cleared at any time by pressing the # key. When finished, simply hang up the phone.

2.2.1. MAKING VOICE CALLS IN LOCAL/TONE/DC REMOTE CONTROL

To make a voice call in any of these systems, follow the instructions above. If dialing has been disabled, and no ANI is programmed, when the user picks up the telephone the TRA will allow the VOX circuit to key up the transmitter whenever the user talks. At this point, the user can call a mobile and carry on a conversation.

2.2.2. MAKING CALLS FOR IN-PLANT PAGING

To make and in-plant page, follow the instructions above. Using the primary and secondary dialing features, the TRA can be programmed to dial two types of signaling formats based upon digit length. For example, the user could dial a three digit number for two-tone sequential and a five digit number for five-tone paging. Or, the primary and secondary dialing locations could be programmed for Touch Tone.

The user can now dial the desired number. When the tone sequence is completed a tone prompt will be heard indicating to the user that he can now give a voice message. The user can stay on-line at this point and talk to the unit they called, provided they called a talk-back paging/portable. If the user called a simple pager, they should hang up after the message is completed.

2.2.3. MAKING CALLS FOR RADIOTELEPHONE APPLICATIONS

To make and in-plant page, follow the instructions above. ANI and Dialing can be accomplished using the following method:

a) Upon going off hook, the TRA will scan to an empty channel, automatically send ANI, and then a dial tone will be heard from the base station.
b) After receiving dial tone, do one of the following:
    1. Enter the desired number and press *. The TRA will automatically dial the sequence.
    2. Enter the desired number and wait. The TRA will pause for the keyboard auto dial period programmed in **Auto Dial Time** and then dial the sequence.
    3. Press * followed by a digit 0-9 to dial one of the ten stored numbers.
    4. Press ** to redial the last number entered.
c) Disconnect ANI is automatically sent upon hang up.

2.3. Answering Calls

2.3.1. ANSWERING CALLS USING PTT CLICKS

When the user of a mobile unit wishes to call the base station, he may rapidly key his microphone button several times. The TRA will count the number of clicks that are programmed in **N-Click Decode**, and if they arrive within the time out period programmed in **N-Click Timeout**, the TRA will generate a 70V ring to signal the telephone receptionist, who may in turn page anyone throughout the building to pick up the line to which the TRA is connected, and answer the call. If the line rings at each phone, a receptionist might not be required.

The phone user simply talks into the microphone and the VOX will then key up the base station or Tone/DC Remote. When finished, simply hang up the phone. The user should monitor the channel for any other traffic to make sure he does not cause interference. The Busy Lockout feature can also provide this protection when programmed in **Busy Lockout**.

2.3.2. ANSWERING CALLS FOR IN-PLANT PAGING

Mobile or portable radios that are equipped with Touch Tone encoders for Talk Back paging can call into the base station using the address programmed in **Decode Numbers 1, 2, or 3**. The unit will ring and the phone user will proceed as described above.

2.3.3. ANSWERING CALLS FOR RADIOTELEPHONE APPLICATIONS

When a unit is called, the TRA generates a 70V RMS ring signal that activates the bell on the telephone. The TRA tip/ring is capable of ringing several phones. When the phone is taken off hook, only voice is transmitted when the RTI-800 Interconnect is used. Other terminals require ANI when the TRA comes off hook. When the phone is placed back on hook, the disconnect ANI is transmitted to the mobile telephone terminal thereby terminating the call.

3. PROGRAMMABLE FEATURES

See programming worksheet, pages 13-14.

3.1. Decode Numbers

When the DTMF, Five-Tone or Two-Tone decoder (as programmed in **Decode Format & Tone Detect Time**) receives a number it compares it with **Decode Numbers** 1, 2, and 3. Each location holds up to 8 digits followed by a special code that determines the unit's response. The decode digits may be any DTMF tone pair. The ring code must be one of the following:

1 - Standard telephone ring, ANI when answered
2 - Standard telephone ring, no ANI when answered
7 - 30 second key up for locating stolen radio
8 - Reset internal test call lamp and call reminder tone
9 - Unit deadbeat disable (see below)

If a match is found the unit will do one of the following:

a) Begin ringing (codes 1 and 2).
b) Key transmitter for 30 seconds (code 7).
c) Reset internal test call lamp and call reminder tone (code 8).
d) Change deadbeat disable status (code 9).

When the unit begins ringing it will continue to do so until the phone is taken off hook, the carrier is lost, the preprogrammed ring time has elapsed, or a DTMF A tone is received, which resets the TRA. If the call is not answered, a single short ring pulse will be generated every 1 to 99 seconds, depending on the setting in **Call Reminder Interval**, to alert the user that a call was received during his absence. This feature can be reset by quickly taking the receiver off and on hook (800 msec flash).

In the RTX-compatible format, the TRA decoder uses the DTMF digits A and D in the following manner. The scanner looks for a D collect tone at the start of the decode sequence. All other digits are ignored until a D tone is received. Upon receipt of a 150 msec A tone, the TRA will remute and resume scanning.

Ring code 7, when assigned to a decode register, will send back a 30 second carrier for triangulation on a lost or stolen unit. Ring code 9, when assigned to a register, will disable the VOX/PTT output function, preventing the user from keying up on a channel, and it will mute the receive audio. The unit is still capable of decoding a phone number in order to reset the deadbeat disable feature.

3.2. Connect & Disconnect ANI

The Automatic Number Identification locations contain the connect and disconnect ANI sequences. There is an entry for **Connect ANI**, and one for **Disconnect ANI.** Each location can be programmed with 0 to 8 digits.

The RTX-compatible format requires a * or a # in front of the ANI or in place of the ANI. If the * or # is in front of the ANI, it will be sent at the same speed as the ANI is programmed. If the * or # is used in place of the ANI, it will be sent for the time programmed in **Single Digit Tone Time**.

3.3. Transpond ANI

Transpond ANI can be programmed in this location for a 0 to 8 digit transpond sequence. The unit will send this sequence after decoding a number and prior to ringing. Note that the TRA transponds on **Decode Number 1** (Individual Call) only. There is no transpond on **Decode Numbers** 2 and 3, which are usually used for Group Call and All Call, because this would cause "mid air collisions" of the transpond tone.

3.4. ANI & Secondary Dialing Format

ANI & Secondary Dialing Format control the ANI format and timing for the first tone and subsequent tones.

- **Number of Digits:** This determines whether this format will be used for the dialing format. (See Primary Dialing Format, below, for additional information.
- **ANI Format:** Choose this from the **ANI, Dial, Transpond, and Decode Modes Table.**
- **Time 1:** This setting controls the duration of tone 1. A separate first tone timing makes it possible to create a preamble tone. If nothing is entered in the first timing field, the unit will default to the industry standard timings for that format.
- **Time 2:** This setting controls the duration of tone 2. If a time is entered in **Time1** but nothing is entered in **Time2**, the unit will encode all tones for the timing entered in **Time1**.

3.5. Primary Dialing Format

The dialing format is programmed here in the same manner as the ANI format. Choose a format from the **ANI, Dial, Transpond, and Decode Modes** Table and set the desired tone timings.

When a keyboard sequence is entered, the TRA first looks at the number of digits entered and compares this number to the **Number of Digits** value entered here. If the length of the entered sequence matches this, and **Primary Dialing Format** contains a valid format, then the primary dialing format is used to encode the sequence. If the length of the entered sequence does not match required number of digits, then the length is compared with the **Number of Digits** value in **ANI & Secondary Dialing Format**. If a match occurs, the secondary format is used to encode the sequence. If the length of the entered sequence does not match either setting, an error tone prompt is returned and the TRA waits for another to be re-

entered. A length of 0 in either location will allow you to dial any length sequence. You cannot have a 0 in both locations if you are doing dual type dialing. The primary dialing format **Number of Digits** must be set to a defined length and the secondary dialing format **Number of Digits** , when programmed to a 0, can send any length from 1-11 digits.

