Z E T R O N

MODEL 32 DAPT-Jr
OPERATING MANUAL

#025-9040M

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WARRANTY STATEMENT

Zetron, Inc. warrants that all equipment sold pursuant to any agreement shall be free from defects in material and workmanship at the time of delivery. The warranty shall extend from the time of delivery for one year. The buyer must provide written notice of any defect to Zetron within this warranty period. If the defect is not the result of improper usage, service, maintenance, or installation and if the equipment has not been damaged or modified after delivery, Zetron shall, at its option and after the buyer has returned the equipment to Zetron, 1. replace or repair the defective part or parts of equipment, 2. replace the equipment, or 3. refund the purchase price. Shipment of the equipment to Zetron's facility shall be borne on the account of the buyer.

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

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

FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

To comply with FCC regulations, the following must be met:

1. If used in the End-to-End configuration, then the FCC registration number (EYB5Q5-71748-OT-R), Ringer Equivalence Number (0.7B) and Interface Jack (RJ11C) may be reported to the business office of the local telephone company, if requested.

2. If used in the 2 wire DID or 4 wire E&M configuration then the FCC registration number (EYB5Q5-71748-OT-R), ringer equivalence number (0.0B), Service Order Code (9.0F), and Interface Jack (RJ2EX) should be reported to the Centralized Operations Group (COG) rather than the local area business office. The COG Group is better equipped to handle the complex signaling requirements of these devices. The Facility Interface Code for E&M operation is TL11E for the DAPT-1000 end of the connection. (TL11M for the Telco end).

3. This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

   a. This device may not cause harmful interference.

   b. This device must accept any interference received, including interference that may cause undesired operation.

4. This device must not be installed on coin-operated or multi-party telephone lines.

5. If this unit malfunctions, the telephone company may disconnect service temporarily. If disconnection is necessary, the telephone company must attempt to notify the user in advance, if possible. If not, they must notify the user as soon as they are able.

6. Repair work on this device must be done by ZETRON, INC.

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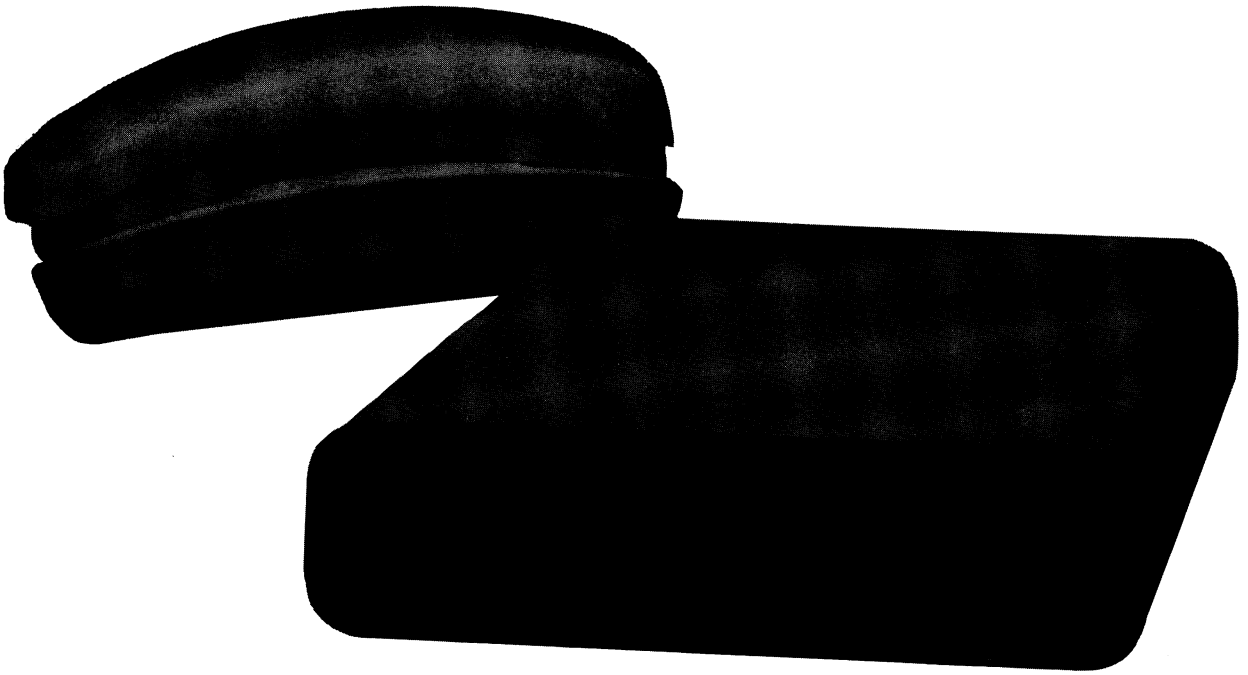
INSTALLATION WARNING

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

Installation of the DAPT-1000 should be accomplished by personnel with experience in radio and paging systems. Specialized knowledge in telephone systems is also important to ensure a smooth interface when connecting with the Telco network.

1. INTRODUCTION

GENERAL



The Zetron Model 32 DAPT-Jr is a fully automatic Dial Access Paging Terminal, specifically designed to provide flexible operation for industrial plant paging applications and for small RCC service, yet at a low cost. The DAPT-1000 is considered the industry standard for interconnecting the telephone system and a radio transmitter to perform selective signaling activation of paging/mobile decoders. The DAPT-Jr was developed by minimizing the extensive features of the DAPT-1000 and thus reducing the cost. This makes the DAPT-Jr ideal for small systems that are serviced by only one telephone input and don't need a lot of surplus features.

Through advanced technology software, the DAPT-Jr provides most features found on terminals costing several times as much. In addition to one-way selective calling of pagers, the 1000-call, tone-format DAPT-Jr includes a talkback interface for two-way communications and phone call origination for mobile and handheld radios. State-of-the-art microprocessor circuitry combined with meticulous engineering provides compatibility with the most popular signaling formats used in the communications industry today. Even the newest binary digital display paging formats can be encoded by the DAPT-Jr. These and other programmable features enhance the flexibility and increase the range of applications for the DAPT-Jr.

The capabilities of the DAPT-Jr are complemented by its small size. At 11" x 8" x 2.3", it conveniently fits in an office environment or on an equipment shelf.

FEATURES

- Capacity of 100 or 1000 calls
- Encodes most popular paging formats
- Remote access to field programmable functions
- 100% number substitution for pager interchange
- Remote programming of pager validation
- Individual selection of pager voice interval
- Talkback paging for use with two-way radios (duplex operation only)
- Calling from mobile to landline, pager, or mobile
- Field configured telco interface for end-to-end, selector level, E&M Type I, PBX loop start, PBX ground start trunks
- Optional dial click decoding for rotary telephones
- Field programmed Morse Code station identifier
- Input to inhibit paging when radio channel is busy
- Operation from 120V AC or 12V DC

2. SPECIFICATIONS

GENERAL SPECIFICATIONS

Call Capacity	100 or 1000 calls
Signaling Formats	Field programmed capcode prefix digits Motorola and GE two-tone sequential Five/Six-tone sequential Reach two-tone POCSAG (NEC D4) numeric display Motorola GSC numeric display HSC tone and voice, numeric display
Morse Code ID	Automatic Station ID 1200 Hz at 20 WPM 15- or 30-minute intervals 5 WPM remote verify mode by telephone

PROGRAMMING SPECIFICATIONS

Access	Remote or Local via DTMF telephone Access code required, field changeable
Storage	High lifetime nonvolatile RAM
Settings	Paging format digit block, timing, function codes Pager Validation/Invalidation, Substitution Pager Talk Time Station ID Talkback Timers/Modes/Originate Parameters Calibration/Adjustment/Test Modes Security/Program Access Codes

SIGNALING SPECIFICATIONS

Frequency Range	50 Hz to 3500 Hz
Amplitude Stability	±1.0 dB maximum
Tone Freq Accuracy	±0.1%
Tone Freq Stability	±0.005%
Tone Distortion	2% nominal
Output Transformer	Balanced 600 ohm Level 0 to 2V pk-pk Tone and voice level adjustments
Audio Conditioning	Jumper for tone de-emphasis Jumper for voice pre-emphasis
Control Relays	PTT DPDT contacts, rated 1A at 26V AC
Digital Data	Unipolar 0-5V, adjustable Programmable polarity
Digital Mode	5V TTL logic Jumper for polarity selection
Channel Busy/COR Input	Contact closure or voltage level Jumpers for impedance and polarity selection
Power Supply	120/240V AC ±15%, 48-62 Hz 12V DC
Operating Temperature	0 to +65 °Celsius
Size	2.25"H x 8"W x 10.5"D Desktop/Shelf mountable
Weight	5 lb

TELEPHONE INTERFACE SPECIFICATIONS

Type	FIELD SELECTABLE End-to-End loop start PBX loop control (pulse or DTMF) PBX E&M Type I tie trunk OPTIONAL Rotary click option Selector level (DID immediate, DID wink) PBX ground start
Connector	RJ11-C modular connector
Line Coupling	600 ohm Transformer, 66 dB Longitudinal Balance 300 to 3500 Hz frequency response
Progress Tones	Beep 1000 Hz Prompt Busy 500+250 Hz - 0.5 sec On, 0.5 sec Off Ring 500+32 Hz - 2 sec On, 2 sec Off
Protection	High voltage varistors

SELECTOR LEVEL AND PBX LOOP SETTING SPECIFICATIONS

Inputs Accepted	Dial Pulse current across tip-ring (see below) DTMF 16 tone pairs on tip-ring
Wiring	2 leads: tip and ring
Incoming Call	Immediate dial start across tip-ring pair
Outgoing Call	10 pps rotary dial across tip-ring Not applicable to central office selector level
Answer Supervision	Battery Reversal 100 to 250 msec after last incoming digit PBX Setting: 1 second silence and 400 msec beep Selector Setting: 5-second billing delay
Dial Pulse Acceptance	5 to 33 pulses/second 8 millisecond Make-during-Break Immunity
Dial Pulse Current	17 to 39mA limiter 4 to 12mA threshold detector Maximum resistance of 2400 ohms
Battery	Supplied by paging terminal -46 to -51 volts DC Unsupervised: Tip=+, Ring=- Supervised: Tip=-, Ring=+
Calling Party Disconnect	Current loss (Break) longer than 350 msec
Forced Disconnect	Return to unsupervised state 2 seconds after paging

PBX E&M TYPE I TIE-TRUNK SETTING SPECIFICATIONS

Inputs Accepted	Dial Pulse current on M-lead (see below) DTMF 16 tone pairs on tip-ring
Wiring	5 wires: tip, ring, E, M, ground
Incoming Call	PBX connects M-lead to -48V DC
Outgoing Call	10 pps rotary dial from E-lead to ground
Call Answer	100 to 250 msec after last incoming digit 1 second silence and 400 msec beep for pager # Terminal connects E-lead to ground
Dial Pulse Acceptance	5 to 33 pulses/second 8 millisecond Make-during-Break Immunity
Dial Pulse Current	17 to 39mA limiter 4 to 12mA threshold detector Maximum resistance of 2400 ohms
Battery	Supplied by PBX Unsupervised M-lead: open circuit or ground Supervised M-lead: -48V
Calling Party Disconnect	Current loss on M-lead (Break) longer than 350 msec
Forced Disconnect	Terminal opens E-lead 2 seconds after paging

END-TO-END SETTING SPECIFICATIONS

Inputs Accepted	DTMF 16 tone pairs overdial on tip-ring Rotary dial clock overdial with Dial Click Option Card
Wiring	2 leads: tip and ring
Incoming Call	Ring Detection on tip-ring pair
Call Answer	Programmable delay, 0 to 35 seconds Closure across tip-ring
Calling Party Disconnect	8-second timeout at end of page
Forced Disconnect	Terminal opens tip-ring 2 seconds after paging

RECEIVER INTERFACE SPECIFICATIONS

Base Station	Duplex
Switching Algorithm	Mobile carrier control
Receive Audio Input	Unbalanced, 0.2 to 20V pk-pk adjustable
Disconnect Code	"#" for 200 msec
Channel Busy/COR Input	Contact closure or voltage level Jumpers for impedance and polarity selection
Call Limit Timer	Programmable, 0-990 seconds
Call Limit Warning	Programmable, 0-990 seconds Before Expiration
Mobile Activity Timer	Programmable, 0-99 seconds
Call Origination	Programmable Enable Connect code "*" with security code Mobile to landline, to pager, or to mobile
Landline Calling	Available for end-to-end, PBX Loop, and PBX E&M DTMF to 10 pps conversion Non-regenerated DTMF dial through
Toll Restrict	Programmable 1- or 0- dialing Prevents DTMF dial through

DIAL CLICK OPTION CARD SPECIFICATIONS

Installation	Inside paging terminal
Inputs Accepted	Rotary audio clicks
Input Level	Adjustable
Frequency Response	4-pole Low Pass at 300 Hz
Click Acceptance	2 to 21 Clicks, 5-33 pps Click Pair every 93.75 msec Duration <12.75 msec and >50 μsec Restart Zone 12.75 msec
Digit Acceptance	No Click in 93.75 msec
Click Detector	Attack Time 10 msec Decay Time 100 msec Adjustable Threshold LED Output
Auto-Calibrate Option	Compensating Difference Tracking Algorithm Prefix Digits Required, 1-0 Pulse Acceptance, 5 to 15 pulses/second Missing Single Click Immunity Long Digit Rejection >2.4 seconds Inter-digit Spacing >450 msec Auto-mute Time Compensation 5-second Inactivity Timeout

3. BASIC OPERATION

INTRODUCTION

Although paging operation depends somewhat upon the phone line setting, type of pager being accessed, and whether or not the security code has been enabled through field programming, alerting a pager and sending a voice or display message can basically be described by following events:

1. Phone caller picks up phone and calls terminal.
2. Terminal detects phone line activity and Answers, going off-hook.
3. Terminal takes in Pager Number.
4. If Pager is Display type, terminal sends audible chirp prompt to caller and takes in Numeric Message.
5. Terminal sends audible ringing to caller while transmitting paging tones or binary digital address code over radio channel.
6. If Pager accepts talk time, terminal sends single beep to caller and connects phone audio to radio transmitter for duration of talk time.
7. Terminal sends busy tones to caller for 2 seconds, then disconnects phone line, going on-hook again.

This section will describe the fixed characteristics, programmable features, and types of accessory phone lines that affect the operation of the DAPT-Jr.

POWER-ON

Following installation by qualified radio service personnel, plug in the wall transformer and connect the power plug into the back of the Model 32. The display on the front panel will illuminate and the unit will perform a built-in self-test, spell out various messages, and finally display ".---". A code number instead of the minus signs signifies a fault condition. If this should occur, note the fault code and power down the unit. The fault code can be referred to in Section 9. If a call for repair service is necessary, please report the fault code.

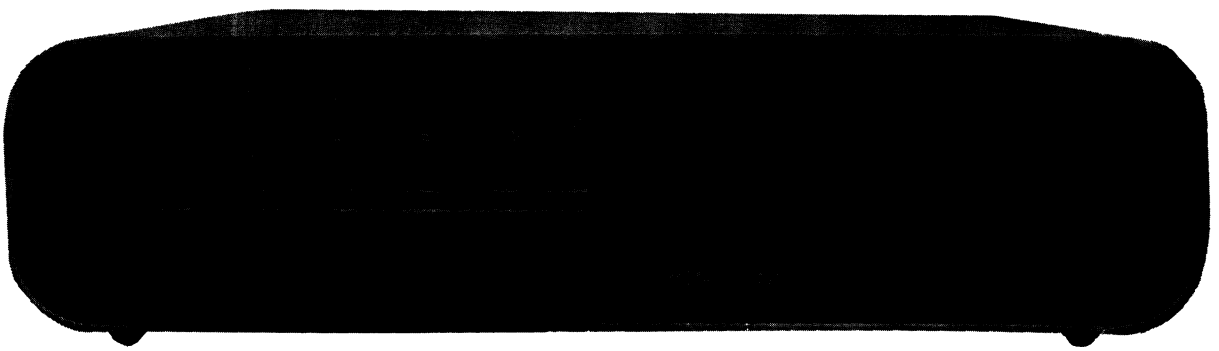
FRONT PANEL INDICATORS

INDICATOR	DESCRIPTION
Power	".---" Decimal point on left-hand digit lights when the internal +5V power supply is up.
Display	Under normal paging, this 3-digit read-out indicates the three digits of the pager being signaled.
	"---" when the unit is idle.
	"CLr" when the program memory is initialized.
	BLINKS with the error code in display if a self-test error is detected.
	" 0 " while the security code is entered.
	BLINKS if the radio channel is busy when paging is attempted.
	"tSt" during test mode
Ring	ON when an incoming phone line receives ringing pulses.
Line	ON when a phone line is answered or is receiving dial pulse closures from the selector-level or PBX telco.
Xmit	ON when a transmitter is keyed and is transmitting.

REAR PANEL CONNECTIONS

CONNECTION	DESCRIPTION
Phone Line	Modular RJ11-C jack for dial-in telephone line. An internal jumper board sets the telephone line type to selector level/PBX loop, PBX E&M, or end-to-end.
Radio	A removable screw type connector for transmitter or two-way duplex base station: System Ground, Transmitter Audio, Radio Channel Busy/COR/CAS Input, Transmitters Push-to-Talk Relay, Digital Pager Data and Mode Outputs, Receiver Audio.
Power	9V AC or 12V DC power jack input.

Note: See Section 7. for details on Installation



PROGRESS TONES

The DAPT-Jr can be accessed from the switched telephone network or from PBXs using any Touch-Tone telephone. Rotary dial phones may be used with selector level/PBX phone trunks or on end-to-end lines with the terminal's optional dial click board. A variety of progress tones are generated by the terminal to notify the caller of the progress of the paging cycle and also to prompt for further action.

PROGRESS TONE	MEANING
Single Beep	Ready for pager number, or voice message
Double Beep	Talkback time limit close to expiring
Triple Beep	Program memory loss or failure; reprogramming required
Continuous Beeping	Unrecoverable equipment failure; repair required
Quick Beep	Ready for next programming value,
Chirp	Ready for display message or programming command
Ringing	Paging tones being transmitted
Interrupted Ringing	Busy radio channel
Busy	End of page, Invalid pager #, or error
Five Beeps	Call/page completion

ACCESSING PAGERS

The terminal can be ordered with a 100-call or 1000-call capacity as indicated on the order form. In the 100-call configuration, each pager is assigned a number from 00 to 99 which is its "pager code". The pager code is keyed in by the phone caller (end-to-end or PBX) or supplied as the two digits of the phone number (selector-level) to call one of the 100 pagers contained in the terminal's format block. The pager code corresponds to the last two digits of the pager capcode. The leading digits of the pager capcodes and any function digits can be programmed into the terminal (see Section 4).