The TRA uses the number of digits entered before the user presses * or the **Auto Dial Time** expires. For example, a system could have the following settings:

Primary Dialing Format Number of Digits: 4
Primary Dialing Format: 1 (DTMF format)
ANI & Secondary Dialing Format # of Digits: 5
ANI & Secondary Dialing Format: 50 (CCIR format)

In this case, if four digits are keyed into the telephone, the TRA will dial in the primary format—DTMF. If five digits are entered on the keyboard, the TRA will dial in CCIR format—the secondary dialing format.

3.6. Transpond Format

The transpond format and tone lengths are programmed in the same manner as the ANI and Dialing formats. (See above)

3.7. Decode Format & Tone Detect Time

Choose a **Decode Format** from the **ANI, Dial, Transpond, and Decode Modes Table** and set the desired **Tone Detect Time** here. (See Table 4.) The decoder uses a sampling and averaging technique to improve the signal to noise ratio. *Therefore, the decode tone detect time for formats other than DTMF should be set at 1/4 to 1/5 the encode tone timings and should be set in increments of 5 ms*. For example, if the encode timings are set to 20 ms, the decode timings should be set to 5 ms; if the encode timings are set to 100 ms, the decode timings should be 20 to 25 ms.

If DTMF is chosen for the decode format, then **Time 1** determines the maximum inter-digit time between tones, not the detect time as used in five-tone or two-tone. This prevents falsing between short and long codes. When the tone disappears, the gap time is measured. If another digit arrives before the time has elapsed, it is appended to the decode buffer. An incoming DTMF sequence isn't compared to any Decode Numbers until the last tone has been received. This prevents falsing on longer numbers (i.e., decode number 1234 will not respond to 12345.) Set up a long timeout of 1 second or more if decoding manual dialing.

3.8. Transmit Parameters

Transmit parameters control the operation of the TRA during a call.

- **Trunking Delay:** This determines the period the TRA will delay after initial keyup before transmitting the ANI to allow the TRA-equipped trunked radio to find and to connect to a channel with an interconnect for TRA-to-Landline conversations.
- **Front Porch/Lead-In Delay:** This determines the period of time the TRA will wait with no modulation after applying PTT and before encoding the ANI or dialing sequence. This gives the repeater or base time to open and pass audio.
- **Back Porch/Lead-Out Delay:** This determines the period of time the TRA will wait with no modulation after sending the ANI or dialing sequence before releasing the PTT. This feature is necessary in Basic's RT5 and RT6 Terminal.
- **Single Digit Tone Time:** This sets the encode length of any single digit during ANI or dialing. (For example * up, # down)
- **COR Refresh Period** and **COR Refresh Width:** These settings respectively set the length of time between transmission bursts and the width of the burst used to prevent some full-duplex systems from disconnecting a half-duplex or simplex user while listening to the phone line side of the conversation. This is usually unnecessary in Touch Tone interconnects.
- **Dialing Enabled:** This can be set to inhibit dialing for Voice Call, Decode Only, and Tone & DC remote applications. When the phone is taken offhook, the TRA automatically keys the transmitter and then transmits its ANI after waiting for the time set in **Front Porch Lead-In Delay**. The micro then unkeys, allowing the simplex mobile to hear dial tone. At this time, the user can enter the desired number on the telephone Touch Tone pad.
- **Auto Dial Time:** This can be used to set a fixed period of time after which the TRA will automatically send a pre-entered string of digits. Thus, if during the keyboard entry of the dialing sequence, the user has not pressed any more keys within the auto dial time, the TRA will automatically send the digits entered instead of waiting for a * to instantly start dialing. In the duplex mode, the transmitter does not unkey, and the receiver is able to hear dial tone.

3.9. Decoding Parameters

Decoding parameters control the operation of the TRA after a number has been decoded.

- **Ring Period:** This controls the length of time the unit rings. The unit ANI's on the "busy" channel during the ring interval.
- **Horn Period**: This controls the length of time that an optional horn/external bell will energize. The unit ANI's on the "busy" channel during the ring interval.

In the TRA, there is an additional decoding format called *N-click*. This format is normally used for In-plant Paging systems. N-click allows a user to click the PTT of a mobile or handheld several times rapidly, which is received as a logic-state change on the COR Input of the TRA. This, in turn, can be used to ring an operator or receptionist.

- **N-Click Decode:** This programs the number of clicks needed to activate the ringer.

- **N-Click Timeout:** This sets the maximum time allowed between clicks before the click decoder is reset.

Typically, **N-Click Decode** is programmed for 5 to 7 clicks. Fewer clicks can result in falsing on noise. **N-Click Timeout** is typically set to 0.1 to 0.2 seconds. Programming too long a time here may also result in falsing. The TRA automatically rings when decoding N-clicks.

- **Hot Dialing Time:** This programs the Hot Dialing time from 0.0 to 9.9 seconds. This is how long the PTT will remain up between keypad entries.
- **VOX Hold Timer**: This timer prevents the PTT from dropping out between words, and can be set between .0 and .9 seconds. This timer is normally programmed from .5 to .8 seconds.
- **Scan Step**: This permits selecting either three line binary scan (for a maximum of 8 channels) or step scanning for radios employing push button channel steppers.

3.10. System Parameters

Miscellaneous system parameters are programmed here.

- **Queuing Signal Delay:** This sets the transmit Queuing Signal Delay time. When making a call in an RTX system, the scanner looks for a non-busy channel after the user comes off hook. (A channel is considered idle if no carrier is sensed.) If the TRA fails to find an empty channel when the user comes off hook, the TRA generates a busy tone. After the user hangs up, the TRA enters a **Queuing** mode, while it looks for an available channel. After a channel has been clear for the time programmed here, the TRA will ring the telephone for approximately 160 msec to inform the user that a channel has become available.
- **COR Active Input Level:** This determines whether a ground or V+ indicates a busy channel.
- **Squelch Active Input Level:** This determines whether a ground or V+ is used to squelch the radio audio output amplifiers. The polarity of diode D3 may also need to be reversed using JU7. In normal operation, it is not necessary to use the Squelch Output wire, because the earpiece audio in the telephone handset is muted by the TRA and the radio speaker serves no purpose.
- **Busy Lockout, # Channels to Scan:** Entering 00 disables both busy lockout and radio channel scanning. Entering 01-16 determines the number of channels to be scanned. When using binary a maximum of eight channels can be scanned (three lines). When step scanning, a maximum of sixteen channels is available. During step scan the radio is scanned in a circle. The TRA needs to know when it has gone through the circle so that it can determine whether all channels are busy and should give a busy indication and start the queuing timer.

The channel scanner controls an open-collector output that is used to step the radio to the next channel or the Least Significant Bit (LSB) of a binary address. (See installation section for the Violet Wire.) This can be wired to the channel-advance button on many synthesized radios or to the LSB of radios with binary channel advance.

- **Scan Pulse Time/Synthesizer Lock Time:** This sets length of time that the scan output is active. In step radios this time should be set for a period that guarantees that the output is recognized by the radio's step channel advance input circuit. In binary radios this time would represent how long the synthesizer takes to lock.
- **Scan COR Detect Time:** This sets the minimum length of time that the radio takes to advance and lock on to and provide a Carrier Present indication to the COR Input lead.

During decode in RTX-compatible systems, the channels are scanned for a DTMF **D** collect tone. Once a DTMF **D** tone is found, the scanner remains locked on the channel until the number has been decoded. If it matches one of the Decode Numbers (1, 2 or 3), scanning is disabled while ringing occurs. Answering the call during ringing will lock the scanner on the current channel.

- **Dial Tone and Talk Beep:** This Dial Tone function determines whether or not the TRA internally generates its own Pulsating Dial Tone while waiting for a number to be dialed. This feature is generally used for In-Plant Paging systems. The Talk Beep feature enables an audible tone after paging tones have finished. Entering a 0 disables both the dial tone and talk beep. A **1** enables the dial tone and disables the talk beep. A **2** enables the Talk Beep but disables the dial tone. Entering **3** enables both the dial tone and talk beep. See Table 12.
- **System Type:** This indicates to the TRA the type of system in which it is being used. Enter a **1** if the unit will operate in half duplex; enter a **2** if the unit will operate in simplex; and enter a **0** if the unit will operate in full duplex.

3.11. System Timers

The settings in this location control various timers. After an ANI is sent, the call length timer is started.

- **Call Limit Time**: This sets the maximum length of time a call may last before forcing a disconnect. Programming this to 000 will disable the timer. Setting this to 001 to 999 will set the timer to run for that many seconds. A warning beep in the earpiece is generated one minute before auto disconnect.
- **VOX Keyup Limit:** This is the maximum length of time that the TRA will generate PTT with a continuous voice input, before timing out. This prevents background noise from keeping the TRA keyed continuously if the telephone was accidentally not placed back on the hook. Setting this to 00 will disable timeout; setting it to 01-99 allows the unit to operate for that many seconds.
- **No VOX Activity Disconnect Time:** If the TRA's VOX has not detected any voice activity within the

period of time entered here, it will force disconnect. This is a safety feature to prevent the TRA from tying up the system when a handset is inadvertently not placed back on hook. Setting this to 00 disables this feature; setting it to 01-99 delays disconnect for that many seconds.

- **Call Reminder Interval:** This sets the length of time between reminder rings. After decoding a call, the TRA will ring for the time programmed in the **Ring Period** in **Decoding Parameters**. If the call is not answered during the ring time, the TRA will produce a very short reminder ring (approximately 160 msec) to tell the user that a call was received during his absence.

4. PROGRAMMING

Attach a standard telephone to the TRA "PHONE" input. Take phone off hook, then depress and hold down the "#" button. While monitoring "TP3" with an oscilloscope, adjust R27 for a reading of 650 mv (P. to P.) This is a preliminary setting to produce an adequate DTMF level for programming the TRA.

4.1. Entering Program Mode

Press # and hold it down while taking the phone off hook. Release the #, and two beeps will be heard. Enter the following number sequence on the telephone keypad:

2 7 1 8 2 8 1 8 2 8 4

After this has been entered, the unit will beep three times, indicating that programming mode is active.

4.2. Programming a Location

To change the contents of a system parameter, key in the required data and press

*** nn**

where nn=location 01-14. If fewer digits are entered than the register requires, trailing zeros are assumed. Extra digits are ignored.

For instance, to enter the sequence **1234** as the connect ANI, enter:

1 2 3 4 * 04

To exit the programming mode, press

*** 00**

The unit will respond with a long beep and resume normal operation.

The DTMF characters **A, B, C, D, *,** and # are programmed by using a quick flash on the hook switch, which allows the **2, 5, 8**, and **0** buttons to represent A-D. (The middle column of the telephone keyboard replaces the fourth column on a 16-button keyboard.) The * and # characters, with a quick flash on the hook switch, represent themselves. This is necessary for the * and #, because # serves as a clear key, and * serves as an entry key during normal operation.

For example, to program the connect ANI with the number **12A***, it would be necessary to enter the following sequence:

1 2 <flash>2 <flash>* *04

4.3. Programming the Memory Dial Numbers

Press # and hold it down while taking the phone off hook. Release #. Two beeps will be heard. Key in the number **0 0 0 0 0 0**. The unit will respond with three beeps indicating that the memory locations are unlocked.

Key in each number (up to 11 digits), and press ***** followed by 0-9. The unit will then store the number into the memory dial location selected, and will beep twice to indicate successful programming.

To exit programming mode, hang up the telephone.

For example, the number 520-884-7981 would be stored in memory dial number 3 by the following steps:

1. To enter programming mode, press # while going off hook, release #, and then dial **000000**.
2. Enter the number **5208847981**.
3. Press ***3** to store the number.
4. Exit programming mode by hanging up the telephone.

5. TRA SETUP PROCEDURES

Program the unit as desired using the programming sheets on page **Error! Bookmark not defined.**. Pay particular attention to setting the COR polarity, as this controls the Busy Channel Lockout and Busy Tone. Also, set the VOX timing to a comfortable setting; we recommend .5-.8 seconds. You may want to let your customer make the final determination on the VOX timing.

5.1. In-Plant Paging Setup

When the telephone handset is taken off hook, a dial tone will be heard if **Dial Tones** is set to 1. Enter the desired two-tone or five-tone paging code and set the modulation to 3.3 KCs using Mod Pot R58.

Then, using the "5" button on the Touch Tone phone, set modulation to about 3.3 KCs using TX Audio Gain Pot R27. Peak voice should now be going out at about 4 KCs, assuming the radio was properly set at 5 KCs maximum. The TX Audio Gain Pot R27 should be approximately mid-range for most telephones. The voltage on Pin 1 of U5 TP1 should be approximately 1.25 Volts peak to peak when pressing the "5" on the Touch Tone phone.

If the injection point to the radio is Low Z and the maximum tone output level is insufficient, install jumper JU6, which shorts out R59, lowering the output impedance. Then repeat above steps.

Using a service monitor, with a 1 KC test tone set to 3.5 KC of deviation, inject an RF signal into the receiver sufficient to quiet it, and set RX Gain Pot R34 so that test point 2 is set at 1.5 vp-p (500 mV RMS).

To set earpiece volume, adjust R17 to a comfortable level. Do not set this level too high as this can cause hybrid ringing.

NOTE: The hybrid balance pot **R13**, has been set at the factory using a standard telephone. The transmit audio level pot **R27** has been factory set to about mid-range and so has the receive earpiece level pot **R17**. **R27** and **R17** and should not need readjustment. You may need to readjust the hybrid balance **R13**. The simplest method is to turn up the receive earpiece level pot **R17**, and transmit audio level pot **R27**. You will then notice that when the hybrid balance pot **R13** is adjusted, there will be a null between a low frequency howl and a high frequency howl. Set the hybrid balance pot in the quiet zone between the two howls, then turn down the receive input and the ear piece levels according to the instructions above, and reset the TX audio level pot **R27** to the factory setting or to the point of 3.3 kHz of deviation when pressing a 5 on the telephone's touch tone pad. If either the transmit or receive audio path levels are turned up too high, there may be some noise heard during conversation that sounds like the hybrid is on the verge of singing. If this occurs, lower the TX and/or RX level controls. Generally, the hybrid pot may need readjustment if you change from one manufacturer or type of telephone to another.

5.2. Trunked Radiotelephone Setup

When the telephone handset is taken off hook, a dial tone will be heard if the ANI was received and validated at the repeater terminal. Enter the desired phone number and set the modulation to 3.3 KCs using Mod Pot R58.

Then, using the "5" button on the Touch Tone phone, set modulation to about 3.3 KCs using TX Gain Pot R27. Peak voice should now be going out at about 4 KCs, assuming the radio was properly set at 5 KCs maximum.

If the injection point to the radio is Low Z and the maximum tone output level is insufficient, install jumper JU6, which shorts out R59, lowering the output impedance. Then repeat above steps.

Using a service monitor, with a 1 KC test tone set to 3.5 KC of deviation, inject an RF signal into the receiver sufficient to quiet it, and set RX Gain Pot R34 so that test point 2 is set at 1.5 vp-p (500 mV RMS).

To set earpiece volume, adjust R17 to a comfortable level. Do not set this level too high as this can cause hybrid ringing.

NOTE: The hybrid balance pot R13, has been set at the factory using a standard telephone. The transmit audio level pot R27 has been factory set to about mid-range and so has the receive earpiece level pot R17. R27 and R17 and should not need readjustment. You may need to readjust the hybrid balance R13. The simplest method is to turn up the receive earpiece level pot R17, and transmit audio level pot R27. You will then notice that when the hybrid balance pot R13 is adjusted, there will be a null between a low frequency howl and a high frequency howl. Set the hybrid balance pot in the quiet zone between the two howls, then turn back down the receive input and the ear piece levels according to the instructions above, and reset the TX audio level pot R27 to the factory setting or to the point of 3.3Khz of deviation when pressing a 5 on the telephone's touch tone pad. If either the transmit or receive audio path levels are turned up too high, there may be some noise heard during conversation that sounds like the hybrid is on the verge of singing. If this occurs, lower the TX and/or RX level controls. Generally, the hybrid pot may need readjustment if you change from one manufacturer or type of telephone to another.