In the 1000-call configuration, each pager is assigned a pager code from 000 to 999. The caller enters a three-digit number (end-to-end or PBX) or the terminal uses the last three digits of the phone number (selector-level) to call one of the 1000 pagers. The first digit of the pager code determines which block of 100 pagers. The last two digits corresponds to the last two digits of the pager capcode. The leading digits of the pager capcodes and any function digits can be programmed into the terminal (see Section 4).

PAGER ATTRIBUTES

Each of the 1000 pagers that can be signaled by the terminal has an individual set of characteristics or attributes that are stored in the memory of the terminal. These attributes such as validation, substitution, two-way communication, and talk time are individually programmed for each pager (see Section 4). However, the format and capcode prefix digits are programmed for an entire block of 100 pagers because they are FORMAT ATTRIBUTES.

Field programming is done using an ordinary Touch-Tone phone by calling into the terminal, entering the Program Access Code to initiate programming and entering other key sequences to form programming "commands". These commands are all detailed in Programming Section 4. For now, let's just say that these various attributes must be programmed correctly so that the paging tones, voice message, and display message go out properly. In addition, these field-programmable attributes are stored in a memory chip whose contents are retained by its own built-in five-year battery.

VOICE MESSAGES

For tone and voice pagers, a live voice message (phone caller connected live to the radio transmitter) can be sent after the pager has been alerted. The duration of the voice message is determined by the pager attribute called Talk Code. Each pager can have any one of 4 talk codes labeled 0, 1, 2, and 3. Each talk code is programmed for a specific duration from 0 to 99 seconds.

After the pager has been alerted, the terminal finds the pager's talk code in the pager attribute memory. If the talk code's time is 0 seconds, then a tone-only page is sent; otherwise the caller can talk to the pager for as many seconds as have been programmed into the talk code. Talk code settings are field-programmed (see Section 4.).

DISPLAY MESSAGES

If the pager code selects a display pager, then the terminal sends an audible chirp sound back to the calling party. This is a special prompt, asking for the display message. The caller then keys a numeric message (digits 0-9) on the Touch-Tone phone, and ends the message with the # key. The terminal then sends ringing tones to the caller and transmits the digital message along with the pager address/alert code over the radio channel. If the pager is programmed to be tone-only, then paging begins immediately upon receipt of the pager number. If the pager is programmed with non-zero talk time, the terminal will send a single beep to the caller after the pager has been alerted to prompt for a voice message.

The display message lengths supported by the terminal depend upon the type of pager being alerted:

Pager Type	Max Message	Special Characters
NEC D3	20 characters	
POCSAG	20	
GSC	12	
HSC	12	* key will generate a hyphen -

REPAGING

The DAPT-Jr has an additional feature for sending more than one page without rephoning the terminal. To do this, the # key is pressed during the talk time (voice interval) or during the 2-second busy tones just before the terminal disconnects the phone line. When the terminal recognizes the # key, it issues a single beep. Then another pager code may be entered.

SECURITY CODE

The terminal is attached to a standard phone line, and normally is accessible by anyone knowing or discovering the phone number or block of phone numbers. This may not be the most secure system unless some sort of password or security code is required before the terminal allows paging. Such a field-programmable security code is a standard feature of the DAPT-Jr. If the security code is enabled, the terminal will give a single beep after it answers the phone. The caller must then enter the correct 3 keys from a Touch-Tone phone in order to have paging proceed, otherwise the terminal will disconnect the phone. The security code is enable by programming into the terminal's program memory just as any other attribute would be (see Section 4). A security code of 000 turns off security checking. See Section 4 for what to do if you forget the security code.

END-TO-END TELCO

The type of phone line connected to the DAPT-Jr is field adjustable as end-to-end, PBX loop trunk, E&M tie-trunk, or hardwired phone. Any other configurations need to be special ordered. An End-to-end phone line is the same as that for a private residence. A single phone number, when dialed by any paging customer, causes a ringing signal to be sent down the phone wire pair to the terminal. When the terminal answers the line by drawing loop current across the tip-ring wire pair (off-hook), the phone company connects audio between the caller and the terminal and reverses the battery voltage to the phone. The terminal then sends a single beep to the caller to have the caller key a pager number on his/her telephone keypad. This "overdialing" after the call is connected must be performed with Touch-Tone phones equipped with polarity guard.

For use with rotary dial phones, the phone equipment must pass residual audio clicks of the dial turning, without disconnecting the caller. The optional Dial Click Detector Card with special software converts these clicks into a usable pager number. This conversion process generally works, but each installation should be tested before having callers rely upon overdial click interpretation. Note that most electronic "Universal Dial" phones with FET loop current interrupters do not provide clicks that are sharp enough to be passed through phone equipment.

End-to-End Line Paging Flowchart

```
1. Detect Ringing cycle.
   Wait Programmed Answer Delay.
   Answer phone line.

2. Is Program Memory OK?
      :Yes - Single Beep
      :No  - Beep 3 Times

3. Single Beep
   Accept & Display Pager Entry
   (DTMF or Dial Click)

4. Is Security Enabled (programmed not as 000)?
      :Yes - Single Beep
             Display ' 0 '.
             Accept 3-digit Security Code
             Is Security Code correct?
                :No - Send Busy Tone
                    -->END-PAGE

REORDER:
5. Is Pager Entry = Program Access Code?
      :Yes--> PROGRAM MODE (Section 4)

6. -->SEND-PAGE (See SEND-PAGE FLOWCHART.)

END-PAGE:
7. Disconnect Caller
```

SELECTOR LEVEL TELCO

Phone company central offices provide a type of access called Selector Level DID (Direct Inward Dial), which is normally higher cost than end-to-end access. In the case of a DID trunk, the phone line represents a bank of sequential 100, 1000, or 10000 phone numbers (for example 555-34xx covers the 100 numbers from 555-3400 through 555-3499. The last 2,3, or 4 digits of the phone number correspond to each possible user on the paging terminal. This way each user on the terminal can be assigned a different 7-digit phone number within the number bank. The paging terminal is ordered with 2-, 3-, or 4-digit feed (see Configuration Sheet in the back of this manual) to match the number of DID numbers ordered from the phone company. The advantages of a selector line are:

* Each customer has a unique 7-digit telephone number. There is no additional user number to memorize.

* Paging access is quicker on selector-level trunks that on plain end-to-end lines. When a call is placed through a selector line the number is automatically sent by the phone company to the paging terminal. No beep is issued to the caller for the user number since the digits will have been sent by the phone equipment.

* Because overdialing of the user number is eliminated, the paging terminal is used more efficiently. The system is signaled at a fast rate and is not "tied up" waiting for someone to enter a user number.

The disadvantages of selector level signaling are:

* Normally a higher cost than end-to-end access.

* Sometimes the phone office cannot give the desired range of numbers when a paging system requires future expansion.

Immediate Dial Start Telco

Immediate dial start selector level access provides a bank of sequential numbers like wink start (see above paragraph on Selector Level Telco Access). With a immediate dial start line, when a caller dials one of the phone numbers in the bank, the phone equipment signals the terminal by drawing current from the 48V 'battery' supply in the terminal. The phone equipment will expect the terminal to be ready to accept digits within 100 ms. It then sends the digits to the terminal by "pulsing" each digit with current pulses which are equivalent to the pulsed digits made when dialing a rotary dial type telephone.

Wink Start Telco

Wink start selector level access provides a means of controlled signaling from the phone company central office to the terminal equipment. A wink start line, like loop start represents a bank of sequential numbers (see above paragraph on Selector Level Telco Access). When a caller dials one of the phone numbers in the bank, the phone equipment signals the terminal by drawing current from the 48V 'battery' supply in the terminal. The phone equipment will then wait for the terminal to signal that it is ready to receive digits. The terminal signals that it is ready by reversing the 'battery' polarity for a short time (250 ms) then restoring the polarity.

After receiving this "wink", the phone equipment sends the digits to the terminal. Typically the digits are sent using DTMF signaling. Wink start has the advantage of allowing the terminal equipment to tell the phone equipment when it is ready to receive a new call.

2-Digit Feed on 1000-Call Terminals
1000-Call terminals can support 2-digit feed by assuming the missing digit is a leading 0. This forces all pages to be out of the 0 Block. Even though only one block of pagers can be signaled, this need not limit the terminal to a single format or tone group because one may substitute other pagers out of other blocks into the 0 Block. See Section 4. for details on this programming feature. 4-digit feed lines are supported by ignoring the first one or two digits.

* NOTE *

The Selector Level Configuration is not field-programmable unless specified at the time of order. The number of feed digits (2, 3, or 4) and the type of handshake (immediate dial or wink start) are available options.

Default telephone configurations are: PBX Loop Telco, End-to-End Telco and E&M Tie Trunk. All other configurations must be special ordered.

Selector Level (DID) Paging Flowchart

1. Accept & Display Pager Code (last 2 or 3 digits of phone number)

2. Answer Trunk by Reversing "Battery"

3. Is Program Memory OK?
   :No - Beep 3 Times

4. Is Security Enabled (programmed as not 000)?
   :Yes - Single Beep
   Display ' 0 '
   Accept 3-digit Security Code
   Is Security Code correct?
   :Yes-->Step 5
   :No - Send Busy Tone
   -->END-PAGE

5. Send 3 seconds Ringing for Billing Delay

6. '#' Key (during silence between rings)?
   :Yes - Single Beep
   Accept New Pager Code

REORDER:
7. Is Entry = Program Access Code?
   :Yes--> PROGRAM MODE (Section 4.)

8. -->SEND-PAGE (See SEND-PAGE FLOWCHART.)

END-PAGE:
9. Disconnect Trunk by Setting "Battery" Normal.

PBX LOOP TRUNK TELCO

A different type of phone line similar to a selector-level trunk is commonly found on in-plant private branch exchanges (PBX); this trunk is sometimes called an outside line trunk. This type of trunk normally allows the caller to use either Rotary Dial or Touch-Tone phones and can allow 2-way call origination to the PBX from mobiles. The caller accesses the terminal by dialing a short one- or two-digit access code (similar to getting an outside line by dialing '9'), which causes the PBX controller to draw current from the terminal's battery. The terminal detects loop current and sends a beep to the caller for the pager access code. As the caller keys or dials the pager access code, the PBX converts the digits into current pulses or DTMF on the phone pair. Unlike a normal selector-level trunk, the phone digits are not a bank of numbers and pulsing occurs as the PBX forwards the caller's dialed digits. The terminal connects to a loop start PBX trunk with a the DID telco setting and the programming mode set for PBX.

PBX GROUND START TELCO

This type of trunk, was designed for signaling between a PBX and a central office. It works well for connection between a paging terminal and a PBX although it is not as commonly used as E&M trunks. The ground start trunk provides a way for the terminal to positively disconnect from the PBX when a page is completed. This can be very important if a caller does not hang up after accessing the paging terminal, especially if the PBX does not have a time limit for connections through the trunk line. Although signaling both directions is supported by the design of the ground start trunk, the Model 32 does not support signaling out through a ground start trunk. Therefore talkback mobile origination is not possible with ground start trunks. Ground start trunks use a two wire interface to the paging terminal comprised of a T (Tip) and an R (Ring) lead. Unlike the PBX loop trunk, ground start trunks also require that the PBX and the terminal be connected to a common ground. On the Model 32 it is advised to obtain ground directly from one of the rear panel connectors.

A caller typically accesses the paging terminal by dialing a short one- or two-digit access code (similar to getting an outside line by dialing '9'). If the PBX is senderized, the caller may then dial the desired user number without pausing. If the PBX is non-senderized then the caller will have to wait for the PBX to connect to the paging terminal. When connected, the paging terminal will generate a beep to let the caller know to proceed (the beep on connection should be requested at the time of order).

To connect to the terminal, the PBX controller will ground the Ring lead (through a resistance). The terminal then grounds the Tip lead when it is ready to receive digits (typically within 100 ms). The PBX then simultaneously removes its ground from the Ring lead and provides a loop closure between the Tip and Ring leads by applying a resistance across the two wires. If the PBX is senderized and the caller has entered the digits the PBX will then send the stored digits. They may be sent as pulses (similar to the rotary dial pulses from a rotary dial telephone) or as DTMF tone burst. The PBX will then connect audio between the terminal and the caller. If the PBX is non-senderized then the caller will be issued a beep

by the terminal to prompt for the user number. Once a user number is entered from the caller or the PBX, paging will commence. At the completion of paging the terminal disconnects from the PBX by removing the ground from the Tip lead. The PBX detects the loss of ground and will disconnect the caller and remove the loop closure between the Tip and Ring leads. This will free up the trunk for use by other callers. If the caller hangs up before paging is completed then the PBX will remove the loop closure between the Tip and Ring leads. Note: PBX ground start is an option that must be special ordered.

PBX E&M TIE-TRUNK TELCO

This type of trunk, originally designed for central office to central office communications is commonly available on newer PBXs. Callers can use either Rotary Dial or Touch-Tone phones for paging. Also, E&M trunks support 2-way call origination through the PBX from mobiles. A caller accesses the terminal by dialing a short one or two-digit access code (similar to getting an outside line by dialing '9'), which causes the PBX controller to put -48V on the M-lead circuit to the terminal. The terminal detects the M-lead and sends a beep to the caller for the pager code. As the caller keys or dials the pager access code, the PBX converts the digits into current pulses or DTMF on the phone pair. When the pager code is complete, the terminal closes the E-lead to ground to accept the call from the PBX. At the end of the call, the terminal can disconnect the trunk by opening the E-lead connection thereby forcing the caller off the line and freeing the trunk for use by other callers. Disconnection may also occur if the PBX removes battery from the M-lead.

PBX Loop Trunk or E&M Tie-Line Paging Flowchart

```
1. Wait 1 Second
   Single Beep
   Accept & Display Pager Entry

2. Answer Trunk

3. Is Program Memory OK?
      :No  - Beep 3 Times

4. Is Security  Enabled (programmed as not 000)?
      :Yes - Single Beep
             Display ' 0 '
             Accept 3-digit Security Code
             Is Security Code correct?
                :Yes-->Step 5
                :No - Send Busy Tone
                    -->END-PAGE

5. Send 1-second silence

6. '#' Key (during silence between rings)?
      :Yes - Single Beep
             Accept New Pager Code

REORDER:
7. Is Entry = Program Access Code?
      :Yes--> PROGRAM MODE (Section 4.)

8. -->SEND-PAGE (See SEND-PAGE FLOWCHART.)

END-PAGE:
9. Disconnect Caller
```

SEND-PAGE FLOWCHART

1. Is Pager Number Valid?
   :No--> PRE-END

2. Is Pager Number Substituted?
   :Yes - Display Substitution Number

3. Does Pager require Display Message?
   :Yes - Chirp
   Accept & Display Numeric Message

4. Send Ringing

5. Is Radio Channel Busy?
   :Yes - Send Interrupted Ringing & Blink Display
   Keep checking for 30 seconds;
   If timeout, then --> PRE-END.

6. Turn on Xmit Light
   Key up Transmitter
   Wait 1 second

7. Is Pager Type = Binary Digital?
   :Yes - Set Digital Mode Output On

8. Transmit Tone/Digital Page

9. Is Pager Type = Binary Digital?
   :Yes - Set Digital Mode Output Off

10. Is Talk Time Required?
    :Yes--> TALK (See TALK FLOWCHART.)

TALK-END:
11. Is Pager Type = Talk-back?
    :Yes --> TALKBACK (Section 5.)

PRE-END:
12. Turn Off Transmitter
    Turn Off Xmit Light
    Send Busy Tone for 2 seconds.
    Is '#' key entered (while busy tone)?
    :Yes - Single Beep
    Accept & Display Pager Entry
    --> REORDER

13. Is Station ID required? (timer expired)
    :Yes - Transmit ID

14. --> END-PAGE

TALK FLOWCHART

1. Send Single Beep to Caller

2. Transmit Voice Message from Phone

3. Is '#' Entered from Keypad (during voice time)?
   :Yes - Turn off Transmitter
          Turn off Xmit Light
          Send Single Beep
          Accept & Display Pager Entry
          --> REORDER
   :No - Keep sending until Talk Time Done.

5. Turn off Xmit Light

6. --> TALK-END

LOCAL AND EMERGENCY PAGING

The DAPT-Jr may be used as a remotely located paging encoder. Simply run a metallic wire pair phone line from a telephone to the terminal. Acting like a PBX loop start trunk, the terminal provides 48 volts to power the telephone set to operate its audio and Touch-Tone circuitry. The attendant places a page by lifting the telephone handset, listening for the beep, and keying in the pager code.

NOTE: When the DAPT-Jr is used in this manner, the local telephone is the only input that can be used.

4. PROGRAMMING

INTRODUCTION

This section tells you how to program your Model 32. Instructions begin on the next page. This page discusses the factory default settings.

Factory Default Settings

Unless specially programmed by Zetron, your Model 32 is preprogrammed with the following factory default settings:

All blocks not assigned to a format
Talk code 0 through 3 = 0, 10, 20, 30 seconds respectively
All pagers assigned talk code 1 (10 seconds)
All pagers validated
All substitutions cleared
All pagers one-way
Morse code ID empty
ID interval 15 minutes
Digital paging data polarity normal
Ring-before-answer duration (end-to-end) = 1.0 rings
Security checking off (code = 000)
Program access code = #30
Mobile channel ID disabled

NOTE: Model 32 Units are not delivered programmed with an encoding format unless specifically requested at the time of the order. It is the task of the installer to set each of the blocks to the desired format and attributes.

Restoring the Factory Default Settings

There are three ways to restore the original factory default settings. Each of the three methods erases all other programming.

The Touch-Tone Method (requires knowledge of program access code):

1) follow the instructions under "Putting the Model 32 into the Program Mode" (next page)
2) enter the program code 000 200

The Physical Method (does not require knowledge of program access code):

1) open the unit
2) connect test point TP5 (about three inches from the front right corner of the circuit board) to ground until the display on the front panel goes blank (about five seconds)
3) unplug the power jack, then plug it back in. "CLr" on the display indicates the return of the default settings

The Method for Units in Inaccessible Locations

Call Zetron at (206) 820-6363. A technician will call up and reset your Model 32 over the phone.