6. THEORY OF OPERATION

The receiver audio applied to the Orange RX Tone Input lead will be present at connector P1 pin 11 feeding 3 basic paths:

- the receiver earpiece audio via RX Gain Input Pot R34 and U5A through U4A and Earpiece Level Pot R17;
- the tone signal for DTMF decode through R62 and Gain Control Feedback Resistor R63;
- and the two-tone/five tone circuit U6A and U6B.

Receive earpiece audio is enabled/disabled by U4A and controlled by pin 27 of the microprocessor. This path, normally disabled, is enabled after the TRA sends its ANI. If the channel is busy, the microprocessor generates a Busy tone on pin 20 and applies it to U4 Pin 12 The amplified voice audio is applied to hybrid transformer T2, which drives the telephone handset. Trimpot R13 is the trans-hybrid isolation balance control.

Audio/tones are fed to U8, DTMF decoder, via U4C Pin 4. Gain for U8 is determined by the ratio of R62/R63, tone acquisition time by the RC time constant, C42, R64 and R65. With the values shown, this timing is approximately 35 msec.

U6A—along with U6B (a Schmidt trigger)—acts as a low pass filter for processing two-tone and five-tone when decoded by the microprocessor at Pin 41.

Relay RLY1 is used to switch the telephone handset from the ringer transformer T1 to the balanced hybrid transformer T2. The ringer, composed of T1, Q1, and Q2 and associated components, generates 70V RMS when ringing. The 33 Hz ringing frequency is generated by the micro at pin 24 and 28. These two signals are 180 degrees out of phase and are integrated by R6, R8, C6 and C7. The opto isolator U2 monitors this voltage during each cycle. If the telephone handset is taken off hook during ringing, the voltage drops, causing U2 Pin 5 to go high. This causes the micro to terminate ringing. Resistors R10, R11, and Q5 act as the off hook detector when making or terminating a call.

The *transmit audio*, voice and tones, are generated in the telephone handset and appear at hybrid transformer T2 terminal 10. Amplified by U5-B, which is then fed to U4-B and U4-C. U4-C is turned on by the microprocessor during dialing so that the Touch Tone decoder can see the dialing sequence to tell the micro to regenerate its own dialing sequence. During this time, U4-B blocks handset Touch Tone audio from going out the low pass filter Q7

and Mod Pot R58. When U4-B is ready to re-encode the tones, it will switch the modulation path over to the DAC output coming in from Pin 1 of U4-B.

Transmit telephone audio is applied to the low pass filter when the micro switches on U4-B Pin 2. With JU6 installed, the output impedance is approximately 1KW, and the output impedance is approximately 27KW if jumper JU6 is not installed.

U5-C is the VOX amplifier which feeds transistor Q4, which acts as a detector instantly charging C19 which has about a 50 msec time constant. This signal causes Schmidt trigger U5-D to tell the micro to key up the transmitter with an additional VOX delay time which has been programmed in **Vox Hold Timer**. The micro asserts PTT out by turning on Q9.

Squelch is controlled by Transistor Q8 and the polarity is selected by Jumper JU7. When using positive squelch the 47K resistor may be lowered if more current is needed. The horn transistor Q10 is a VMOS power FET and provides a momentary ground to honk the horn for the time programmed in **Horn Period**.

Channel Scanning. There are two types of channel scanning on the TRA, binary and step scanning. The binary scan uses a three line address on P1-2, P1-6 and P1-12. When binary is employed remove Q11 and install a jumper from its base to its collector. In the step scanning Q11 is normally installed and the base collector jumper is omitted. Q11 is an open collector circuit which can be used to step push button type radios. The type of scan is selected in **Scan Step**. **Busy Lockout, # Channels to Scan** controls busy lock out and the number of channels to scan. When using the step scan feature a maximum of 16 channels is available When using the binary method a maximum of 8 channels is available. This is due to the limitation of 3 binary address lines.

MIDIAN CONTACT INFORMATION

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7. PROGRAMMING TABLES

TABLE 1: RING CODE PROGRAMMING	
RING CODE	**FUNCTION**
1	STANDARD TELEPHONE RING, ANI ON ANSWER
2	STANDARD TELEPHONE RING, NO ANI ON ANSWER
7	30 SECOND KEYUP FOR LOCATING STOLEN RADIO
8	RESET CALL LAMP & CALL REMINDER TONE
9	UNIT DEADBEAT DISABLE

TABLE 2: ONE, TWO & FOUR TONE TIMING SEQUENCE				
FORMAT	**CALL SEQUENCE**	**1ST TONE**	**GAP**	**2ND TONE**
MOTOROLA 1 + 1 QUICK CALL 2	INDIVIDUAL CALL TONE & VOICE	1 SEC	0	3 SEC
	GROUP CALL	0	0	8 SEC
	TONE ONLY	.4 SEC	0	.8 SEC
	TONE ONLY BATTERY SAVE	2.7 SEC	0	.8 SEC
REACH TWO TONE	REACH SLOW	2 SEC	25 MS	.7 SEC
	REACH FAST	150 MS	25 MS	150 MS
	REACH GROUP CALL TWO TONE	5 SEC	0	0
GENERAL ELECTRIC	GENERAL ELECTRIC TYPE 99	1 SEC	0	1.5 SEC
NEC	GROUP CALL			
A	6 SEC	1 SEC	.25 SEC	3 SEC
B	6 SEC	1 SEC	0	3 SEC
C	4 SEC	1 SEC	0	1 SEC
D	3 SEC	.4 SEC	0	.4 SEC
L	3 SEC	.5 SEC	0	.5 SEC
M	4 SEC	.4 SEC	0	.8 SEC

TABLE 3: SEQUENTIAL SINGLE FREQUENCY CODES & TIMINGS									
TONE	**CODE**	**EUROPEAN FIVE/SIX TONE FREQUENCIES IN HZ**						**MOTOROLA**	
NUMBER	**DIGIT**	**EEA**	**CCIR**	**ZVEI**	**DZVEI**	**DDZVEI**	**NATEL**	**EIA**	**MODAT**
TONE 0	0	1981	1981	2400	2200	2400	1633	600	637.5
TONE 1	1	1124	1124	1060	970	1060	631	741	787.5
TONE 2	2	1197	1197	1160	1060	1160	697	882	937.5
TONE 3	3	1275	1275	1270	1160	1270	770	1023	1087.5
TONE 4	4	1358	1358	1400	1270	1400	852	1164	1237.5
TONE 5	5	1446	1446	1530	1400	1530	941	1305	1387.5
TONE 6	6	1540	1540	1670	1530	1670	1040	1446	1537.5
TONE 7	7	1640	1640	1830	1670	1830	1209	1587	1687.5
TONE 8	8	1747	1747	2000	1830	2000	1336	1728	1837.5
TONE 9	9	1860	1860	2200	2000	2200	1477	1869	1987.5
REPEAT TONE	R	2110	2110	2600	2400	970	1805	459	487.5
GROUP TONE	G	1055	2400	2800	885	885	1995	2010	---
ALARM TONE	A	2400							
TONE WIDTH (MS)		40±4	100±10	70±15	70±15	70±15	70	33±.5	40±5
SEQ LENGTH (MS)		200	500	350	350	350	350	165	280
MAX INTERTONE TIME (MS)		4	7.5	15	15	15		0	
MIN GAP BEFORE/BETWEEN SEQ (MS)		100	290	140	140	140		33	
ENCODER TOLERANCE		±1%	±8HZ	±1.5%	±1.5%	±1.5%	±1.5%	±.1%	
MUST DECODE BW		±1%	±1%	±1.5%	±1.5%	±1.5%		±16HZ	
MUST REJECT BW		±3%	±3%	±4.5%	±4.5%	±4.5%		NS	

TABLE 4: ANI, DIAL, TRANSPOND & DECODE MODES

#	MODE	TIME 1	TIME 2	#	MODE	TIME 1	TIME 2
00	NONE	UNUSED	UNUSED	**33**	MOTOROLA N	FIRST TONE	NEXT TONE
01	DTMF	TONE ON	TONE OFF	**34**	MOTOROLA P	FIRST TONE	NEXT TONE
02				**35**	MOTOROLA Q	FIRST TONE	NEXT TONE
03				**36**	MOTOROLA R	FIRST TONE	NEXT TONE
04	RTX-COMPATIBLE	TONE ON	TONE OFF	**37**	MOTOROLA S	FIRST TONE	NEXT TONE
05				**38**	MOTOROLA T	FIRST TONE	NEXT TONE
20	MOT GENERAL	FIRST TONE	NEXT TONE	**39**	MOTOROLA U	FIRST TONE	NEXT TONE
21	MOTOROLA A†	FIRST TONE	NEXT TONE	**40**	MOTOROLA V	FIRST TONE	NEXT TONE
22	MOTOROLA B	FIRST TONE	NEXT TONE	**41**	MOTOROLA W	FIRST TONE	NEXT TONE
23	MOTOROLA C	FIRST TONE	NEXT TONE	**45**	GE	FIRST TONE	NEXT TONE
24	MOTOROLA D	FIRST TONE	NEXT TONE	**46**	REACH	FIRST TONE	NEXT TONE
25	MOTOROLA E	FIRST TONE	NEXT TONE	**50**	CCIR	FIRST TONE	NEXT TONES
26	MOTOROLA F	FIRST TONE	NEXT TONE	**51**	EEA	FIRST TONE	NEXT TONES
27	MOTOROLA G	FIRST TONE	NEXT TONE	**52**	EIA	FIRST TONE	NEXT TONES
28	MOTOROLA H	FIRST TONE	NEXT TONE	**53**	ZVEI	FIRST TONE	NEXT TONES
29	MOTOROLA J	FIRST TONE	NEXT TONE	**54**	DZVEI	FIRST TONE	NEXT TONES
30	MOTOROLA K	FIRST TONE	NEXT TONE	**55**	DDZVEI	FIRST TONE	NEXT TONES
31	MOTOROLA L	FIRST TONE	NEXT TONE	**56**	NATEL	FIRST TONE	NEXT TONES
32	MOTOROLA M	FIRST TONE	NEXT TONE	**60**	MODAT	FIRST TONE	NEXT TONES

† - Motorola A is not a Motorola standard.

TABLE 5: MOTOROLA CODE PLAN

FIRST DIGIT	CODE TYPE																				
	A*	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**J**	**K**	**L**	**M**	**N**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**
1	11	11	11	11	11	11	11	11	11	11	11	23	23	23	24	24	25	34	34	35	46
2	22	22	22	22	22	13	13	13	14	14	15	22	22	22	22	22	22	43	43	53	64
3	33	33	12	12	12	33	33	33	41	41	51	33	33	33	42	42	52	33	33	33	56
4	44	12	44	15	21	44	31	31	44	44	16	44	32	32	44	44	26	44	44	36	44
5	55	13	14	55	16	31	55	16	55	16	55	32	55	26	55	26	55	55	36	55	55
6	66	21	21	21	66	14	15	66	15	66	66	24	25	66	25	66	66	35	66	66	66
7		31	41	51	61	41	51	61	45	61	61	42	52	62	45	62	62	45	63	63	45
8		23	24	25	26	34	35	36	54	46	56	34	35	36	54	46	56	54	46	56	54
9		32	42	52	62	43	53	63	51	64	65	43	53	63	52	64	65	53	64	65	65

* A is not a Motorola Standard.

TABLE 6: MOTOROLA GENERAL ENCODING PLAN

FIRST DIGIT OF PAGER CODE	TONE A GROUP	TONE B GROUP
1	1	1
2	2	2
3	1	2
4	4	4
5	5	5
6	2	1
7	4	5
8	5	4
9	2	4
0	4	2

TABLE 7: MOTOROLA REED GROUPS

TONE NUMBER	REED GROUP 1		REED GROUP 2		REED GROUP 3		REED GROUP 4		REED GROUP 5		REED GROUP 6	
	REED CODE	FREQ HZ	REED CODE	FREQ HZ	REED CODE	FREQ HZ	REED CODE	FREQ HZ	REED CODE	FREQ HZ	REED CODE	FREQ HZ
1	111	349.0	121	600.9	138	288.5	141	339.6	151	584.8	191	1153.4
2	112	368.5	122	634.5	108	296.5	142	358.6	152	617.4	192	1185.2
3	113	389.0	123	669.9	139	304.7	143	378.6	153	651.9	193	1217.8
4	114	410.8	124	707.3	109	313.0	144	399.8	154	688.3	194	1251.4
5	115	433.7	125	746.8	160	953.7	145	422.1	155	726.8	195	1285.8
6	116	457.9	126	788.5	130	979.9	146	445.7	156	767.4	196	1321.2
7	117	483.5	127	832.5	161	1006.9	147	470.5	157	810.2	197	1357.6
8	118	510.5	128	879.0	131	1034.7	148	496.8	158	855.5	198	1395.0
9	119	539.0	129	928.1	162	1063.2	149	524.6	159	903.2	199	1433.4
0	110	330.5	120	569.1	189	1092.4	140	321.7	150	553.9	190	1122.5

TABLE 8: GE TYPE 99 TABLE I			
GROUP	A	B	C
TONE #	FREQ	FREQ	FREQ
1	592.5	607.5	712.5
2	757.5	787.5	772.5
3	802.5	832.5	817.5
4	847.5	877.5	862.5
5	892.5	922.5	907.5
6	937.5	967.5	952.5
7	547.5	517.5	532.5
8	727.5	562.5	577.5
9	637.5	697.5	622.5
0	682.5	652.5	667.5
DIA	742.5 HZ		

TABLE 9: GE Type 99 Table II		
100'S	TONE REED GROUPS FOR	
DIGIT	1ST TONE	2ND TONE
0	A	A
1	B	A
2	B	B
3	A	B
4	C	C
5	C	A
6	C	B
7	A	C
8	B	C

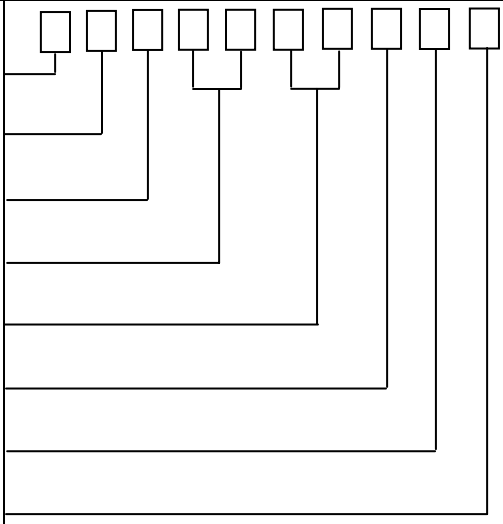
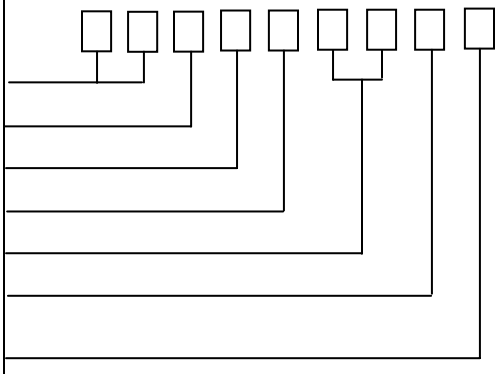
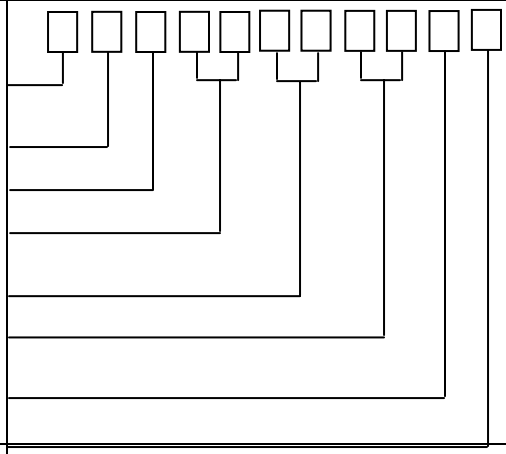
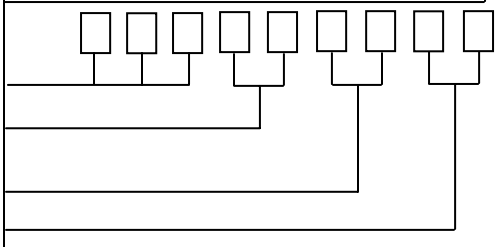
TABLE 10: REACH TWO-TONE SEQUENTIAL -- FAST OR SLOW		
1ST DIGIT OF CODE	GROUP FOR 1ST TONE	GROUP FOR 2ND TONE
1	A	C
2	C	A
3	B	D
4	D	B
5	A	D
6	D	A
7	A	E
8	E	A
9	B	E
0	E	B