PROGRAMMING

Read this page and the next page before attempting to program your unit.

The Model 32 can be programmed from any Touch-Tone telephone that can access the unit. This can be a "local" telephone plugged in directly to the phone jack on the rear panel, or a subscriber telephone or PBX extension that "calls up" the Model 32 over the telephone line to which the Model 32 is connected.

Entering the Right Programming Command

There are three types of programming commands discussed later in this section. "Block-Format Commands" affect selected blocks of 100 pager codes. "System Commands" affect the whole system. "Pager Commands" affect selected pagers.

Every programming command generally has the form: nnn ccc pp,

where: nnn = 000 or a 3-digit pager code (001-999)
ccc = a programming command (100-255)
pp = special parameters

You can make as many programming changes as you wish during a programming session. Simply enter a programming command and wait to hear an acceptance chirp before starting the next. Programming ends when you hang up. Read the following notes before you begin.

Important Programming Notes

A busy tone indicates rejection of a programming command. You have two seconds to press #. If you wait too long the Model 32 will leave the program mode and revert to normal paging.

If you pause longer than 30 seconds without pressing a key, the Model 32 will leave the program mode and revert to normal paging.

Before starting a programming session it is helpful to first make a list of the programming commands you intend to make. This reduces errors during programming and leaves you with a system record.

Always keep track of your pager and system settings. See the example record pages in Section 10.

For 100-call units: a leading 0 must always be added to a pager number when programming a 100-call unit. Thus, for the nnn value, you must press a number from 000-099 to indicate a pager from 00-99.

Putting the Model 32 into the Program Mode
To put the Model 32 into the program mode, perform the following steps:

From a "local" telephone plugged in directly to the phone jack on the rear panel:

1) open the Model 32; remove the small, green matrix card (located about two inches from the phone jack); reinstall the card in the DID position
2) plug a Touch-tone telephone into the phone jack
3) lift the telephone handset
4) the terminal will beep once*
5) enter the program access code (factory default = #30)**
6) replace the matrix plug to its original position after all programming is finished

From the public telephone system, or PBX extension, over a normal subscriber interface (end-to-end line):

1) dial in to the terminal
2) the terminal will beep once*
3) enter the program access code (factory default = #30)

From the public telephone system over a selector level (DID) interface:

1) dial in to the terminal using a valid subscriber number**
2) terminal pages pager while sending you ringing
3) when busy tones are received, press the # key
4) after the terminal beeps, enter the program access code (factory default = #30)

* If the terminal is programmed as a selector level input there will be no beep.

** If the Security Code is enabled, the terminal will beep. At this time the 3-digit Security Code should be entered.

BLOCK-FORMAT COMMANDS

The pager codes or addresses in a Model 32 are divided into blocks of 100 pager codes each. Each block is numbered 0 to 9. The 0 block contains codes from 001 to 099, the 1 block contains codes 100 to 199, etc. A 100-call Model 32 only contains the 0 block. A 1000-call Model 32 contains all ten. "Block-Format Commands" affect an entire block of 100 codes.

When a Model 32 is received from Zetron, a paging format (two-tone, HSC, etc.) must be assigned to each block. In the case of a 1000-call Model 32, this is done by first selecting a block to be programmed (using 000-100-b, below), then by entering the program code that selects the right format (see following pages). In the case of a 100-call Model 32, this is done by entering the program code that selects the right format, without first trying to select a block (there is only one block in a 100-call unit).

The block-format commands below are general-purpose. The block-format commands used for assigning paging formats are on the following pages. There's a block-format section for each type of paging format. At the end is an example block-format programming session.

IMPORTANT--for 1000-call units (only)
Select Block for Programming 000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Clear Block's System and Pager Commands
000 101 Sets all system and pager commands in the block to their default values. As with the 000 201 command, all block-format commands remain the same, including those that specify a block's format.

Validate Block of Pagers (default = all blocks validated)
000 102 Validates all pagers in the block. Similar to the nnn 202 command.

Invalidate Block of Pagers (default = no blocks invalidated)
000 103 Invalidates all pagers in the block. Similar to the nnn 202 pager command.

Clear Block Substitutions (default = all substitutions cleared)
000 104 Clears all pager substitutions in the block. Similar to the nnn 205 command.

Two-Way Block (default = all blocks one-way)
000 105 Sets all pagers in the block to two-way for talk-back conversations. Similar to the nnn 225 pager command.

One-Way Block (default = all blocks one-way)
000 106 Sets all pagers in a block to one-way paging. Similar to the nnn 226 pager command.

Two-Tone Block-Format Commands

After assigning the two-tone format to a block (with 000 120), you must decide which 100 codes you want the block to contain. This is done by selecting a group of ten possible codes for the A tone (with 000 124 dd), and similarly for the B tone (with 000 125 dd). The other two-tone commands below can usually be ignored. See "Understanding the Two-Tone Coding System" in the appendix.

> IMPORTANT--for 1000-call units (only)
>
> Select Block for Programming
> 000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Assign 2-Tone Format to Block (default = no blocks are two-tone)

000 120 Designates all pagers in the block to be two-tone pagers. Also sets the two-tone block-format commands below to their default values for the block.

Set 2-Tone Timing (default = 0)

000 121 d Determines the duration of the tones, the gap between the tones, and the length of the group call tone for all pagers in the block, according to the nine listed timing schemes. The default timing is adequate for most paging purposes.

d	1st tone	Gap	2nd tone	Group call	Timing Name
0	1.0	0.0	3.0	8.0 sec	Mot T&V (default)
1	1.0	0.25	3.0	8.0	GE T&V
2	0.4	0.0	0.8	8.0	Mot Tone
3	1.0	0.0	3.0	6.0	NECB
4	1.0	0.25	3.0	6.0	NECA
5	1.0	0.0	1.0	4.0	NECC
6	0.4	0.0	0.8	4.0	NECM
7	0.5	0.0	0.5	3.0	NECL
8	0.4	0.0	0.4	3.0	NECD

Diagonal Tone (default = 0)
000 122 d Should be changed from its default value only if a diagonal tone has been installed in a pager. Causes the Model 32 to encode the diagonal tone in the following chart in place of either the A or B tone (000 123 d) during what would normally be a group call.

d	Diagonal Frequency
0	Group call (default value)
1	Std diagonal from tone group
2	569.1 Hz
3	979.9 Hz
4	742.5 Hz
5	953.7 Hz

Diagonal Tone Placement (default = 1)
000 123 d Determines which tone (A or B) is replaced by the diagonal tone chosen in 000 122 d. Tone A is d=1, Tone B is d=2.

Tone Group for Tone A (default = 01)
000 124 dd Selects tone group for the A tone for all pagers in the block.

dd	Group	dd	Group
01	Mot 1 (default)	08	Mot B
02	Mot 2	09	Mot Z
03	Mot 3	10	GE A'
04	Mot 4	11	GE B'
05	Mot 5	12	GE C'
06	Mot 6	13	Mot 10
07	Mot A	14	Mot 11

Tone Group for Tone B (default = 01)
000 125 dd Selects tone group for the B tone for all pagers in the block.

dd	Group	dd	Group
01	Mot 1 (default)	08	Mot B
02	Mot 2	09	Mot Z
03	Mot 3	10	GE A'
04	Mot 4	11	GE B'
05	Mot 5	12	GE C'
06	Mot 6	13	Mot 10
07	Mot A	14	Mot 11

Reach Pagers, Fast Timing (default = no blocks are Reach)
000 126 d Selects a d00 Reach code plan with fast timing for all pagers in the block. The timing is 0.13/0.0/0.13/1.4 seconds.

Reach Pager, Slow Timing (default = no blocks are Reach)
000 127 d Selects a d00 Reach code plan with slow timing for all pagers in the block. The timing is 2.0/0.0/0.7/4.5 seconds.

Table 1. Motorola and GE Code Plans

Pager Capcode	Code Plans: Mot B Groups	Mot C Groups	Mot D Groups	Mot E Groups	Mot F Groups	Mot G Groups	Mot H Groups	Mot J Groups	Mot K Groups
0xx	2+4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
[illegible]	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1
2xx	2+2	2+2	2+2	2+2	1+3	1+3	1+3	1+4	1+4
3xx	3+3	1+2	1+2	1+2	3+3	3+3	3+3	4+1	4+1
4xx	1+2	4+4	1+5	2+1	4+4	3+1	3+1	4+4	4+4
5xx	1+3	1+4	5+5	1+6	3+1	5+5	1+6	5+5	1+6
[illegible]	2+1	2+1	2+1	6+6	1+4	1+5	6+6	1+5	6+6
7xx	3+1	4+1	5+1	6+1	4+1	5+1	6+1	4+5	6+1
8xx	2+3	2+4	2+5	2+6	3+4	3+5	3+6	5+4	4+6
9xx	3+2	4+2	5+2	6+2	4+3	5+3	6+3	5+1	6+4
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

Pager Capcode	Code Plans: Mot L Groups	Mot M Groups	Mot N Groups	Mot P Groups	Mot Q Groups	Mot R Groups	Mot S Groups	Mot T Groups	Mot U Groups
0xx	N/A	4+2	4+2	4+2	4+2	4+2	4+2	4+2	4+2
1xx	1+1	2+3	2+3	2+3	2+4	2+4	2+5	3+4	3+4
2xx	1+5	2+2	2+2	2+2	2+2	2+2	2+2	4+3	4+3
3xx	5+1	3+3	3+3	3+3	4+2	4+2	5+2	3+3	3+3
4xx	1+6	4+4	3+2	3+2	4+4	4+4	2+6	4+4	4+4
5xx	5+5	3+2	5+5	2+6	5+5	2+6	5+5	5+5	3+6
6xx	6+6	2+4	2+5	6+6	2+5	6+6	6+6	3+5	6+6
7xx	6+1	4+2	5+2	6+2	4+5	6+2	6+2	4+5	6+3
8xx	5+6	3+4	3+5	3+6	5+4	4+6	5+6	5+4	4+6
9xx	6+5	4+3	5+3	6+3	5+2	6+4	6+5	5+3	6+4
Groups:	1,5,6	2,3,4	2,3,4,5	2,3,4,6	2,4,5	2,4,6	2,5,6	2,3,4,5	2,3,4,6

Pager Capcode	Code Plans: Mot V Groups	Mot W Groups	Mot Y Groups	Mot MT Groups	GE X Groups	GE Y Groups	GE Z* Groups	Special Groups
0xx	4+2	4+2	N/A	4+2	A′+A′	B′+B′	A′+A′	Z+Z
1xx	3+5	4+6	A+A	1+1	B′+A′	C′+B′	C′+A′	1+1
2xx	5+3	6+4	B+B	2+2	B′+B′	C′+C′	C′+C′	2+2
3xx	3+3	5+6	Z+Z	1+2	A′+B′	B′+C′	A′+C′	3+3
4xx	3+6	4+4	A+B	4+4	C′+C′	N/A	N/A	4+4
5xx	5+5	5+5	A+Z	5+5	C′+A′	N/A	N/A	5+5
6xx	6+6	6+6	B+A	2+1	C′+B′	N/A	N/A	6+6
7xx	6+3	4+5	Z+A	4+5	A′+C′	N/A	N/A	A′+A′
8xx	5+6	5+4	B+Z	5+4	B′+C′	N/A	N/A	B′+B′
9xx	6+5	6+5	Z+B	2+4	N/A	N/A	N/A	C′+C′
Groups:	2,3,4,5,6	2,4,5,6	A,B,Z	1,2,4,5	A′,B′,C′	B′,C′	A′,C′	

* GE 100-call plan Z is tone groups C′+ C′; use (100-Call format).

If the two tone groups desired are the same (i.e. the capcode ends with the same two digits, e.g. 122 in code plan C) a special case occurs. A diagonal tone (a different tone not in the group) must be substitued for one of the duplicate tones; or a group tone (a long duration tone of the same frequency) is substitued for both tones. The method used, the tone groups and the timing depend upon the type of pager.

Table 2. Motorola and GE Tone Group Frequencies

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

Tone Number	Tone Groups						
	Mot B	Mot Z	GE A′	GE B′	GE C′	Mot 10	Mot 11
0	371.5	346.7	682.5	652.5	667.5	1472.9	1930.2
1	412.1	384.6	592.5	607.5	712.5	1513.5	1989.0
2	457.1	426.6	757.5	787.5	772.5	1555.2	2043.8
3	507.0	473.2	802.5	832.5	817.5	1598.0	2094.5
4	562.3	524.8	847.5	877.5	862.5	1642.0	2155.6
5	623.7	582.1	892.5	922.5	907.5	1687.2	2212.2
6	691.8	645.7	937.5	967.5	952.5	1733.7	2271.7
7	767.4	716.1	547.5	517.5	532.5	1781.5	2334.6
8	851.1	794.3	727.5	562.5	577.5	1830.5	2401.0
9	944.1	881.0	637.5	697.5	622.5	1881.0	2468.2
Diagonal Tone:	979.9	979.9	742.5	742.5	742.5	none	none

HSC Block-Format Commands

Hexadecimal sequential coding (HSC) allows numeric-display messages to be sent to pagers over normal voice-grade systems without requiring digital-capable transmitters. HSC conveys numeric information to a pager by using combinations of audio tones. HSC paging can include combinations of tone-only, display, and voice paging. The Model 32 supports repeat paging, group call, priority page, and battery-saver, and can be used to reprogram an HSC pager's capcode, service block, and beep duration.

If the battery saver feature is enabled, the terminal will send a sleep command to the pagers that tells them to power down for a precise amount of time, typically about 15 seconds. After the 15 seconds the pagers will wake up and look for a page. The Model 32 can then issue a page or another sleep command. While the period between commands is programmable, a long duration is undesirable because it causes the Model 32 to delay transmission of a page until the end of the sleep state, which reduces the maximum traffic capability.

An HSC capcode takes the form CCCCC-SB, where CCCCC is a number from 00000-99999 that represents the pager address, S is a number from 0-9 that represents the service block (see note at end of HSC section), and B is a number from 0-9 that represents the beep duration in increments of 1.25 seconds.

IMPORTANT--for 1000-call units (only)

Select Block for Programming

000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Assign HSC Format to Block (default = no blocks are HSC)

000 130 Designates all pagers in the block to be HSC pagers. Also sets the HSC commands below to their default values for every pager in the block.

Set Capcode Prefix Digits (default = none)

000 131 nnn Sets the first three capcode digits of all pagers in the block to be nnn.

Set Pager Function (default = tone-only)
000 132 d Determines the operation of all pagers in the block:

d	FUNCTION
0	Tone-only (default)
1	Tone + voice
2	Tone + display. Display = C-icon + 12 digits
3	Tone + display. Display = large phone icon + 12 digits
4	Tone + display + voice. Display = C-icon + 12 digits
5	Tone + display + voice. Display = large phone icon + 12 digits
6	Priority, tone + display. Display = C-icon + 12 digits
7	Priority, tone + display. Display = large phone icon + 12 digits
8	Priority, tone + display + voice. Display = C-icon + 12 digits
9	Priority, tone + display + voice. Disp. = lg. phone icon + 12 dig.
#	User enters function digit (see note 1)

Service Block (default = 0)
000 133 d Sets all pagers in the block to belong to service block d (0-9).

Beep Duration (default = 3.75 seconds)
000 134 d Sets the beep duration to d multiplied by 1.25 seconds.

HSC Group Call (default = individual calls only)
000 135 Sets all pagers in block to following group call type:

d	Group Call Type
0	Individual calls only (default)
1	Groups of 9 pagers signaled by S00, S11, ..., S99
2	Group of 99 pagers signaled by S00 (S = service block)

Repeat Page (default = 0)
000 136 d Causes all pages to be repeated d times.

HSC Battery Saver (default = 0 for off)
000 137 tt Sets the HSC battery-saver interval to tt seconds for all HSC pagers on the system.

Pager Reprogramming

000 138 CCCCC S The capcode, beep duration, and service block of an HSC pager (Maxon HSC 6000 Data-Voice or Seiwa MR 700VH) can all be changed by first putting the pager in the "learn" mode and then sending the pager the new information from the paging terminal.

A. Put the pager in the "learn" mode:

1. Turn the pager off then on. The pager should light up every segment on its display for about two seconds.
2. During the two-second test, press the R/R key twice. The pager should display its current NNN-CCCCC-SB, where:

   NNN = owner's RCC ID code
   CCCCC = current capcode of the pager
   S = service block* of the capcode
   B = pager-beep duration in seconds when multiplied by 1.25

3. Press and hold the R/R key until the pager beeps (about ten seconds). The pager will go into the "learn" mode, displaying all hyphens.

B. Send the pager the new information:

4. From a Touch-Tone telephone, call the Model 32 and put it into the programming mode (as described in the DAPT-Jr manual on the first page of the programming section).
5. From the telephone keypad, enter the command code 000 138 (to select HSC pager programming), then enter the pager's complete, current CCCCC-S**.
6. Wait for a beep from the DAPT-Jr, then enter the new NNN-CCCCC-SB. Be sure to enter all five digits for CCCCC.**
7. Hang up.
8. The DAPT-Jr will key up the transmitter and send the new information to the pager. The pager will beep and exit the learn mode. Press the pager's R/R key to see the new settings.
9. The new settings can be verified at any time with steps 1 and 2.

* Similar to an extra capcode digit, S is added to CCCCC to make ten service blocks of 100,000 (CCCCC) pager codes each. This allows pagers with identical capcodes but in different service blocks to be signaled individually.

** On most paging systems the operator is allowed to press fewer than five keys when signaling an HSC pager. This is because all pagers on a system typically have common or "understood" digits that are inserted by the encoder automatically. During step 5, however, the complete five-digit capcode must be entered. Also, the understood or "strapped" digits cannot be changed.

5/6-Tone Block-Format Commands

The 5/6-tone paging format is the predecessor to HSC. It supports tone-only and tone-and-voice paging. The "5" in 5/6-tone refers to the five digital filters in the pager that are set off by a five-tone sequence from the paging terminal. The "6" in 5/6-tone refers to pagers with a sixth "preamble" filter which is used for battery-saver functions.