TABLE 11: REACH TWO-TONE & SINGLE TONE PAGING FREQUENCIES										
TONE	GROUP A		GROUP B		GROUP C		GROUP D		GROUP E	
NUM	CHN	FREQ	CHN	FREQ	CHN	FREQ	CHN	FREQ	CHN	FREQ
1	11	2704	21	1912	26	1608	36	1137	46	804
2	12	2612	22	1847	67	1553	37	1098	47	776
3	13	2523	23	1784	68	1500	38	1061	48	750
4	14	2437	24	1723	69	1449	39	1025	49	725
5	15	2354	25	1664	30	1400	40	990	50	700
6	16	2274	26	1608	31	1352	41	956	51	676
7	17	2196	27	1553	32	1306	42	923	52	653
8	18	2121	28	1500	33	1261	43	892	53	631
9	19	2049	29	1449	34	1219	44	862	54	609
0	20	1980	30	1400	35	1177	45	832	55	588

TABLE 12: DIAL TONE & TALK BEEP		
DIGIT	DIAL TONE	TALK BEEP
0	OFF	OFF
1	ON	OFF
2	OFF	ON
3	ON	ON

Enter Programming Access Code: **2 7 1 8 2 8 1 8 2 8 4** on telephone keypad (see Section 3)

For this feature	Enter These Codes
Decode Number 1 (1-8 digits) plus Ring Code (1 digit) Enter the desired decode number plus Ring Code. The last digit entered will become the ring code. For example, if the desired decode number is 12345 with ring code 1, enter the sequence 123451 followed by * 01.	□□□□□□□□+□ *** 01**
Decode Number 2 (1-8 digits) plus Ring Code (1 digit) Program in the same manner as Decode Number 1.	□□□□□□□□+□ *** 02**
Decode Number 3 (1-8 digits) plus Ring Code (1 digit) Program in the same manner as Decode Number 1.	□□□□□□□□+□ *** 03**
Connect ANI (0-8 digits) This will be transmitted when PTT is pressed and/or released, depending on the **ANI Position** setting in **Transmit Parameters**.	□□□□□□□□ *** 04**
Disconnect ANI (0-8 digits) Program in the same manner as Connect ANI.	□□□□□□□□ *** 05**
Transpond (0-8 digits) This sequence will be transponded only on decode of Decode Number 1; this prevents "mid-air collisions" on group call. **Note:** The **Auxiliary Input** in **Transmit Parameters** turns transpond ON or OFF.	□□□□□□□□ *** 06**
ANI/Secondary Dialing Format & Tone Lengths (11 digits) A) Number of Digits (1-9, 0=any) Sets the number of digits accepted in the Secondary Dialing Format ; 0 disables this feature. B) ANI Format (00-60; see table 4) Enter the two digit code that corresponds to the desired format from Table 4. C) Time 1 (0.000-9.999 seconds) Enter the desired time for the first tone. This separate timing makes possible a preamble tone. If nothing is entered, industry standard timings will be used. D) Time 2 (0.000-9.999 seconds) Enter the desired time for subsequent tones. If nothing is entered , all tones will be encoded for the length that is entered in **Time 1**.	□□□□□□□□□□□ *** 07**
Primary Dialing Format & Tone Lengths (11 digits) A) Number of Digits (1-9, 0=any) Sets the number of digits accepted in the Primary Dialing Format ; 0 disables this feature. B) Dialing Format (00-60; see table 4) Program in the same manner as **ANI/Secondary Format & Tone Lengths**. C) Time 1 (0.000-9.999 seconds) Program in the same manner as **ANI/Secondary Format & Tone Lengths**. D) Time 2 (0.000-9.999 seconds) Program in the same manner as **ANI/Secondary Format & Tone Lengths**.	□□□□□□□□□□□ *** 08**
Transpond Format (10 digits) A) Transpond Format (00-60; see table 4) Program in the same manner as **ANI Format & Tone Lengths**. B) Time 1 (0.000-9.999 seconds) Program in the same manner as **ANI Format & Tone Lengths**. C) Time 2 (0.000-9.999 seconds) Program in the same manner as **ANI Format & Tone Lengths**.	□□□□□□□□□□ *** 09**
Decode Format & Tone Detect Time (6 digits) A) Decode Format (00-60; see table 4) Program in the same manner as **ANI Format & Tone Lengths**. B) Time 1 (0.000-9.999 seconds) When using DTMF, this is an interdigit timer. We recommend 1-2 seconds. When using 5-tone, enter a time that is 1/5 of the encode tone time in increments of 5 ms. For example, if the encode time is 25 ms/ tone, set the decode time to 5 ms/tone.	□□□□□□ *** 10**

For this feature	Enter These Codes
Transmit Parameters (10 digits) A) Trunking Delay (0-9 seconds) Enter a trunking delay of 0-9 seconds. This allows the radio to scan for an empty interconnect channel. B) Key-Up Delay (.0-.9 seconds) When dialing the transmitter will key, pause for the key-up delay, & then send the tones. C) Back Porch/Lead-Out Delay (.0-.9 seconds) This is a time after sending ANI that the transmitter will release PTT. D) Single Digit Tone Time (0.0-9.9 seconds) Sets the length of time for any single-digit sequence during ANI or dialing. E) COR Refresh Period (00-99 seconds) Sets length of time between transmission bursts. This prevents some full-duplex systems from disconnecting during conversations. F) COR Refresh Width (.0-.9 seconds) Sets width of transmission burst. This prevents some full-duplex systems from disconnecting during conversations. G) Dialing Enabled (0=disabled, 1=enabled) This enables dialing. In some systems dialing will not be desired. H) Auto Dial Time (0=disabled, 1-9=seconds) This limits the time between manually-entered digits. If enabled & the user pauses for more than this time, the TRA will automatically send the entered sequence.	 *** 11**
Decoding Parameters (9 digits) A) Ring Period (00-99 seconds) Enter a ring period of 00-99 seconds. B) Horn Period (0-9 seconds) This sets the length of time the optional horn relay will be energized. C) N-Click Decode (0=disabled, 1-9 =enabled) The number of PTT clicks needed to activate the TRA ring tones. D) N-Click Timeout (.0-.9 seconds) Enter the maximum time allowed between clicks to activate N-Click decode. E) Hot Dialing Time (0.0-9.9 seconds) The amount of time PTT will remain up between entries. F) VOX Hold Timer (.0-.9 seconds) Amount of time that PTT will remain open on an unmodulated signal. Recommended: .5 to .8 seconds. G) Scan Step (0=Step, 1=Binary) Selects between 3-line binary scan or step scanning.	 *** 12**
System Parameters (11 digits) A) Queuing Signal Delay (0-9 seconds) The unit will monitor the channel until it has been idle for the time entered here and then generate 3 beeps to indicate that the channel is no longer busy. B) COR Active Input Level (0=GND, 1=V+) Sets COR Active logic state. C) Squelch Active Input Level (0=GND, 1=V+) Sets Squelch Active logic state. D) Busy Lockout, # Channels to Scan (00=off, 01-16=on, # chan.) Enables Busy Lockout and sets the number of channels to scan. 00 disables both scanning and busy lockout. E) Scan Pulse Time/Synthesizer Lock Time (.00-.99 seconds) Sets length of time that scan output is active. F) Scan COR Detect Time (.00-.99 seconds) Sets minimum length of time for radio to lock on to carrier. G) Dial Tone and Talk Beep (0=Both OFF, 1=Dial Tone Only, 2=Talk Beep Only, 3=Both ON) Determines whether TRA internally generates dial tone and beep after dialing. H) System Type (0=Duplex, 1=Half-duplex, 2=Simplex)	 *** 13**
System Timers (9 digits) A) Call Limit Time (000-999 seconds; 000=disabled) Sets the maximum length of time before disconnect. B) VOX Keyup Limit (00-99 seconds; 00=disabled) Length of time TRA will generate PTT with continuous voice input, before timing out. C) No VOX Activity Disconnect Time (00-99 seconds) Length of time before disconnect when no voice is detected. D) Call Reminder Interval (00-99 seconds) If call is not answered by user, a reminder ring is generated at the interval set here.	 *** 14**

Enter *00 to exit programming mode (unit will emit long beep)

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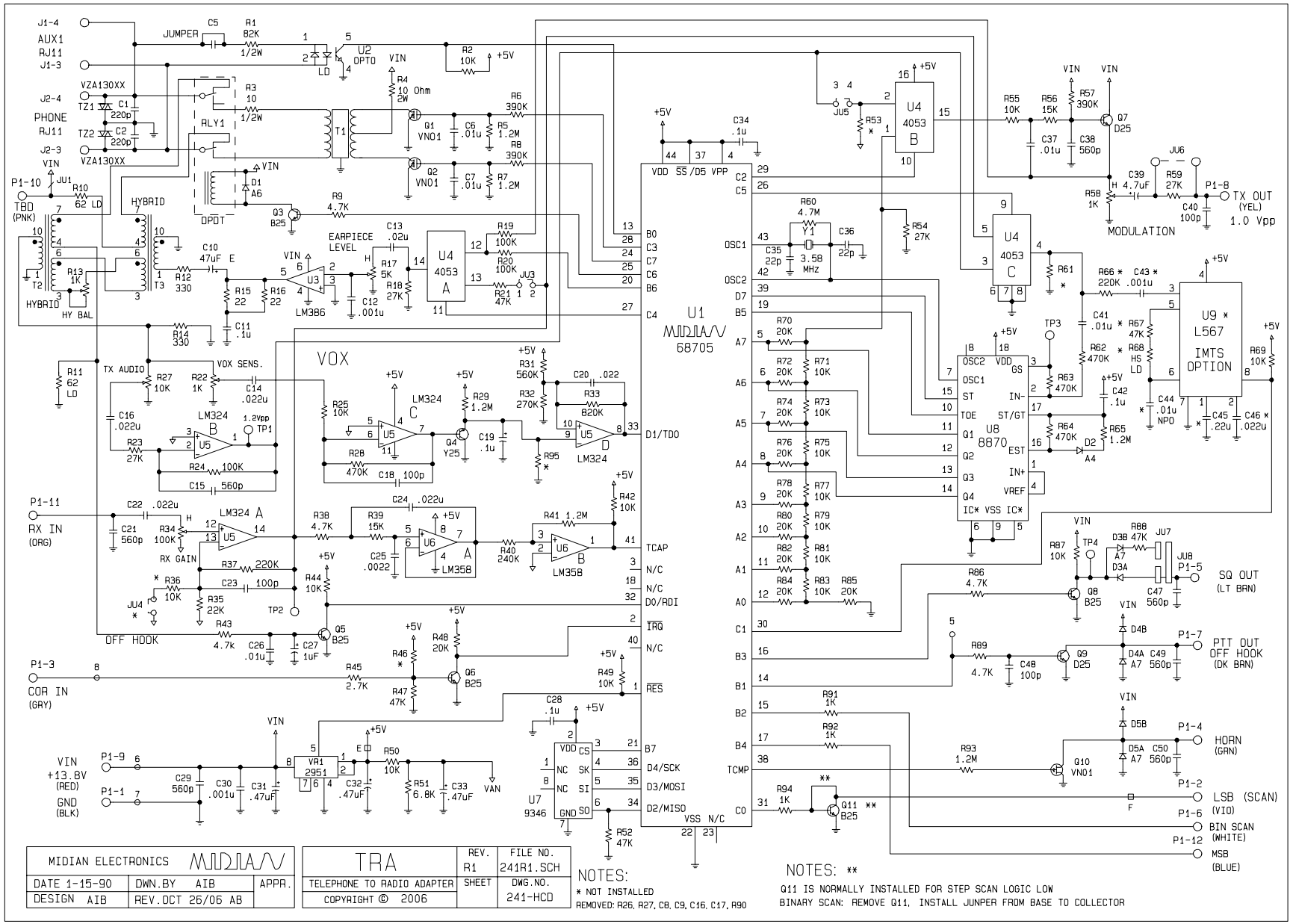

MIDIAN ELECTRONICS		
DATE 1-15-90	DWN.BY AIB	APPR.
DESIGN AIB	REV.OCT 26/06 AB	

TRA	REV.	FILE NO.
	R1	241R1.SCH
TELEPHONE TO RADIO ADAPTER	SHEET	DWG.NO.
COPYRIGHT © 2006		241-HCD

NOTES:
* NOT INSTALLED
REMOVED: R26, R27, C8, C9, C16, C17, R90

NOTES: **
Q11 IS NORMALLY INSTALLED FOR STEP SCAN LOGIC LOW
BINARY SCAN: REMOVE Q11, INSTALL JUNPER FROM BASE TO COLLECTOR