Since ten tones are available for each of the six filters, the 5/6-tone format allows 1,000,000 different pager addresses. A 5/6-tone capcode is a five- or six-digit number like 13746 or 213746. In the six-digit case, the first digit is the preamble digit.

All 5/6-tone pagers in a particular 100-block of the Model 32 need to have identical capcodes, except for the last two digits (the last two digits provide the 100 codes xxxx00-xxxx99). After assigning the 5/6-tone format to a 100-block (with 000 150), it's necessary to specify the common digits of the pager codes (with 000 151 pnnn).

The Model 32 supports dual-address 5/6-tone pagers. If the dual-address capability is selected (with 000 152 d), the Model 32 will only page even-numbered pagers. The odd pager codes are reserved for signaling the second address of the even pager codes.

IMPORTANT--for 1000-call units (only)

Select Block for Programming

000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Assign 5/6-Tone Format to Block (default = no blocks are 5/6-tone)

000 150 Designates all pagers in the block to be 5/6-tone pagers. Also sets the 5/6-tone commands below to their default values for all pagers in the block.

5/6-Tone Capcode Prefix (default = 0000)

000 151 pnnn Selects all but the last two capcode digits for all pagers in the block. Enter #nnn if no preamble is desired.

5/6-Tone Dual-Address (default = single address)

000 152 d Sets all pagers in the block to be dual-address pagers if d=2. All pagers are single-address pagers if d=1.

Set Tones and Timing (EIA)
000 153 Selects the tone and timing standard for all pagers in the block.

d	Series
0	EIA (default)
1	ZVEI
2	CCIR
3	CCITT
4	EURO

Tone Number	Tone Series EIA	CCIR	ZVEI	CCITT	EURO	EEA
0	600	1981	2400	400	980	1981
1	741	1124	1060	697	903	1124
2	882	1197	1160	770	833	1197
3	1023	1275	1270	852	767	1275
4	1164	1358	1400	941	707	1358
5	1305	1446	1530	1209	652	1446
6	1446	1540	1670	1335	601	1540
7	1587	1640	1830	1477	552	1640
8	1728	1747	2000	1633	511	1747
9	1869	1860	2200	1800	471	1860
X	2010	2247	970	N/A	N/A	N/A
Repeat	459	2110	2600	2300	1063	2110
Tone Length	33	100	100	100	100	40
Preamble	690	690	690	690	690	690
Pream-Gap	65	65	65	65	65	65
X Tone	65	100	100	N/A	N/A	N/A

Note: Group call tones are not supported.

5/6-Tone Repeat Paging (default = 0)
000 154 d Causes the Model 32 to send each 5/6-tone page d (0-7) additional times.

POCSAG Block-Format Commands

The POCSAG format uses a fast binary signal that requires a digital-capable transmitter. POCSAG in the Model 32 supports tone-and-voice and display paging. Display paging is in the form of numeric data. The Model 32 can signal a POCSAG pager four different ways to support different signaling features of the pager.

A POCSAG pager has a seven-digit capcode. For the purposes of Model 32 programming, the first five digits are set to be common for all pagers (with 000 161 nnnnn), and the last two digits identify a specific pager.

> IMPORTANT--for 1000-call units (only)
>
> Select Block for Programming
> 000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Assign POCSAG Format (default = no blocks are POCSAG)
000 160 Designates all pagers in the block to be POCSAG pagers. Also sets all POCSAG commands below to their default values for all pagers in the block.

POCSAG Capcode Prefix (default = 00000)
000 161 nnnnn Assigns the capcode nnnnnxx to all pagers in the block, where nnnnn is common to all pagers and xx (00-99) identifies a specific pager.

POCSAG Pager Type (default = tone-and-voice; pager function 1)
000 162 d Defines the type of paging for all pagers in the block. The four different pager functions, which depend on the brand of pager, usually correspond to different-sounding alerts.

d	FUNCTION
0	Invalid
1	Tone-and-voice; pager function 1 (default)
2	Tone-and-voice; pager function 2
3	Tone-and-voice; pager function 3
4	Tone-and-voice; pager function 4
5	Display-and-voice; pager function 1
6	Display-and-voice; pager function 2
7	Display-and-voice; pager function 3
8	Display-and-voice; pager function 4
9	Invalid
#	User selects function digit during paging. May not be used during mobile-to-mobile paging.

Note: If voice is not desired, set talk code to 0 using command 000 208 0. This sets talk time to 0.

GSC Block-Format Commands
The GSC format uses a binary signal which requires a digital-capable transmitter. The Model 32 supports tone-only, voice, and display GSC paging.

A GSC pager has a six-digit capcode, often followed by a seventh "function digit". All capcodes in a block need to have the same first four digits (set with 000 171 nnnn). The last two digits of the capcode identify a specific pager out of the 100-block (00-99). The function digit determines what type of paging takes place (tone-only, tone-and-voice, or display) and also selects a certain pager function which depends on the model of the pager (set function digit with 000 172 d).

> IMPORTANT--for 1000-call units (only)
>
> Select Block for Programming
> 000 100 b Selects a block in a 1000-call Model 32 for programming. This is necessary before attempting any other block-format commands. Enter 0-9 for b. The selected block is the block that is affected by all ensuing block-format commands until a new block is selected.

Assign GSC Format to a Block (default = no blocks are GSC)
000 170 Designates all pagers in the block to be GSC pagers. Also sets GSC commands below to their default values for all pagers in the block.

GSC Capcode Prefix (default = 0000)
000 171 nnnn Assigns the capcode nnnnxx to all pagers in the block, where nnnn is common to all pagers and xx (00-99) identifies a specific pager.

GSC Paging Type (default = tone-only; pager function 0)
000 172 d Chooses the function digit to define the type of paging for all pagers in the block. Also specifies a particular pager function which depends on the model of the pager.

d	Type of Paging	Pager Function
0	Tone-only	Pager function 0 (default)
1	Tone-and-voice	Pager function 1
2	Tone-and-voice	Pager function 2
3	Tone-and-voice	Pager function 3
4	Tone-and-voice	Pager function 4
5	Display	Pager function 5
6	Display	Pager function 6
7	Display	Pager function 7
8	Display	Pager function 8
9	Tone Only	Pager function 9
#	User selects pager function during paging. May not be used with mobile-to-mobile paging.	

Example Block-Format Command Programming Session
In this example, we'll program the block-format commands for a Model 32 paging system that includes two-tone, 5/6-tone, and HSC pagers.

For this example, let's say the two-tone pagers need a first tone of 1.0 seconds, a tone gap of 0.25 seconds, and a second tone of 3.0 seconds. The tones are from Motorola Tone Group 2 and the pager supports group call.

The 5/6-tone pagers have a preamble of 1, with capcodes from 12300 to 12399. They are EIA standard pagers, and don't support dual-address.

The HSC pagers are out of service block 2 and their capcodes range from 00000 to 00099. We don't want to use battery-saver (to increase paging system throughput, or traffic) but we want group call (10 groups of 9 pagers each). We also want to allow HSC voice and display paging and want each HSC page to be repeated once.

1) MAKE LIST OF BLOCKS	2) MAKE LIST OF COMMANDS	
Block 0	000 100 0	Select block 0
two-tone	000 120	Set 2-tone
Mot group 2, first tone	000 124 02	Motorola Group 2
Mot group 2, second tone	000 125 02	
1/.25/3 seconds timing	000 121 1	GE tone-and-voice
8-second group call	Default	
Block 1	000 100 1	Select block 1
5/6-tone	000 150	Set 5/6-tone
preamble 1 and capcodes 123xx	000 151 1123	Set preamble & capcode
Block 2	000 100 2	Select block 2
HSC	000 130	Set HSC format
service block 2	000 133 2	Set service block
capcodes 000xx	000 131 000	Set capcode
tone display voice	000 132 4	Set pager function
group call 10 groups of 9	000 135 1	Set group call

3) PROGRAM THE UNIT

Put the unit in the program mode and key each command. The terminal will chirp each time a command is accepted. Exit the program mode by keying 000 255 or pressing *.

4) TEST THE PAGES

Pager Code	Action
037	Block 0, so this is a 2-Tone page using tones 3 and 7 out of Motorola tone group 2.
259	Block 2, so this is an HSC page to pager 00059-2-3 with 12 digits of message accepted after pager code.
193	Block 1, so this is a 5/6-Tone page to pager 1-12393.

SYSTEM COMMANDS

These commands affect the paging system as a whole. They include operational commands such as 000 180 for the key-up delay, and diagnostic commands such as 000 213 to view all invalidated pager codes. It is recommended that when programming a Model 32, the block-format commands are completed prior to the system commands.

Key-up Delay (default = 1.0 second)
000 180 tt Sets the delay between the transmitter key-up and the tone output to t.t (0.0 to 5.0 seconds). Default = 1.0.

Enable Mobile ID (default = disabled)
000 181 Enables the automatic ID. For mobile channels.

Disable Mobile ID (default = disabled)
000 182 Disables the automatic ID. For paging channels.

Set 15-Minute ID (default = 15 minutes)
000 183 Sets the channel ID interval to 15 minutes.

Set 30-Minute ID (default = 15 minutes)
000 184 Sets the channel ID interval to 30 minutes.

Invert Digital Data (default = not inverted)
000 185 Inverts the polarity of the digital paging data output.

Normal Digital Data (default = normal)
000 186 Sets the polarity of the digital paging data output back to normal.

Selector-Level Recording Mode
000 194 Turns on the selector-level recording mode for 15 minutes. Each time an incoming current pulse is detected on the selector-level trunk, the terminal will issue a beep at the audio output (rear panel). A tape recorder connected to the audio output can record the timing and duration of the selector-level pulses for analysis at the Zetron factory. To exit this mode, dial in and press *, or turn off power to the terminal, or wait for the 15-minute timeout.

Restore Factory Default Settings
000 200 Restores all programming commands to their factory default values.

Display All Invalid Pagers
000 213 Scrolls the pager codes that have been invalidated across the front panel display at slow speed.

Display All Pager Substitutions
000 216 Scrolls the pager codes that have been substituted, as well as their replacements, across the front panel display at slow speed. First the original pager number is shown, followed by its new substituted setting.

Verify Transmitter Station ID
000 217 Plays the station ID over the phone at a rate of about 5 wpm. Refer to Section 10 for a Morse code chart.

Enable Unattended Autopage (default = not enabled)
000 189 Causes the Model 32 to automatically transmit a paging tone whenever a telephone call comes in on the telephone line to which the Model 32 is attached. This paging tone can be used to signal a selectively called handheld radio and, if the Model 32 has a talkback interface, the person with the radio can answer the telephone call from the radio for a two-way conversation. For unattended autopage, the Model 32 attempts to send pager code 000; the actual pager code that it sends is the one that has been substituted for 000 using command 000 206 mmm above.

Disable Unattended Auto-page (default = disabled)
000 190 Disables unattended autopage.

Transmitter Station ID
000 219 kk, kk, ..., # Sets the transmitter station ID. Each letter of the 8-letter call sign is individually selected with a two-key sequence kk, using a standard Touch-Tone telephone. The terminal sends a quick beep after accepting each letter. Press # when finished.

kk	Letter	kk	Letter	kk	Letter
00	0	12	A	26	N
01	1	22	B	36	O
02	2	32	C	17	P
03	3	13	D	10	Q
04	4	23	E	27	R
05	5	33	F	37	S
06	6	14	G	18	T
07	7	24	H	28	U
08	8	34	I	38	V
09	9	15	J	19	W
		25	K	29	X
		35	L	39	Y
		16	M	20	Z
				#	(done)

Security Code (default = no security code)

sss 221 Sets the three-digit security code. This requires the caller to enter the correct code before a page can be sent. (See the paging flowcharts in Section 3 to see exactly when the code should be entered.) If the unit is equipped with the talkback option, a security code is required for calls initiated in either direction. (Refer to commands 000 245 and 000 246 to see how to disable the security code in one direction or another.) The security code consists of three Touch-Tone digits (0-9, #, A, B, C, D). The * key cannot be used as part of the security code. On selector-level lines with DTMF-to-pulse converters, use only digits 0-9. If sss = 000 then the security code is turned off.

Program Access Code (default = #30)

aaa 222 Sets the three-digit program access code, which allows an authorized person to make programming changes. For 1000-call terminals, the code can include any Touch-Tone digit except *. For 100-call units the first digit must be #.

Rings-before-Answer (default = 1.0 rings-before-answer)

000 227 tt Sets the number of rings the Model 32 waits before answering an incoming call on an end-to-end line. The range for tt is 00 - 99 (0.0 - 9.9 rings). For Central Office selector set-ups, tt = 00 disables the billing delay.

PAGER COMMANDS

These commands affect individual (or all) pagers. They include validation/ invalidation, substitution, and talk code commands.

All Pager Set-Up
000 201 Validates all pagers, clears all substitutions, and assigns 'talk code 1' to all pagers on the system.

Validate Pager (default = all pagers valid)
nnn 202 Validates pager nnn. Only necessary for already invalid pagers.

Invalidate Pager (default = no pagers invalid)
nnn 203 Invalidates pager nnn. The list of all current invalid pager codes can be scrolled across the front panel display of the Model 32 by using the 000 213 command.

Clear Pager Substitution (default = all substitutions cleared)
nnn 205 Clears the substitution of pager code nnn for another (see nnn 206 mmm).

Substitute Pager (default = no pagers substituted)
nnn 206 mmm Substitutes one pager code for another. When a caller keys in nnn, pager mmm is paged. The settings of the incoming pager code (nnn) determine validity, talk time, transmitter steering, and two-way enable during paging. The list of all substitutions can be scrolled across the front panel display of the Model 32 by using the 000 216 command.

Assign Talk Code to Pager (default = talk code 1 for all pagers)
nnn 207 d Assigns talk code d (0-3) to pager nnn.

Assign Talk Code to All Pagers (default = talk code 1)
000 208 d Assigns talk code d (0-3) to all pagers.

Set Duration of Talk Code 0 (default = 0 seconds) 20
000 209 tt Sets the duration of talk code 0 to tt (00-99) seconds. Two digits must be entered. When a pager has a non-zero talk time, the talk period during the page may be terminated by pressing * or #. The # key causes a reorder (prompt for next page) to occur, while a * causes disconnect.
2-Tone POCSAG T&V

Set Duration of Talk Code 1 (default = 10 seconds) 0
000 210 tt Sets the duration of talk code 1 to tt (00-99) seconds. Two digits must be entered.
POCSAG Display

Set Duration of Talk Code 2 (default = 20 seconds)
000 211 tt Sets the duration of talk code 2 to tt (00-99) seconds. Two digits must be entered.

Set Duration of Talk Code 3 (default = 30 seconds)
000 212 tt Sets the duration of talk code 3 to tt (00-99) seconds. Two digits must be entered.

5. TALKBACK PAGING

GENERAL

The DAPT-Jr Talkback Option allows the paged (mobile) party to talk back to the calling (landline) party. Mobiles may also originate phone calls (when enabled by a programming mode) on an end-to-end or PBX telco line and also call other mobiles using the paging features of the terminal. The talkback circuitry, together with advanced software in the EPROM, provides talkback paging, call origination, and mobile to mobile paging.

Features of this option include duplex radio channel operation, carrier receive control, and full field programming of all timing parameters such as: Call Time, Mobile Activity Time, Warning Beep Time, Phone VOX Hold Time, and Mobile VOR/COR Hold Time.

RESTRICTIONS

The Model 32 supports half duplex and full duplex radio operation only. The internal audio bus of the Model 32 is NOT full duplex and cannot carry conversations simultaneously between the landline and mobile. At any one time, the audio passes either to the mobile or to the landline, thereby providing half duplex operation. Under sophisticated microprocessor control, the high-speed gate on the audio bus allows for frequent switching of the direction of the conversation and in a system with a duplex base station, the users are often unaware of the switching.

It should also be noted that calls cannot be originated onto central office DID selector-level trunks, therefore the call origination feature is not available when the DAPT-Jr is programmed for selector-level operation.

ONE-WAY/TWO-WAY PAGING

The memory setup programming operation (000 200 or 000 201 - Section 4.) initializes all pagers to be one-way. However, any 'pager code' may be enabled for two-way talkback operation once the talkback software is installed. As in paging, a talkback conversation is initiated by calling the terminal, entering the pager number, and speaking a voice message. On one-way paging, the talk time ends with a busy signal; whereas talkback paging goes into the two-way conversation.

CALL LIMIT TIMER AND WARNING BEEP TIMER

After the mobile answers the page, the terminal begins timing the two-way conversation. A programmable limit of 000-990 seconds, in 10-second increments, may be set. When the call limit timer has counted down to less than the Warning Beep Time of 000-990 seconds (also in 10-second increments) from the end of the call, the terminal begins sending double 'pips' every 1.6 sec to whichever party is listening. The conversation is terminated with transmission of a long 1.5-second 1000-Hz tone to both parties.

There is no way for either the mobile or the phone caller to extend the talkback conversation longer than what has been programmed into the

terminal by the system operator. If additional time is desired, the phone caller may press the pound sign ('#') on the Touch-Tone phone after two-way termination during the busy signal, getting a beep (reorder), and paging the mobile again (see flowcharts in Section 3.).

MOBILE ACTIVITY TIMER

As required by FCC regulations, the mobile party must have control of a two-way conversation with a landline. This is implemented on the Talkback Option with a field programmable Mobile Activity Timer. Whenever the landline party is given control (terminal is transmitting), the timer counts down. When there is less than 5 seconds left, the terminal begins sending double 'pips' to whomever is listening. This is a cue to the phone party to stop talking and let the mobile key-up and speak in order to restart the activity timer and allow the conversation to continue. If the mobile does not, the conversation is ended with a long beep to the mobile.

DUPLEX OPERATION

With a duplex base station, it is possible for the mobile party to interrupt the phone party since the radio receiver is always active. The phone party can always speak unless the mobile interrupts (overrides). The audio does not switch to the mobile party when the phone party stops speaking, instead, it stays with the phone party. The mobile party 'overrides' by keying push-to-talk and speaking. The conversation switches as soon as the mobile presses the PTT and the base station COR output goes active. Duplex override operation provides phone patch operation that is nearly as good as a full-duplex phone patch for in-plant paging installations. Since few handheld mobiles are true full-duplex, conversations normally occur on a simplex basis anyway; one party speaking at a time. The fast switching of the terminal's audio bus and the mobile's ability to interrupt whenever desired make Duplex Talkback an economical system. The COR hold time can be set to zero with command "000 238 00" for fast audio switching to the phone party when the mobile releases PTT.

SPECIAL PRECAUTIONS

DC Remote Keying

When the radio base station is located remotely from the terminal, some kind of keying scheme is used between the two. If DC remote keying is employed, problems to be resolved are - 1) how to carry the receive audio back from the base station to the terminal, 2) how to carry the channel busy indication to the terminal, and 3) how to select the keying current to switch the base station between transmit and receive.

TALKBACK FLOWCHART

```
1. Already connected to Mobile?
      :No - Do CONNECT
            Connected now?
               :No -->TBEND

2. Start Call Limit Timer
   Start Mobile Activity Timer

TX-SWITCH:
3. Disconnect Receiver audio
   Short Beep to Phone party
   Connect Phone audio to Transmitter

TRANSMIT:
4. Start Phone Hold Timer
   Is Call Timer expired?
      :Yes -->TBEND
   Is Mobile Activity Timer expired?
      :Yes -->TBRECOV
   Is Disconnect Code '#' keyed?
      :Yes -->TBEND
   Is Mobile active?
      :Yes - Restart Mobile Activity Timer
           -->REC-SWITCH
      :No  - Stay in TRANSMIT

REC-SWITCH:
5. Disconnect Phone Audio from Transmitter
   Wait 2 seconds unless Mobile comes active sooner
   Connect Receive Audio

RECEIVE:
6. Start Mobile Hold Timer
   Is Call Timer expired?
      :Yes -->TBEND
   Is Mobile Activity Timer expired?
      :Yes -->TBEND
   Is Disconnect Code '#' keyed?
      :Yes -->TBEND
   Is Mobile active?
      :Yes - Restart Mobile Activity Timer
             Restart Mobile Hold Timer
             Stay in RECEIVE
      :No  - Is Mobile Hold Timer expired?
                :Yes -->TX-SWITCH
                :No - Stay in RECEIVE
```

```
TBRECOV:
7. Disconnect Phone audio from Transmitter
   Connect Receive audio
   Is Mobile active?
      :Yes - Restart Mobile Activity Timer
             Short Beep to Mobile
           -->RECEIVE
      :No - Keep checking for 3 seconds,
            if still no Mobile activity -->TBEND

TBEND:
8. Disconnect Phone party audio
   Disconnect Receive audio
   Long Disconnect Tone
   Turn Off Transmitter(s)
   Busy Progress to Phone party
   Disconnect Phone line
```

MOBILE TALKBACK CONNECT

Mobiles with or without DTMF keypads on their radios can answer a page from a landline caller. If the mobile security mode is disabled, then mobiles answer simply by keying PTT. If the mobile security mode is enabled, mobiles must key up, press "*", and enter the programmed 3-digit security code.

As an indication to mobiles that a landline caller is paging them, the terminal sends ringing tones out over the radio channel. On business band channels, the phone party should not be allowed to give a voice message prior to mobiles answering the page. In these systems, the talk time for 2-way 'pagers' should be programmed for 0 voice time.

TALKBACK CONNECT FLOWCHART

1. Start Connect Timer

2. Turn Off Phone party audio
   Turn On Receive audio

3. Is Connect Timer expired?
   :Yes -->CONN-FAIL
   Is Mobile active?
   :Yes - Is Mobile Security enabled?
   No -->CONN-SUCCESS (PTT is enough)
   Yes - Is '*' + 3-digit code keyed?
   Yes -->CONN-SUCCESS
   No -->CONN-FAIL
   Keep checking for 2 seconds,
   if still no mobile activity, go on to step 4.

4. Turn Off Receive audio
   Turn On Phone party audio
   Start Ringing to Phone party and to Mobile

5. Is Connect Timer expired?
   :Yes -->CONN-FAIL
   Is Mobile now active? (mobile can interrupt ringing)
   :Yes -->Step 2
   Continue Ringing for 3 seconds, then -->Step 2

CONN-FAIL:

6. Turn Off Transmitter(s)
   Turn Off Receive audio
   Flag Connect Failure
   Return to TALKBACK

CONN-SUCCESS:

7. Turn On Phone party audio
   Flag Connect Success
   Return to TALKBACK

MOBILE ORIGINATE

Talkback configurations with an end-to-end or PBX tie-trunk allow mobiles to originate telephone calls through the Telco network or PBX. "Originate mode" is enabled with programming command "000 242". Command "000 241" disables origination. Calls are originated with a "* Connect Code" from mobiles. Procedures for originating calls from mobiles with and without DTMF keypads follow.

Mobiles Equipped with DTMF Keypads

To initiate a call, the mobile transmits the "* Connect Code" for at least 150 msec. This causes the terminal to pick up the telephone line, connect the phone line, and return the Telco audio dial tone to the mobile for a few seconds. Next, the terminal issues a beep to the mobile to prompt for the telephone number.

The mobile should key in the number (11 digits or fewer) followed by a second "*" key. On receipt of the second "*" , the terminal dials the number using rotary pulse-dialing and delays 2.25 seconds after the first digit to allow dialing through PBX access lines. When the number has been dialed, the terminal continues to transmit telephone audio (ringing if the call is placed) for a few seconds then issues a beep to the mobile and enters normal talkback operation to allow communication between the mobile and the phone party.

Mobiles can also dial directly using their radio DTMF keypads without conversion to pulse-dialing. The mobile presses "*" to connect, waits for the dial tone, then presses "*" again without putting the phone number in between the two stars. The terminal enters talkback operation with phone dial tone transmitted to the mobile. Since audio is now established between the phone line and the mobile, direct dialing from the mobile's DTMF keypad is now possible (terminal does not perform DTMF tone regeneration).

Direct DTMF dialing can also be accessed with a single "*" key by setting the dialing mode via the remote programming commands.

000250 1	Sets direct DTMF dial only mode for mobile origination.
000250 0	Sets normal regenerated pulse dial mode for mobile origination.

Originate Flowchart (After '*' Connect Code Recognized)

1. Is Mobile Security Code enabled?
   :Yes - Display ' 0 ' on front panel
   Accept 3-digit DTMF entry from mobile
   Is Entry = Security Code?
   :No - Turn Off Transmitter(s)
   Disconnect Phone line
   Return to Main Polling Loop

2. Pickup Phone line
   Connect Phone audio
   Turn Off Receive audio
   Turn On Transmitter
   2 seconds Phone Dial Tone to mobile
   Short Beep to mobile

3. Turn Off Phone audio
   Turn On Receive audio
   Accept first DTMF digit of phone number
   Is digit = '*' Connect Code?
   :Yes -->TALKBACK
   :No - Drop Phone Line temporarily

4. Accept 10 more DTMF digits from mobile,
   or until Connect Code again.
   Pick up Phone Line again
   Turn Off Receive audio
   Turn On Phone audio

5. Rotary Pulse-Dial any digits entered

6. -->TALKBACK

Mobiles without a DTMF Keypad
The terminal can be programmed (command 000 244 nn...#) to automatically dial a fixed phone number up to 8 digits long. This action can be initiated by mobiles without DTMF keypads. This feature is useful for calling a predetermined emergency number or for getting a telephone operator who can place the call for the mobile. If the programmed phone number is empty (command 000 244 #), then this automatic phone dialing mode is disabled.

The mobile should first monitor the channel to make sure that it is not in use. If the channel is free, key up the mobile PTT two times at regular intervals in a space of two and a half seconds. This needs to be done slowly enough so that the base station carrier/squelch circuitry recovers for each key-up.

The terminal will sense the mobile activity, pick up the telephone line and transmit the phone dial tone to the mobile. Next, the terminal automatically pulse dials the preprogrammed telephone number of up to 8 digits. Rotary pulse-dialing is used for compatibility with all phone systems with a 2.25-second delay after the first digit to allow dialing through PBX access lines. At the end of the dialing sequence, the terminal will wait a few seconds and then enter normal talkback operation.

Auto-Dial Originate Flowchart (After 2 Clicks Recognized)

1. Any Programmed Phone Number?
   :No - no action

2. Pick up Phone line
   Connect Phone audio
   Turn On Originate Transmitter
   2 seconds Dial Tone to mobile

3. Rotary Pulse-Dial Programmed phone number

4. -->TALKBACK

MOBILE TO MOBILE PAGING

Once decoders are installed into handhelds, portables, and mobiles for selective signaling from landline parties, it is difficult for one mobile to directly communicate with another since the decoders keep mobile audio squelched until selectively signaled. This signaling function from a mobile to another mobile or to a pager is implemented by the DAPT's mobile to mobile calling feature. This feature requires the initiating mobile to be equipped with a DTMF keypad. Note that while the mobile to mobile/pager talk time is occurring, the DAPT will be busy to landline phone callers who want to do paging.

To page a mobile or pager, a mobile transmits a deliberate "* *" double connect code to the terminal while holding down PTT continuously during the stars. (If mobile security is enabled, then key "* sss *" , where "sss" = security code programmed). The terminal transmits a special Hi-Lo beep to prompt for the 3-digit (2-digit if terminal is only 100-call) 'pager' code. This pager code is the same one used by phone parties to call the desired mobile/pager. Upon receipt of the full pager code, the terminal transmits the paging tones over the radio channel to unsquelch the called mobile, followed by a beep to the initiating mobile who can then talk to the called mobile/pager. If the pager code entered by the mobile is invalidated or contains illegal digits (such as *ABCD), then the terminal terminates the page and transmits busy tones over the radio channel.

For a called pager code that is one-way, the initiating mobile can speak for the programmed talk time to the pager. If the mobile wishes to quit talking early, then a "#" disconnect code will tell the DAPT to send any required talk off function as provided by the paging format.

For a signaled two-way mobile, the two mobiles can converse for the programmed two-way time limit. At the end of this time, the terminal will terminate the mobile-mobile call by transmitting the long disconnect tone and make the phone line available for landline initiated paging. During the two-way conversation, the terminal continuously monitors the channel for mobile-to-mobile activity. If this activity ceases completely for an 8-second period, the terminal assumes that the mobiles are finished and terminates the mobile-mobile call.

Mobile to Mobile Flowchart
(After "* *" or "* sss *", where sss=security code, is recognized)

1. Busy out Phone Line
   Turn On Originate Transmitter
   Hi-Lo Beep to mobile

PAGE:
2. Accept Pager Code from Mobile
   Turn On Transmitter
   Transmit Paging Sequence

TALK:
3. Beep to Mobile
   Turn Off Transmitter
   Start Talk Time Timer
   Is # Entered from Mobile (during voice time)
      :Yes -->TALK-END
      :No - Keep waiting until voice time expires

TALK-END:
4. Talk End Function Required?
      :Yes - Turn On Transmitter
             Transmit 'Talk-Off'
             Turn Off Transmitter

TWO-WAY:
5. Start Call Limit Timer
   Start 8-Second Inactivity Timer
   Is Call Timer expired?
      :Yes -->END
   Is '#' Disconnect Entered from Mobile?
      :Yes -->END
   Is Inactivity Timer expired?
      :Yes -->END
      :No - Stay in Two-Way

END:
6. Turn On Transmitter
   Transmit Long Disconnect Tone
   Turn Off Transmitter
   Make Phone Lines available again
   Return to Checking Phone Lines

TOLL CALL RESTRICTION

Although not designed as a full-feature phone patch, the DAPT-Jr provides limited toll call restriction checking for mobile to landline phone call origination. Programming commands "000 248" and "000 249" prevent dialing of phone numbers beginning with "1" or "0" respectively. Command "000 247" turns off checking and allows dialing of any phone number.

When the mobile enters the first digit of the phone number to be dialed, the terminal checks this digit for toll restriction. The terminal will cancel the call if this digit is "1" and command "000 248" has been programmed, or if this digit is "0" and command "000 249" has been programmed.

In order to close back door entry by the mobile, direct nonregenerative DTMF dialing is prohibited if either 1- or 0-toll restriction is enabled. Also, any DTMF keying from the mobile during the two-way conversation will cause a rotary dial digit "three" to be generated by the terminal.

MOBILE SECURITY MODE

The terminal's security code (when enabled by programming command "sss 221" with "sss" not equal to "000") provides phone-accessible paging only to authorized phone callers. After answering the phone, the terminal takes in the pager number, and then beeps the caller for the 3-digit security code before paging can begin. Programming command "sss 221" also turns on mobile security mode which performs two functions; positive mobile connect and mobile originate security.

Security Options

Programming command "sss 221", where "sss" is not equal to "000" turns ON both terminal security and mobile security. The security code is a single 3-digit code used for both. Two additional commands selectively turn OFF terminal security (000 245) and mobile security (000 246). If phone callers do not need security, but mobiles do, then program "sss 221" followed by "000 245". If all phone access is to be secure, but mobiles should have free access, then program "sss 221" followed by "000 246". If both phone access and mobile access are to be secure, then just key in "sss 221", where "sss" is not "000". To turn off all security checking, key in "000 221" (or "000 245" and "000 246").

Positive Connect

When mobile security mode is enabled, mobiles are required to answer a page by keying * sss rather than simply pressing PTT. Phone callers are prevented from dialing the terminal and paging a random talk-back pager in order to converse with a pirate mobile on the channel. For further security, the pager can be programmed for zero talk time for no opportunity for channel voice time until the mobile connects.

Mobile Originate Security

When the mobile security mode is enabled, mobiles are required to key in "* sss" to initiate a landline phone call and "* sss *" to initiate a mobile to mobile/pager page. If the "sss" code is incorrect, the mobile is ignored.

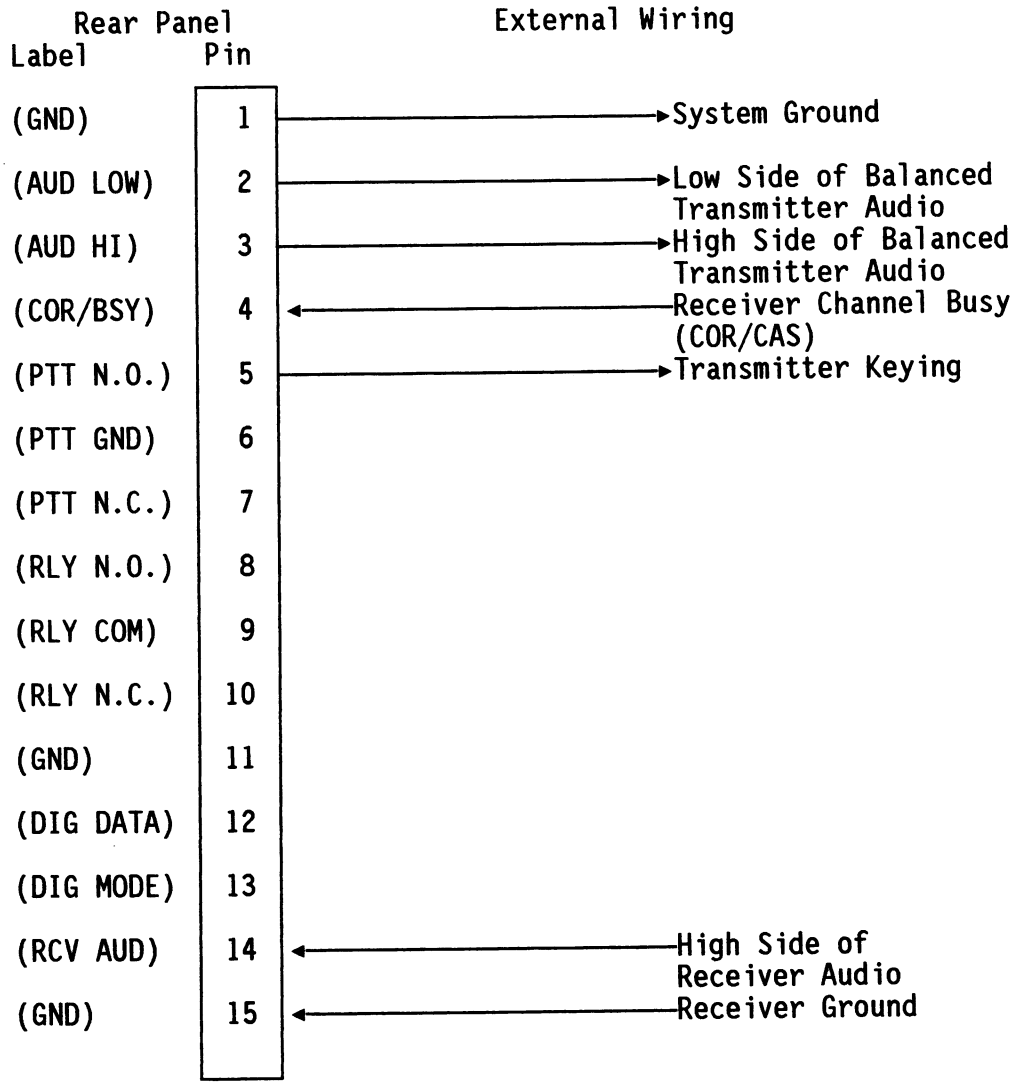
INSTALLATION

Connect receiver audio from the base station to the DAPT rear connector pins 14 and 15. On most base stations it is recommended that receiver audio be tapped before the monitor speaker volume control so that its position will have no effect upon audio levels. It is important to note that pin 15 grounds one side of the audio from the station.

Connect the COR/CAS output from the base station to the DAPT rear connector pin 4. Jumper JP8 sets the impedance loading and JP9 sets the polarity action of the COR signal (see table below). On some stations, it may be necessary to obtain the COR/CAS signal from inside the radio. For reliable operation, it is recommended that this be done and the jumpers be set accordingly as below.

Jumper	Label	Location	Position/Meaning	Factory Setting
JP8	COR	Crystal Y1	A= Input from Carrier Operated Relay (COR) (gnd/open) B= Input from active drive (CAS)	A
JP9	COR POL	Crystal Y1	A= Input grounded is busy channel B= Input open/high is busy channel	A

BASE STATION CONNECTION



ADJUSTMENTS

Proper operation of "*" connect and "#" disconnect from the mobile requires setting the audio levels from the base station receiver onto the DAPT's audio bus. The level presented at the rear connector of the terminal should be between 0.1 and 5V AC rms, measured with an AC reading voltmeter. If the level is above 1V AC rms then move jumper JP5 labeled "ATTEN" and near to relay K2, to position B for 20dB attenuation.

While conducting a two-way conversation through the telephone line, adjust the talkback audio gain R24 for comfortable mobile audio to the phone party. The audio level setting is important to guarantee accurate decoding of mobile DTMF control tones and Telco detection of 0dBm to -10dBm level for call originate dial-through.