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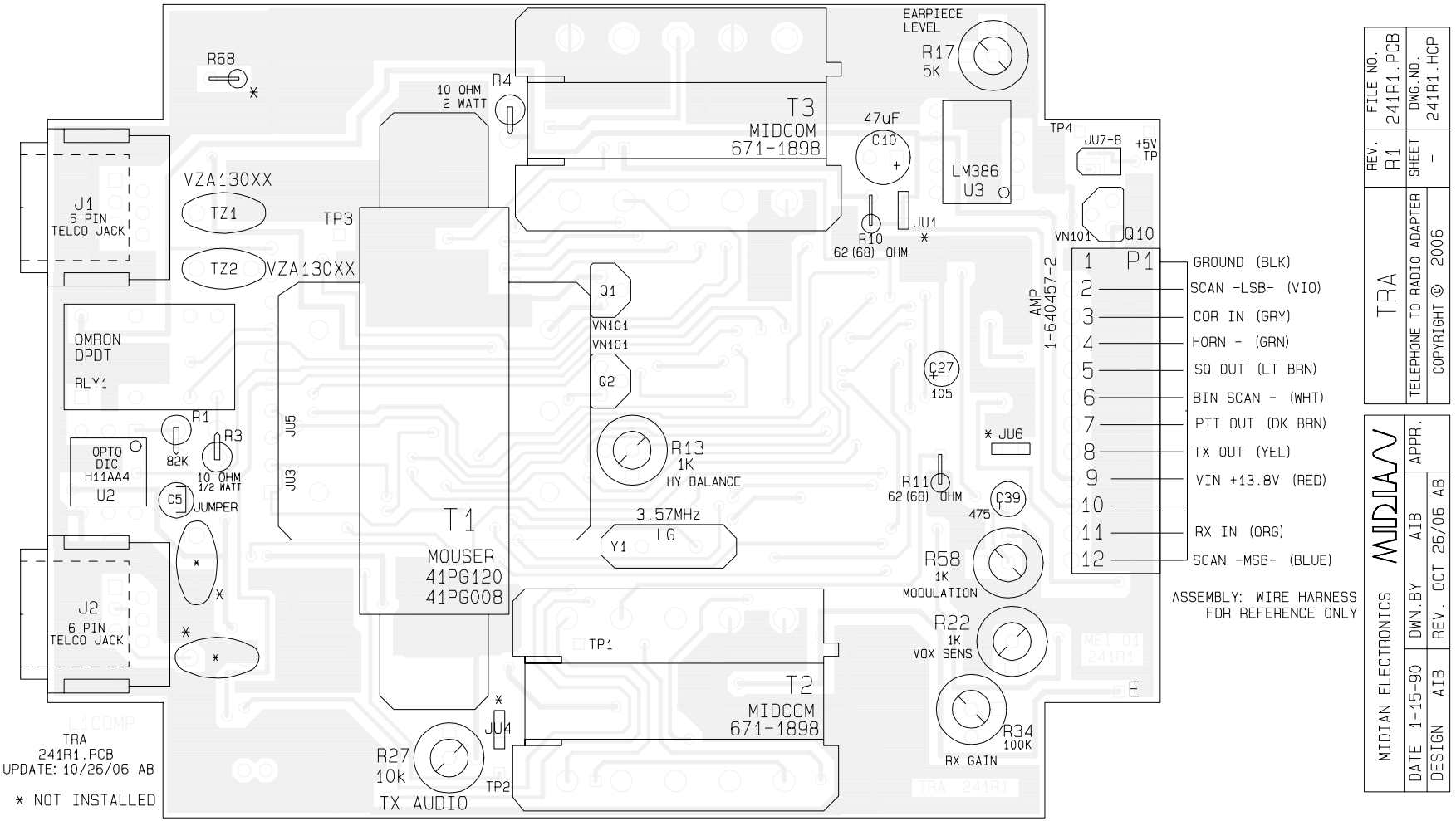
EARPIECE LEVEL
R17 5K
R68
10 OHM 2 WATT
R4
T3 MIDCOM 671-1898
47uF
C10
LM386 U3
TP4
JU7-B
+5V TP
VZA130XX
TZ1
TZ2
VZA130XX
J1 6 PIN TELCO JACK
TP3
R10 62 (68) OHM
JU1
VN101
Q10
AMP 1-640457-2
P1
1 GROUND (BLK)
2 SCAN -LSB- (VIO)
3 COR IN (GRY)
4 HORN - (GRN)
5 SQ OUT (LT BRN)
6 BIN SCAN - (WHT)
7 PTT OUT (DK BRN)
8 TX OUT (YEL)
9 VIN +13.8V (RED)
10
11 RX IN (ORG)
12 SCAN -MSB- (BLUE)
Q1
VN101
VN101
Q2
C27 105
OMRON DPDT RLY1
R1 82K
R3 10 OHM 1/2 WATT
OPTO DIC H11AA4 U2
C5 JUMPER
JU5
JU3
R13 1K HY BALANCE
* JU6
R11 62 (68) OHM
C39 475
3.57MHz LG
Y1
T1 MOUSER 41PG120 41PG008
R58 1K MODULATION
R22 1K VOX SENS
J2 6 PIN TELCO JACK
TP1
T2 MIDCOM 671-1898
R34 100K
RX GAIN
JU4
R27 10k
TX AUDIO
TP2
TRA 241R1
E
L1COMP
TRA
241R1.PCB
UPDATE: 10/26/06 AB
* NOT INSTALLED
ASSEMBLY: WIRE HARNESS FOR REFERENCE ONLY
TRA
TELEPHONE TO RADIO ADAPTER
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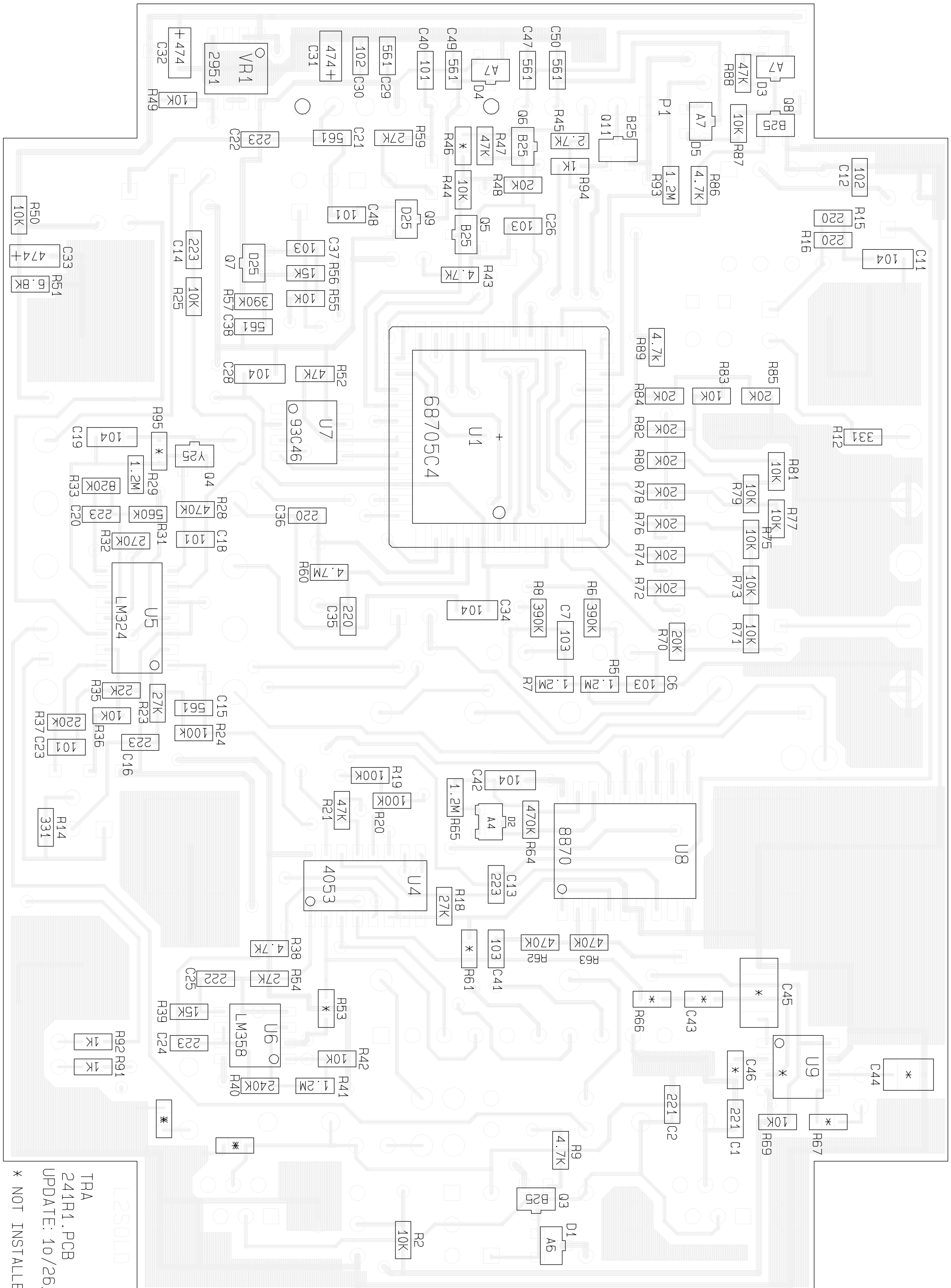
REV. R1
SHEET -
FILE NO. 241R1.PCB
DWG.NO. 241R1.HCP
MIDIAN ELECTRONICS
APPR.
DWN.BY AIB
DATE 1-15-90
DESIGN AIB
REV. OCT 26/06 AB



TRA
241R1.PCB
UPDATE: 10/26/06
* NOT INSTALLED

MIDIAN ELECTRONICS			TRA	REV. R1	FILE NO. 241R1.PCB
DATE 1-15-90	DWN. BY AIB	APPR.	TELEPHONE TO RADIO ADAPTER	SHEET	DWG. NO.
DESIGN AIB	REV. OCT 26/06 AB		COPYRIGHT © 2006	-	241R1.HCP