When the receiver audio is toggled over to the phone, adjust audio level control R24, near the rear of the talkback card, for comfortable voice from the base station receiver. Also try DTMF tones from a mobile to produce about 0.5 to 1.0V AC rms (measured with an AC voltmeter at test point TP1 near the center of the circuit board). If this level is set too soft, DTMF dialing originate will not be recognized by Telco systems.

TALKBACK TESTING

Have an assistant call the terminal and place a few test pages to your handheld that you have programmed as two-way (command "ppp 225" where "ppp" = pager code). If the paging does not happen and the phone caller hears intermittent ringing (instead of rhythmic ringing), then the channel-busy hook-up is probably wrong. Refer to the jumper table above for JP9 polarity and JP8 impedance settings. If you want the phone party to be able to speak to the mobile to deliver a voice message before two-way operation is initiated, then make sure that you program Talk Code 1 (command "000 210 tt") to have some value like "tt" = 10 seconds.

If you have an end-to-end or PBX phone line, try some mobile to landline and mobile to mobile calls. Enable mobile originate with programming command "000 242". Then use the DTMF keypad on your mobile to make a phone call ("* connect code" + "phone number" + "*") and make some mobile-to-mobile calls ("* * connect" + "pager code"). Use the "#" key to disconnect the call and verify that the terminal reliably decodes mobile DTMF key entries.

PROGRAMMING

Following cable hook-up and audio adjustments, the various modes of talkback operation must be programmed using the #30 program mode code (to get the 'chirp' prompt) followed by programming commands below.

Set Pager as Two-Way (opposite of "000 226")
nnn 225 Pager 'nnn' is set as a talkback type 2-way mobile.

Set Pager as One-Way (opposite of "000 225")
nnn 226 Pager 'nnn' is set as normal one-way pager.

Set Two-Way Call Timer
000 234 tt Set Two-Way conversation Time Limit to 'tt0' (000-990 sec) in 10-second steps. Upon expiration of this time limit, the conversation is terminated.

Set Mobile Activity Timer
000 235 tt Set Mobile Activity Time Limit to 'tt' (00-99 sec) By FCC regulations, the mobile party must become active every 'tt' seconds, otherwise the terminal terminates the 2-way conversation. When the mobile activity timer expires, a double-beep warning is always sent, and the mobile has 5 seconds to go active, otherwise the disconnect occurs.

Set Warning Beep Time
000 236 tt Set Warning Beep Time to 'tt0' (000-990 sec) in 10-second steps. 'tt0' seconds before the expiration of the Two-Way Call Timer, the terminal will issue a double-beep warning to signal that there are 'tt0' seconds left before disconnecting.

Set Mobile COR/CAS Hold Time
000 238 tt Set mobile COR/CAS hold time to 't.t' (0.0-9.9 sec)
This parameter applies to COR/BSY rear panel input and sets the silent time required before switching audio away from the mobile party to the phone party.

Originate Disable
000 241 Mobile call origination: mobile to landline, mobile to pager, and mobile to mobile is disabled.

Enable Originate
000 242 Enable originate for mobiles.

Set Preprogrammed Phone Number
000 244 nn...# Program telephone number to pulse dial when 2 mobile activity clicks occur. The number should be 0-8 digits long. If no digits, then call origination can only be done by mobiles with DTMF keypads. The '#' key terminates the command if fewer than 8 digits are entered.

Clear Landline Security Checking
000 245 Command 'sss 221' (with sss not 000) turns ON both landline and mobile security checking. After an 'sss 221' use a '000 245' to turn OFF landline security checking.

Clear Mobile Security Checking
000 246 Command 'sss 221' (with sss not 000) turns ON both landline and mobile security checking. After an 'sss 221' use a '000 246' to turn OFF mobile security checking.

Clear Toll Restriction Checking
000 247 Clear any checking of mobile to landline dialed phone numbers. That is, allow any phone number to be dialed by the mobile.

Enable 1- Toll Call Checking
000 248 Prohibit mobiles from originating phone calls beginning with a '1' digit. When this mode is active, only DTMF to pulse dial regeneration is available (DTMF direct dialing is prohibited). Any DTMF key during 2-way conversations will terminate the connection.

Enable 0- Toll Call Checking
000 249 Prohibit mobiles from originating phone call, beginning with a '0' digit. When this mode is active, only DTMF to pulse dial regeneration is available (DTMF direct dialing is prohibited). Any DTMF key during 2-way conversations will terminate the connection.

Select Mobile Originate Dialing Mode
000 250 Set the mobile dialing mode to regenerative (0; factory default) or direct DTMF (1). In direct DTMF dialing, the DAPT will not regenerate the dialed number from the mobile, but will pass it through directly.

DEFAULT SETTINGS

The terminal, as shipped from the factory, is preprogrammed (initialized) with the following talkback settings and may be reset to these settings by using programming command '000 200', which acts like the following commands:

000 201	All pagers are one-way	
000 234 09	Two-Way Call Timer =	90 sec
000 235 30	Mobile Activity Timer =	30 sec
000 236 01	Warning Beep Timer =	10 sec
000 238 05	Mobile COR/CAS Hold Timer =	0.5 sec
000 241	Mobile Origination disabled	
000 244 #	Auto-Originate Phone number empty	
000 245	Clear Landline Security Checking	
000 246	Clear Mobile Security Checking	
000 247	Clear Toll Restriction Checking	
000 250	Regenerative Mobile Dialing	

6. SPECIAL FEATURES

DIAL CLICK DETECTOR OPTION

In some rural areas, DTMF (tone) dialing is not normally available or used. This makes it difficult to use the DAPT-Jr on end-to-end phone lines and require the caller to dial in the pager number. All that comes through from a rotary dial telephone are audible clicks from the phone's contacts opening and closing as the dial turns. This type of telephone can be supported on the terminal by adding the Dial Click Detector option board and companion software.

The Dial Click board processes the incoming audio clicks from the phone line and converts them into high/low digital pulses that are read by software. Since dials turn at different and varying speeds, and sometimes produce extra clicks during their rotation, the software is designed to be especially discriminating in interpreting these clicks and converting them back into the 0-9 digits dialed by the caller. The process is not 100% perfect and it is advised that particular installations and dialing through different phone company central offices be attempted before assuring subscribers that their paging will always work correctly.

Auto-Calibrating Feature

In most situations, Zetron's standard dial click detection software is more than adequate in interpreting the clicks of a rotary phone turning. However, because of the nature of the audible dial-clicks detected by the terminal, poor Telco line conditions can adversely affect operation. Standard dial click detection requires that for every 'click' (rotary contact make or break action) sent from the calling telephone, a corresponding click must be detected at the terminal. If this does not happen, an incorrect pager code is usually interpreted and sent. Incorrect pager codes may also happen if the phones used to access the terminal stray from the standard 8 to 12 pulses per second dial rate. In addition, some older central offices cause spurious clicking when the calling rotary phone attempts overdialing. This clicking can change from one central office to another and may depend upon the path through which the call has been placed. It is the purpose of the Auto-Calibrating Dial Click software, selectable in programming mode, to compensate for all of these types of problems.

The special Auto-Calibrating Software is nearly immune to missing or added clicks and phone pulse-rate variations. This software requires that a two-digit synchronization sequence first be dialed prior to the pager code information. For this reason of inconvenience, advanced dial-click detection is only advised for those installations having proven difficulty with the standard dial-click software.

The synchronization sequence consists of entering or dialing first a "1" then a "0", after which the information may be entered. This "1-0" sequence allows the terminal to synchronize to the specific pulse-rate speed of the phone and compensate for extraneous click insertion by the central office and switching equipment. For maximum reliability, the rotary phone pulse rate should be consistent during the specific connection period of the call. The terminal will work with a very wide range of telephones as long as each individual telephone has a consistent pulse rate. In order to achieve highly reliable dial click detection, dialing of the rotary phone should be done deliberately. As the dial returns, it should not be

obstructed or sped up with a finger in the dial. These measures will help assure consistent pulse rates. Failing to do this may result in wrong pages being sent, or no page sent at all.

The following modified operations of entry add the "1-0" synchronization:

Paging: enter 1 0 then pager code (2 or 3 digits)

Security Code: enter 1 0 then security code.

Program Access: enter 1 0 then program mode access code.

Display Messages: enter normally without extra digits.

When the synchronization digits are used, they are required of both rotary and Touch-Tone phone entry whether from a remote location or from the local telephone.

Cautions
Disconnection may occur with some central office equipment when rotary overdialing is attempted. There is no solution for this; Touch-Tone overdialing is the only method currently available.

Installation
The Dial Click Detector Card plugs into a special 6-pin connector P2 inside the terminal, mounting onto a standoff. To install, plug the dial click board into P2 and secure it to the standoff with a #4-40x1/4" machine screw. Power the terminal OFF then ON again so that the software finds the dial click board. Perform the dial click adjustment procedure below before replacing the top cover.

The dial click mode may be selected from the programming mode by entering one of the following commands:

000187	Standard dial click detection. This is the default mode after initialization.
000188	Auto calibrating dial click detection. Requires the "1-0" synchronization sequence.

Adjustments
Experience has shown that some older rotary telephones, and rural telephone offices produce differing characteristics of residual audio clicks. Under rare circumstances, the optional Dial Click Detector board may require adjustment or special software. The Input Level R20 is fairly sensitive since it is feeding an AGC Amplifier which must follow the faint residual audio clicks from rotary telephones. The Trigger Level R18 is extremely sensitive and for this reason it is factory sealed. Do not adjust R18 without consulting Zetron. If difficulty is experienced in reliably paging from rotary telephones, call Zetron before attempting any adjustment of the dial click board.

The first step in adjusting or testing the Dial Click Detector (DCD) is to put the terminal into one of two dial click test modes (see Section 4). Program mode 198 should be used to test dial click adjustments from a

remote location since this mode will beep the same number of times as the digit dialed (10 beeps for a '0'). Mode 199 should be used to adjust and verify the dial click adjustments while the technician is near the terminal since the only feedback in this mode is the front panel display of the digit dialed.

Get into programming mode by dialing into the terminal and keying in the Program Mode Access code (#30 factory setting). The terminal will chirp. Then key in '000 198' or '000 199' as described below:

Dial Click Checking with Beep Prompting

000 198 This is used to check the dial click decoder operation when the terminal front panel is out of sight. The number of beeps that comes back tells how many pulses the terminal sensed were dialed.

Dial Click Adjustment without Prompting

000 199 This is used to adjust the dial click decoder option board when the terminal front panel can been seen. As the digits are dialed in, the Pager Code display provides feedback as to digits that the terminal sensed were dialed.

To prepare to verify or adjust the DCD setting, it is necessary for the originating caller to have on hand both a rotary and a Touch-Tone phone connected in parallel to any outgoing Telco phone line. The call to the terminal must be initiated using the Touch-Tone phone via a telephone exchange since the program mode must first be entered in a reliable manner. Once in the program mode, the caller enters only '000 198' or '000 199' using the Touch-Tone phone. At this point, the DCD test may be used to test either dial click information from the rotary phone or DTMF information from the Touch-Tone phone. If you desire to test dial click information, pick up the rotary phone handset and hang up the Touch-Tone phone. If you desire to test DTMF information, then the first Touch-Tone digit entered will cancel the ability to test dial click until program mode is again entered. With Auto-Calibrating Software, '1-0' must be dialed immediately after the '000 198' or '000 199', then any test digits may be dialed.

There are three ways to exit the dial click test modes; enter or dial '8021', enter a Touch-Tone '*' to reset the terminal, or turn off the terminal. '8021' is the only way to exit the mode and remain connected to the terminal. Once exited using '8021', the terminal is still in program mode (as indicated by the chirp prompt) and any other program mode commands may be entered. There is no timeout, so don't lose the Telco connection, or you will not be able to access the terminal without a power-off.

In order to effectively adjust the dial click detector board, the technician should have control of the dialing as well as adjusting. For this reason, it is best to adjust using two phone lines at one location; one line to the terminal and the other to the pair of phones used to dial and originate the calls. The phone lines used during adjustment may not be representative of the typical lines used in day-to-day use. For this reason, it may be desirable to check the adjustment (using mode 198) of the DCD from the several areas likely to use the terminal. In general, areas that have differing telephone prefixes use a different telephone exchange

and this is where the largest difference in line quality is likely to occur. It is quite likely that the dial click detector will not be able to properly decipher dial clicks under all possible telephone line conditions using one setting. This is a drawback of dial click detection.

There are two adjustments on the DCD board. Potentiometer R20 is the gain or level adjustment and R18 is the output pulse width or trigger adjustment. In addition there is a red LED on the board that is useful in showing the state of the output (at pin 6). When the LED is ON, the output is high and when OFF the output is low. The DCD board comes factory adjusted for proper operation under nominal phone line conditions. Adjustments may not be necessary at all. Check this using test modes 198 or 199. Trimmer R18 is factory sealed because the pulse width adjustment is especially critical. Trimmer R18 should only be adjusted as a last resort, but never break the seal without first consulting Zetron.

Ordinarily, the adjustment of R20 (gain) will improve poor dial click detection. Under attenuated phone line conditions, the gain may have to be increased by turning R20 clockwise. Under noisy phone line conditions, the gain may have to be reduced by turning R20 counterclockwise. The proper adjustment of R20 is identified (via the test modes) by successfully verifying a range of dialed digits (1, 5, 0) against those shown on the display. In the case of extremely poor response, the LED on the DCD board can be used to gain more information. The LED should blink once for each dial click (2 clicks per pulse or 20 clicks for a dialed 0). If the LED appears to miss a click, increase the gain. If the LED appears to add clicks in response to noise, decrease the gain.

UNATTENDED AUTO-PAGE FEATURE

For in-plant applications, it is often useful to provide after-hours automatic access to pager or radio-equipped personnel. The unattended auto-page software option specializes access through the trunk access to the DAPT-Jr. Whenever a call arrives, the terminal answers, gives the caller ringing, and automatically initiates a page to pager code 000. The caller need not enter a pager number--the page proceeds automatically giving the caller ringing as if a normal phone call were being placed.

Paging to a tone and voice pager allows a talk time interval for the caller to speak a message at the single beep. Programming pager code '000' for talkback (command '000 225') allows the called mobile party to respond to the caller by simply waiting for the end of the paging tones and then keying up the portable/mobile radio and speaking. If no talk time is desired, pager code 000 can be field-programmed to a talk code whose time is 0.

The system operator may select a pager code other than 000 to receive auto-pages. This is done through programming command '000 206 ppp' to re-route paging for '000' to 'ppp'.

A special feature enables trained callers to select a pager code other than 000 at the time of the call. For two seconds just after the terminal answers Trunk A for auto-page, it listens for a '#' Touch-Tone code. If it detects a '#', it reverts to normal paging by sending a single beep and accepting a pager code from the caller.

The Unattended Auto-Page feature is turned on or off by field programming. Once enabled it will remain enabled until it is disabled. The default state as shipped from the factory is unattended auto-page disabled. The command to enable unattended auto-page is '000 189'. The command to disable unattended auto-page is '000 190'.

7. INSTALLATION

INSTALLATION WARNING

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

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

OPENING THE TERMINAL

The top cover of the terminal is retained by Phillips head #4-40 screws underneath the terminal. After removing the screws, slide the entire cover off and set it aside. The terminal can be placed right-side up on a work surface for servicing.

PROGRAM MEMORY

Upon each power-up, the terminal's self-test software checks the program memory contents for lost bits; a code of "CLr" signifies that the memory has been initialized. Before each page, the memory is tested for loss with a 'check sum' test. Three beeps to the caller and error code of '055' in the display signifies memory loss, usually due to severe lightning discharge via the telephone line or the radio cable. The memory should be reinitialized by remote programming (see Section 4.).

INSTALLING NEW EPROMS

When a factory update is shipped for installation in the DAPT-Jr, new EPROM chips that contain the operating software for the terminal, may have to be changed. The software is contained on just one chip with 28 pins to be put into the socket labeled U24. This chip is delicate and sensitive to static. When handling it, be sure to keep your fingers in contact with the chassis sheet metal to keep yourself grounded. Only remove the chip from the static protective shipping tube when ready for installation.

When the new chip is installed, all program memory settings MAY BE LOST. This is due to the fact that new software features may use different areas of memory than the old software. When possible, the new software will attempt to use the old program contents, but by the time the new software is powered on, the memory settings may be lost. So as a first step, before installing the EPROMs, consult with the DAPT-Jr end-user, convey this information and obtain any pager substitutions, pager invalidations, talk times, security code, special transmitter steering, programmable station IDs, 2-way settings, etc.

Program modes '000 213' and '000 216' display pager invalidations and substitutions on the front panel of the terminal and may help determine these current settings when a written record has not been kept. As stated in Section 4. on Programming, it is highly desirable to keep written records of all of the terminal settings by using the record sheets in Section 10. These sheets contain spaces for all of the hardware and software settings that are unique to a particular DAPT-Jr installation. It is advised that copies of these sheets also be kept at the installation site in order to service the terminal.

In addition to a new EPROM chip, upgrades from 100-call to 1000-call require a new RAM chip. The RAM chip will be included with the EPROM if required. It should be noted that all of the terminal settings are stored in the RAM chip and replacement of the chip will destroy all settings.

To install a new EPROM chip (and RAM), do the following:

1. Before turning off the power, make sure that you know what should be set in the program memory (see paragraph above).
2. Turn off power to the terminal and remove the top cover (see procedure above).
3. Remove the old U24 from its socket by prying gently with a small flat blade screwdriver.
4. Look at the new EPROM carefully. There is an orientation notch on end and a label on top.
5. Install the chip into the U24 socket with the orientation notch aligned with the white ink chip outline on the circuit board.
6. Remove the old U23 if a new RAM chip is required. Leave the socket plugged into the board.
7. Install the new RAM into the socket with the orientation notch aligned with the white ink chip outline on the circuit board. Set JP12 to 8K position.
8. Take some time now to look carefully at all of the pins of the chip. Make sure that the pins are aligned in the socket and fully inserted, not bent out, and not bent under.
9. Turn on power to the terminal and make sure that the front panel display shows "CLr" for at least 10 seconds while it reinitializes the program memory. If "CLr" does not show, then the old program memory was kept intact.
10. The terminal will then perform a self-test and spell out various messages. If erratic behavior occurs, then, most probably, the chips were installed improperly, so turn off the power and go to step 5.
11. If '---' is displayed then all is well.
12. Replace the top cover of the unit.
13. Return the old EPROM to Zetron in the protective tube in which the new EPROM was shipped.

120/240V AC LINE VOLTAGE

The terminal is normally shipped with a wall transformer that changes 120V AC line voltage to 9V AC for use by the DAPT-Jr. Terminals ordered for use on 240V AC mains have a special international transformer enclosed. Be sure you have the correct transformer before plugging it into the wall.

MATRIX PLUG

The DAPT-Jr configures the telco trunk with a special matrix plug. The plug is a small daughter board near the rear panel. To configure the trunk to DID, END to END or E & M, remove power, remove the plug, and plug it back in by aligning the two columns of pins corresponding to necessary configuration into the socket. See Section 2 for telephone specifications, Section 3 for general operation of telephone circuits, and later in this section for installation notes regarding different settings.

RADIO INTERFACING

Connections between the terminal and the customer's radio equipment are made with the detachable connector P1 on the rear panel of the terminal:

Label	P1 Pin	Function
GND	1	System Ground
AUD LO	2	Balanced audio output to Transmitter paired with AUD HI (JP6 De-emphasis, JP10 Pre-emphasis)
AUD HI	3	Balanced audio output to Transmitter paired with AUD LO
COR/BSY	4	Radio channel busy (often called COR or CAS) (JP9 polarity selection)
PTT NO	5	Push-to-talk for TX, normally open, connected by PTT GND during transmit.
PTT GND	6	Push-to-talk reference for TX (JP4 in A for connection to GND all the time)
PTT NC	7	Normally closed side of PTT relay, open during transmit.
RLY NO	8	Spare relay contact for TX, connected to RLY COM during transmit.
RLY COM	9	Common of spare relay for TX, rated 1Amp max at 28VDC.
RLY NC	10	Spare relay contact for TX, connected to RLY COM when not transmitting.
GND	11	System ground, useful for twisted wire pair with DIG DATA for noise immunity
DIG DATA	12	Digital data output, for binary digital paging directly modulates TX FM input (polarity programmable)
DIG MODE	13	Digital mode output to switch TX from tone to digital (JP7 selects polarity)
RCV AUD	14	Receiver audio for use in Talk-back paging and mobile originate (JP5 in B attenuates by 20dB)
GND	15	System ground, useful for twisted wire pair with RCV AUD for noise immunity

AUDIO OUTPUT

The DAPT-Jr provides balanced 600-ohm transformer-coupled audio outputs on pair P1-2 and P1-3 for paging tones and voice. This impedance matches the typical impedance of leased direct telephone wiring. Connection to the AC coupled audio modulation input of the radio transmitter can thereby be made remotely from the terminal over dedicated lines or locally using shielded cable. The tone level output is adjusted by R61 and the voice level by R53. For connection to pre-emphasized microphone inputs, set JP6 to 'B' to get tone transmission flat, and JP10 to 'B' to keep the voice from being de-emphasized. For flat audio inputs, set JP6 to 'A' for flat tones, and JP10 to 'A' for flat voice or to 'B' for pre-emphasized voice.

PUSH-TO-TALK KEYING

The PTT relay output turns on the radio transmitter for the duration of the paging tones/digital data and voice time. This output on P1-5, -6, and -7 normally provides a GND on P1-5 to turn on the transmitter (when JP4 is in position 'A'). For radios that require other keying methods, move JP4 to position 'B' to obtain isolated contact keying for P1-6.

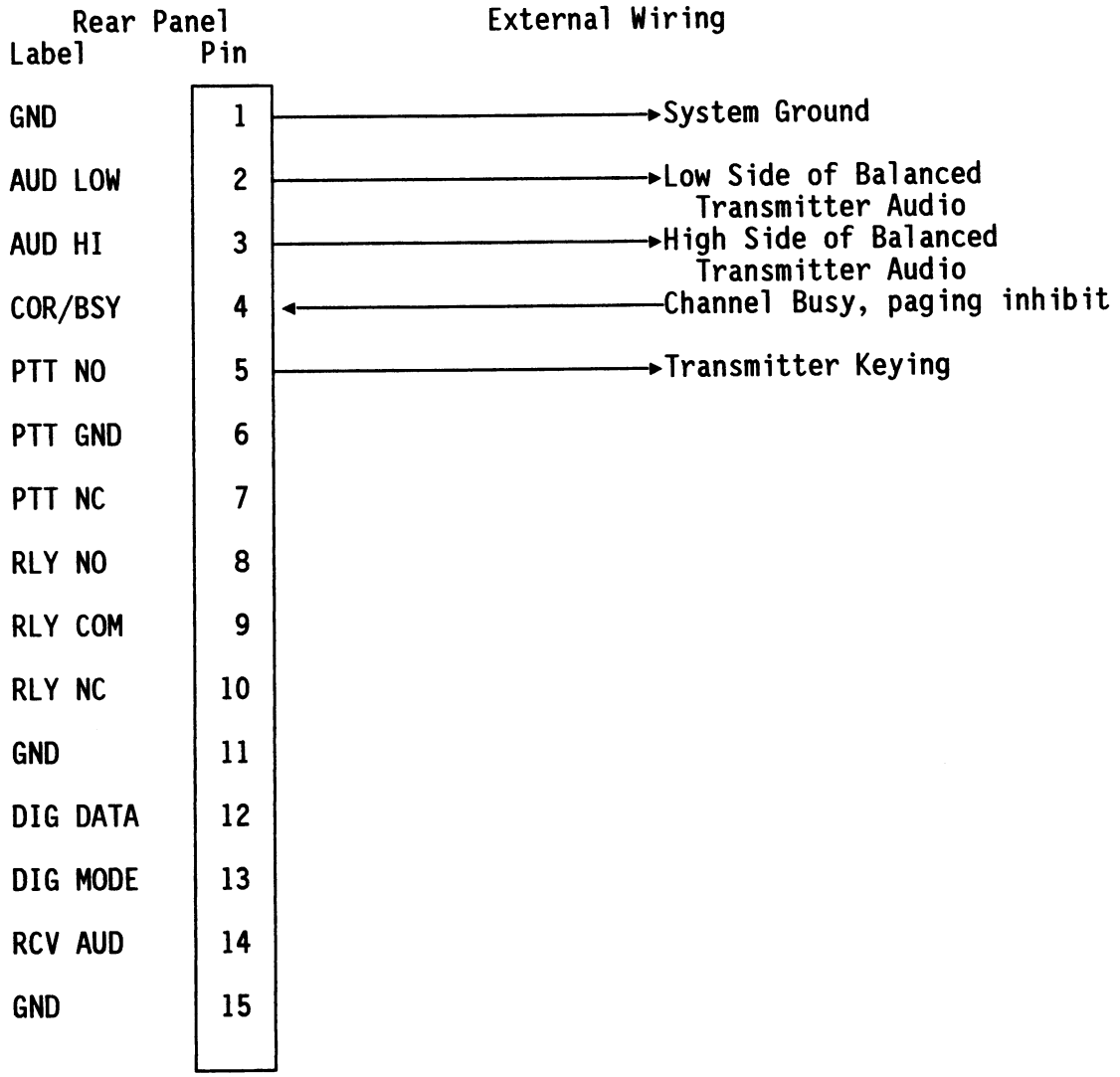
CHANNEL BUSY / PAGE INHIBIT

To inhibit the terminal from transmitting while the radio channel is already in use, provide a signal to the COR/BSY input P1-4. Use the radio's COR/CAS output which detects whenever there is a radio carrier on the channel. When the terminal is ready to transmit, it checks the COR/BSY input. If the channel is busy, the terminal sends back a special intermittent ringing signal to the calling party and flickers the front panel Pager Code display. As soon as the channel is clear, the terminal proceeds as normal.

Jumper JP8 conditions the COR/BSY signal input impedance. Place this jumper in position 'A' when using a COR radio output which goes open circuit when inactive (such as relays or open collector transistors). For drive circuits which can source/sink the required 1.5mA current from the COR/BSY input (such as TTL logic drivers), use the 'A' position also. For other signals such as discriminator CAS signals that are actively driven but cannot source/sink that much current (such as CMOS or high-impedance COS circuitry in base stations), put JP8 into position 'B'.

Jumper JP9 selects the polarity of the COR/BSY input. In position 'A', a ground or logic low (below 0.6V) input signal on COR/BSY means that the channel is busy. Position 'A' is useful for closure-to-ground-busy relay outputs from the transmitter. Position 'B' is useful for carrier-activated-squelch detector circuitry that is logic high (above 2.0V) when radio channel carrier is present.

AUDIO TRANSMITTER CONNECTION



DIGITAL PAGING

The DAPT-Jr encodes the latest binary digital formats. A radio transmitter set up for direct DC FM input for use with digital pagers will have two inputs. One will be the normal microphone input with associated audio signal processing circuits to provide pre-emphasis and limit the maximum FM deviation. The second input is for the digital data (modulation) information.

Digital Data Output

Digital modulation inputs come in two types. The first type has a logic compatible input which expects an input signal of nominally 0 or 5V. The transmitter senses whether the input is at logic '0' (less than 0.8 volts) or logic '1' (greater than 2.4 volts) and shifts the RF signal to -4.5 kHz or +4.5 kHz respectively. The Motorola PURC and Quintron transmitters are of this type.

The second type of input uses the actual input voltage level to modulate the RF signal. In this case it is necessary to ensure that the input signal is adjusted to cause the required carrier shift of +4.5 kHz to -4.5 kHz. To make this easier, the data output of the terminal has an amplitude adjustment which allows the logic '1' voltage to be adjusted from zero to seven volts. The logic '0' voltage is fixed at zero volts. With some transmitters it may be necessary to level shift this signal, since a modulation input of zero may not cause a -4.5 kHz shift. An alternate approach is to offset the carrier to -4.5 kHz and ensure it is biased to the nominal channel center frequency during any conventional tone or audio transmissions. Typical communications monitors (test equipment) are this type.

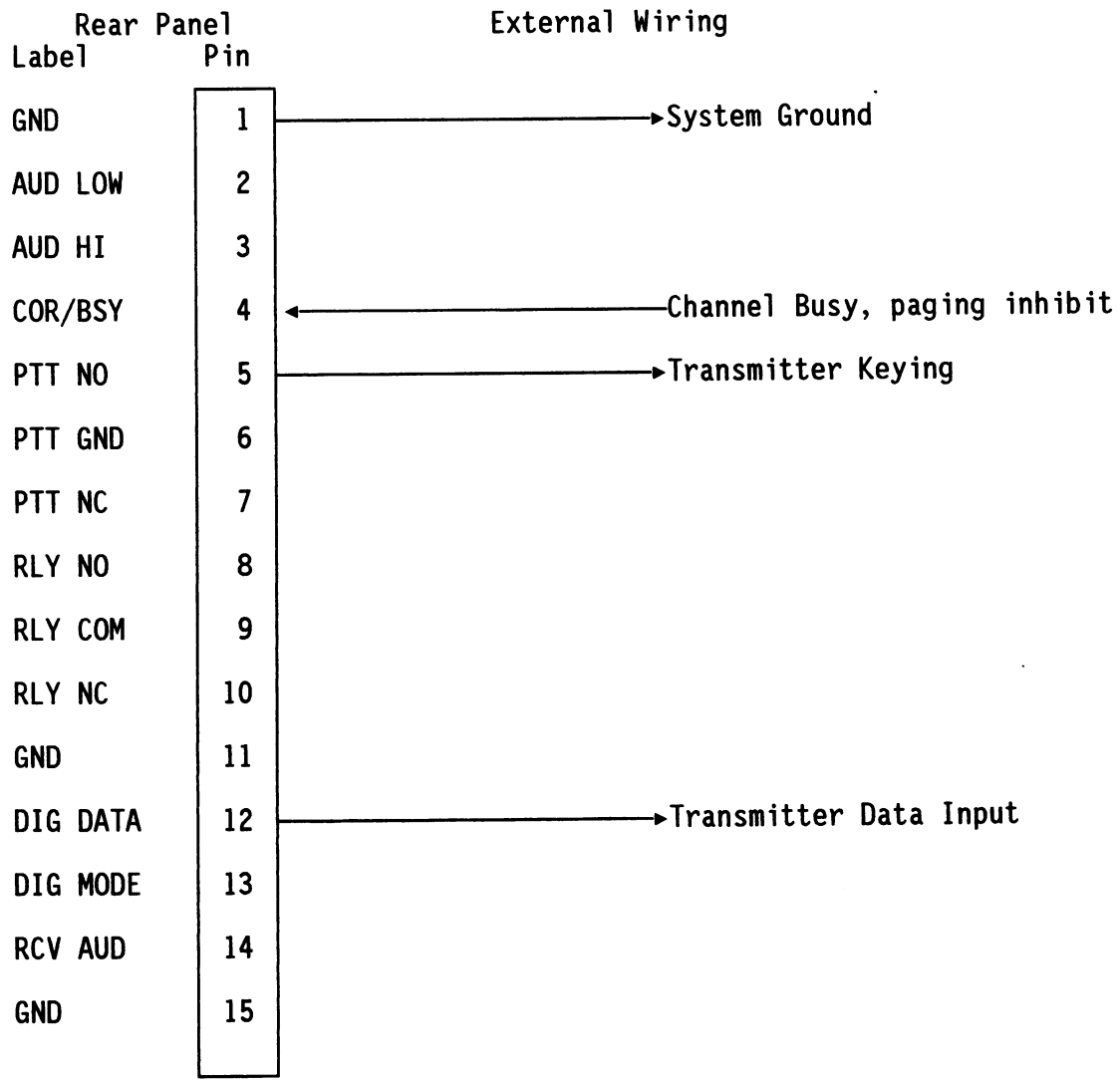
The binary digital formats require very accurate timing reproduction of the digital data waveform edges to the transmitter. To guarantee accuracy, the terminal must be located in close proximity to the digital transmitter (50 feet) or can be remotely located if modems are used to drive long-distance cabling. For short direct connection, it is recommended that shielded coax with a DC resistance of less than 100 ohms be connected to P1-11 and its shield to P1-12. For long distances, the special paging modems translate data into tone information for paging and send the voice directly for talk time. Typical modem/digital transmitter manufacturers include Quintron and Motorola. The pager manufacturer should be consulted for exact requirements, but in general, NEC D2/D3 formats require 300 baud (or faster) modems, while POCSAG and Motorola GOLAY require 600 baud.

The only other consideration is the polarity of the digital data signal. This can usually be changed by jumper settings in the digital transmitter or by programming command in the DAPT-Jr.

Digital Mode Output

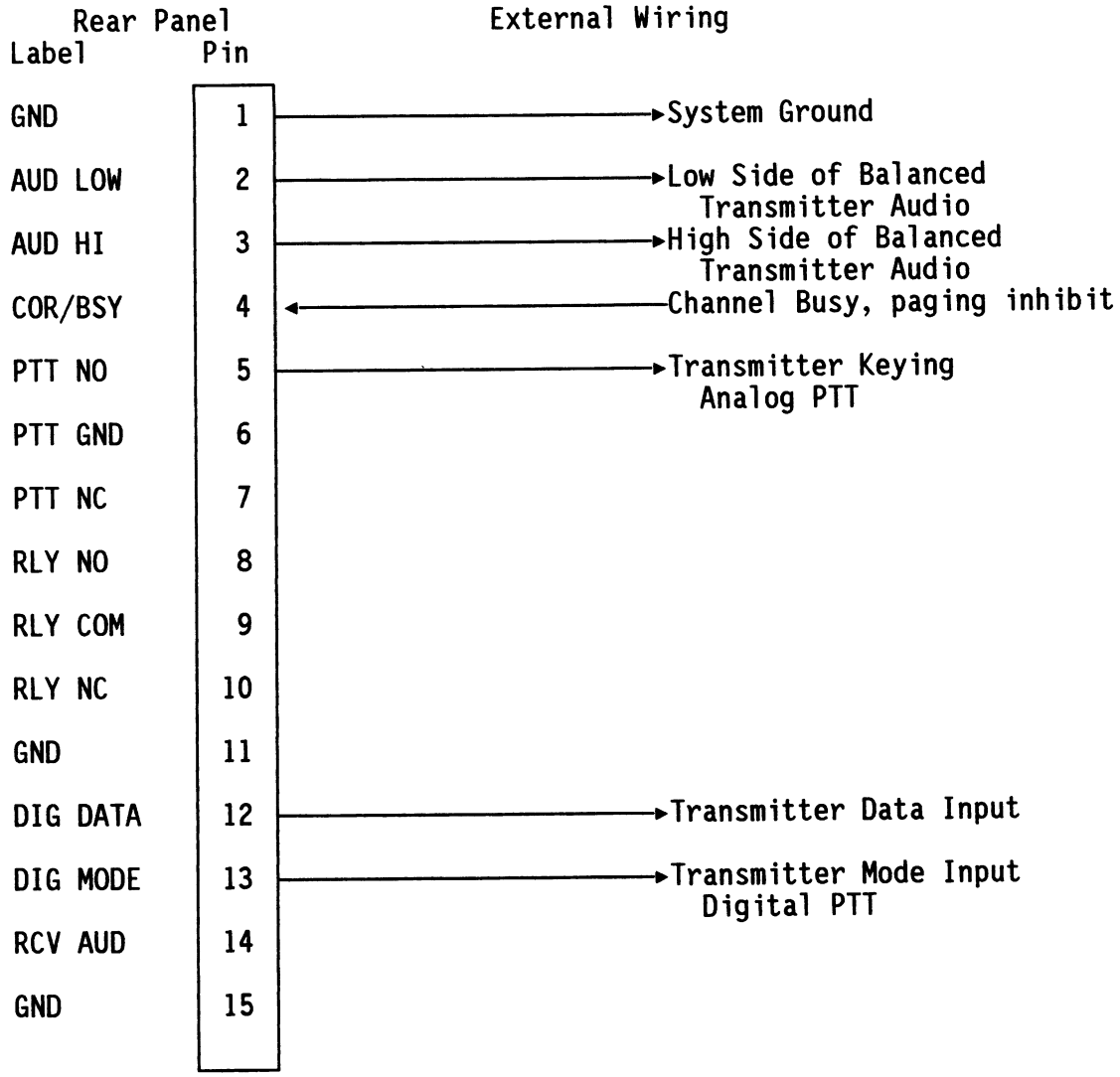
It is necessary to inform the transmitter when to transmit tone/voice audio information or digital data. This is done with the digital mode output on P1-13 from the DAPT-Jr which tells the transmitter whether to be in audio or digital mode. The polarity of this signal is set by jumper JP7.

DIGITAL TRANSMITTER CONNECTION (without Voice or Station ID)

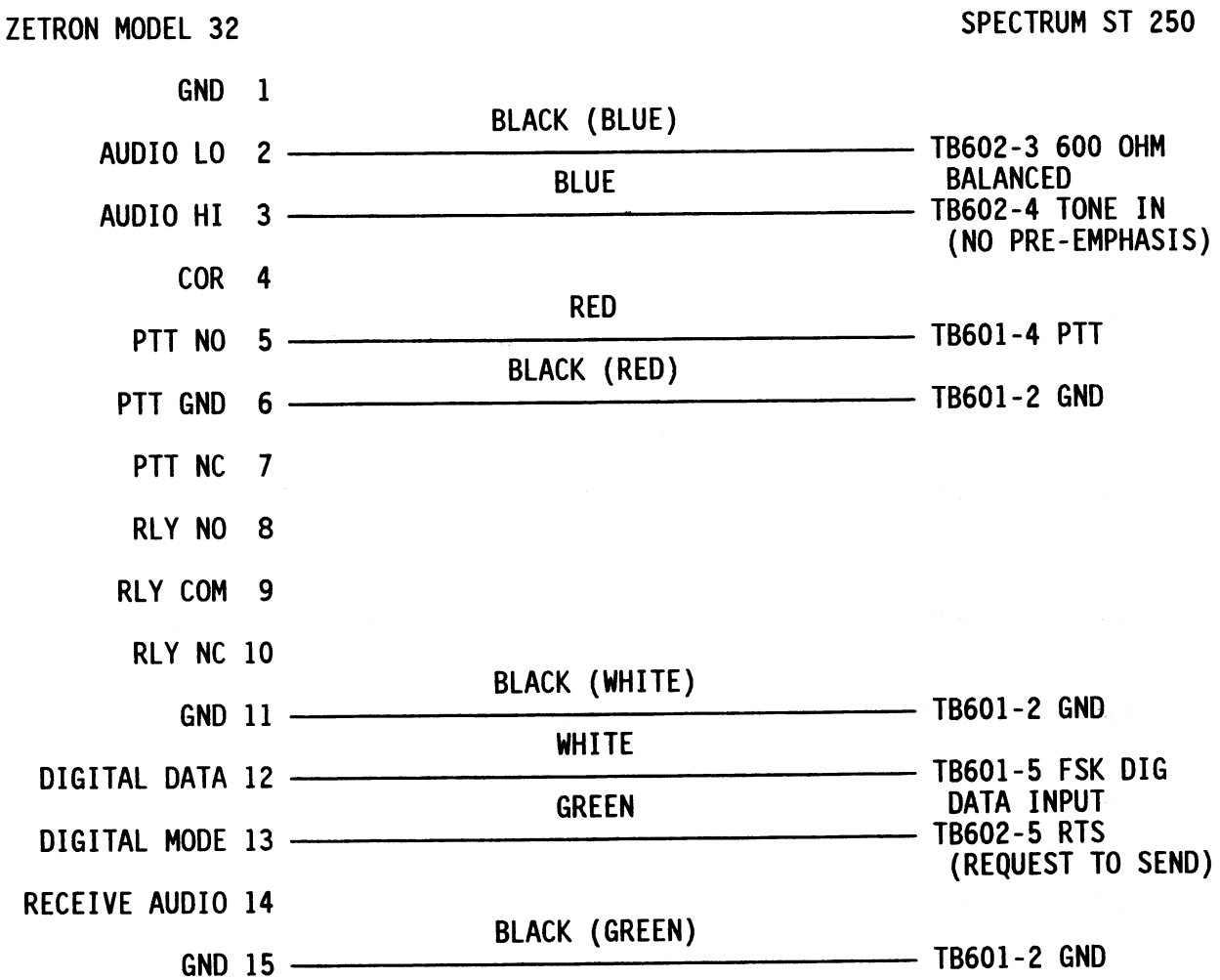


DIGITAL + AUDIO TRANSMITTER CONNECTION

Use the following connection diagram if a single transmitter, capable of both digital and audio transmission is used.



ZETRON MODEL 32 TO SPECTRUM ST 250 WIRING DIAGRAM



JUMPER SETTINGS
- JP1 A POSITION (PTT GND)
- JP3 A POSITION (FLAT TONE AUDIO)
- JP4 B POSITION (DIGITAL MODE POLARITY)
- JP7 B POSITION (PRE-EMPHASIS VOICE AUDIO)

ADJUSTMENTS
- R59 ADJUST TONE LEVEL (±3 kHZ CARRIER)
- R51 ADJUST VOICE LEVEL (±3 kHZ CARRIER)
- R19 1/2 WAY DIGITAL LEVEL (±4.5 kHZ CARRIER)

JUMPER SETTINGS

There are user-configurable jumpers on the circuit board. The default settings in position 'A' usually suffice in most installations. At times, the DAPT-Jr requires special radio or phone interfacing. Check each jumper setting in your terminal and set them as required, using the information in the following table.

Jumper	Label	Location	Position/Meaning	Factory Setting
JP1	+10V	Relay K1	Present=+10V power alive Absent= +10V power off	Present
JP2	DC PWR	Relay K1	A= AC wall transformer B= DC power source to DAPT	A
JP3	+5V	Relay K1	Present=+5V power alive Absent= +5V power off	Present
JP4	PTT	Relay K2	A= Relay connects to GND for TX Push-to-Talk (PTT) B= Relay closure for TX PTT	A
JP5	ATTEN	Relay K2	A= 0.1 to 1V ACrms Receive Audio B= 20dB pad down	A
JP6	DE-EMP	Xfrmr T1	A= Flat Tone Audio output B= -6dB/octave de-emphasis	A
JP7	MODE	Xtal Y1	A= Digital mode LO=Digital B= HI=Digital	A
JP8	COR	Xtal Y1	A= COR/BSY input from relay or open collector (gnd/open) B= COR/BSY input from active drive such as discriminator	A
JP9	COR POL	Xtal Y1	A= COR/BSY input LO/GND=Busy B= COR/BSY input HI/OPEN=Busy	A
JP10	PRE-EMP	Xfrmr T3	A= Flat Voice Audio output B= +6dB/octave pre-emphasis	A
JP11	PROG	IC U24	A= Allows program memory changes B= Prevents programming	A
JP12	2K 8K	IC U24	A= U23 is 2K capacity B= U23 is 8K capacity	A
MATRIX II		Xfrmr T3	DID= Telco is DID/PBX Loop/Local E&M= Telco is E&M Type I tie-trunk E-E= Telco is End-to-End Phone Line	

Note: When changing the Matrix II setting, remove power from the DAPT-Jr to protect the built-in 48V power supply!

ADJUSTMENTS

With the advanced technology in the DAPT-Jr, only a few hardware adjustments are required following installation. Most other settings are software-based, and are initialized through Programming (see Section 4.). To enter transmit adjustment/test mode, use a test lead to momentarily ground TP5 which is near crystal Y2. This causes the terminal to cycle through tones 1000-Hz, 500-Hz, and 2000-Hz on the audio transformer P1-2 and P1-3, to energize PTT (front panel Xmit light comes on), and to generate a 1000-Hz digital data square-wave on P1-12.

Paging Tone Level
While monitoring the radio channel with a deviation meter or oscilloscope, adjust R61 (near connector P2) marked TONE to obtain a peak deviation of 3 kHz to 5 kHz.

Voice Audio Level
The voice level from the phone line through to the transmitter is adjustable by R53 (near large transformer T3) labeled VOICE. Call into the terminal and page a valid pager number. Make sure that the pager has talk time set 'on' by programming talk code 0 to have 60 seconds or so (#30 000 209 60). Speak during the talk interval after getting a beep from the terminal. While monitoring the radio channel with a deviation meter or oscilloscope, adjust R53 to obtain a peak deviation of 3 kHz to 5 kHz. The tone and voice adjustments are independent of one another.

Digital Data Output
If the terminal is equipped with a digital paging format, the digital output level should be set to obtain proper channel deviation. While in the test mode (TP5 momentarily grounded as above), rear panel signal DIG DATA P1-12 will oscillate at 1 kHz between its high and low voltage limits. (Since the digital output is unipolar and will pull the RF carrier to only one side of center frequency, you may need to readjust the carrier center frequency during this adjustment procedure). While monitoring the radio channel with a deviation meter or oscilloscope, adjust R20 (near small transformer T1) labeled DIGITAL to obtain the desired peak deviation of 4.5 kHz.

The following programming commands set the digital data output polarity:

Digital Data Inverted
000 185 Invert digital paging data output polarity.

Digital Data Normal
000 186 Set digital paging data output polarity normal.
Adjustments of Talkback and Dial Click Options - (see Sections 5. and 6.)

TELCO INSTALLATION (Telco types are described in Section 3.)

The DAPT-Jr can be fully set by the installer for any common telephone interface. The sections below should help you and your telephone expert provide an appropriate telephone connection. Engineers at Zetron are available to help you through the telephone process.

End-to-End Connection
A cable is supplied with modular RJ11-C connectors on each end for easy installation. If it is necessary to wire into screw terminals, this cable can be stripped to provide copper conductor wires. You need just the red and green wires (tip and ring) to connect to the Telco line. The polarity of the wires is not important.

Selector Level (DID) Connection
Used in RCC and PCP applications, the direct-inward-dial (DID) service from the telephone company can be 2-, 3-, or 4-digit feed. You must order your telephone line to be Loop Start, Immediate Dial, with the number of feed digits agreeing with your DAPT order. Your terminal was built to match with reception for 2 or 3 digits (see Order Sheet in back of this manual) for 100-call or 1000-call, respectively. The terminal ignores the first digit if 4-digit is specified.

For direct connection to the Telco line, use the supplied cable with RJ11-C connectors. If it is necessary to wire into screw terminals at the Telco end, strip one end and use just the red and green wires (tip and ring) to connect to the Telco line. The polarity of the wires is important so the Telco knows when the DAPT answers an incoming call. If callers are getting cut off, the wires are probably backward; just reverse them.

PBX E&M Tie-Trunk Connection

Connection to a PBX may be made to the terminal through either an end-to-end station extension, loop trunk, or an E&M Type I tie-trunk. End-to-end and loop trunks are described above; tie-trunk is described here. Tie-trunk connection is the preferred method of interfacing a paging terminal to an in-plant private phone system. By dialing a short access code, any phone caller quickly accesses the DAPT, rather than dialing a long extension number. The E&M Type I tie-trunk cabling requires 5 wires (shown below).

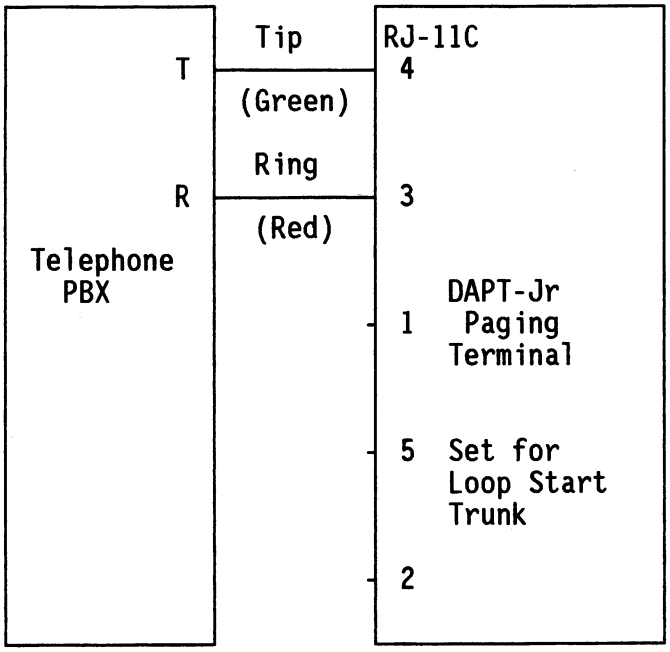
PBX trunk service generally provides access from any type of on-premise phone, rotary, DTMF, or electronic; the caller doesn't require a DTMF phone as in end-to-end overdialing. In addition, the terminal is able to detect when the caller disconnects to speed through the call processing. The E&M Type I tie-trunk has the additional advantage of supporting mobile to landline calling compared to PBX loop start trunks.

A brief description of tie-trunk accessed paging on a PBX is appropriate at this point. A caller dials a short access code (similar to accessing an outside line) to obtain radio paging. If the PBX is "Senderized", the caller may dial the pager code immediately following the access code. A senderized PBX can store the caller's dialed digits and independently place the phone call to a calling party. This store-and-forward the digits makes work easy for the caller. If the PBX is not senderized, then it repeats the dialed digits to the terminal as the caller enters them. On a non-senderized PBX, the caller must dial the paging access code and wait for the PBX to cut through to the terminal, the terminal to answer, and the terminal to send a single beep to the caller. Then the caller may enter the pager code. Ask your telephone expert which type of trunk you are using (describe the sequence of events above if they don't recognize the term 'senderized'), then instruct your callers as to how to use the system.

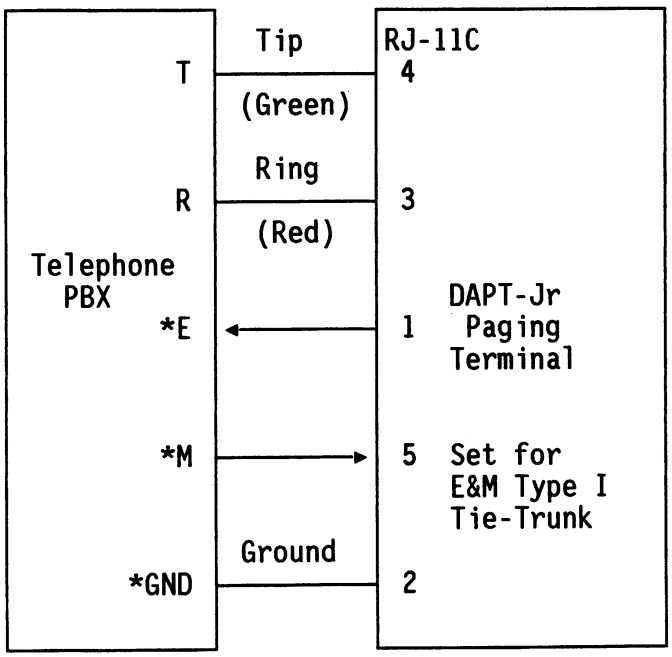
The following chart will assist you in interfacing the DAPT-Jr to the PBX for trunk access:

PBX Brand and Type	PBX Card and Straps	DAPT-Jr Settings	Supported Features
Northern Telecom SL-1	QPC-71 E&M	E&M Type I 5-wire	Calling Party Disconnect Mobile to Landline Calling
Rolm CBX	M/N-8557	Loop Start 2-wire	Calling Party Disconnect No mobile to landline
Bell Centrex		Loop Start 2-wire	Calling Party Disconnect No mobile to landline
Bell Centrex		E&M Type I 5-wire	Calling Party Disconnect Mobile to Landline Calling

PBX LOOP START TRUNK CONNECTION DIAGRAM



PBX E&M TIE-TRUNK CONNECTION



8. THEORY OF OPERATION

BASIC FUNCTIONAL DESCRIPTION

The DAPT-Jr terminal is a microprocessor system with software intensive architecture that greatly reduces the cost of dial-access paging compared to older technologies. The microprocessor controls all internal operations in accordance with a control program stored in programmable read-only memory (ROM). When the terminal is idle, the microprocessor continually scans the phone line for ringing (end-end) or loop current (selector level). Upon detecting the landline call, the microprocessor closes the trunk connect relay, thereby going off-hook and drawing loop current through the Telco circuit to signal the central office (or PABX) that the call has been answered. With the trunk card online, the processor connects Telco audio through to the internal bidirectional audio bus.

Following audio connection, the microprocessor gates a beep from the progress tone generation circuitry to the caller. The DTMF/dial pulse decoder, is enabled to receive and decode the overdialed pager number digit key entries and convert them into four-bit words. (On selector-level telephone trunks, the pager number is loop-current pulsed into the terminal and no overdialing is necessary). After receiving the full pager number entry, the processor does any pager validation and substitution required, then looks up the signaling format which is stored in the internal EPROMs. As the call progresses, ring-back tones, beeps, and busy tones are sent back out over the audio bus and trunk card to the calling party from progress tone generator (U15, U11, U12, U13, U8).

MICROPROCESSOR CONTROL

Power-on reset is generated by power-supply voltage detector CR18/CR19/Q12 and 100 msec delay R70/C43 feeding into CMOS Schmitt-input gate U16. Operating software for the microcomputer is stored in a read-only memory chip (PROM) U24. A long-life nonvolatile CMOS random access memory (RAM) U23, provides storage for programmable options. A jumper-enabled write protect JP11 prevents any alterations to the RAM for extreme security. The RAM's own built-in battery is good for 5 to 7 years.

The front-panel indicators RING, LINE, and XMIT are driven directly by hardware circuitry. The decimal point on the left-hand display digit serves as a +5V power indicator. The 3-digit display is controlled by microprocessor U18 via shift registers U19/U20/U21 and blanking Darlington transistor Q13.

TONE GENERATION

To accommodate all tone signaling formats, a programmable tone generator formed from timer U15 and filter U14 generates precise frequencies and timing under control of the microprocessor. A tone mute U13 provides precise zero-crossing tone frequency changes without output clicks. Tone level is set by R16.

VOICE MESSAGES

Voice from the landline party to pagers is carried from the telco circuitry through the audio bus to voice gate U9. When U9 is enabled, the voice is amplified by U8/R53 and summed via R54 into final amp U3. The voice may be pre-emphasized (+6dB/octave beginning at about 500 Hz) by setting JP10 to 'B'.

TRANSMITTER INTERFACE

Transformer-coupled output T1 provides 600-ohm balanced audio. This type of output configuration is impedance matched to directly drive leased Telco lines or local cabling without significant high-frequency loss. Audio output buffering to T1 is provided by U3 amplifier driving emitter follower Q4. For connection to transmitter mike inputs with pre-emphasized audio, jumper JP6 set to position 'B' de-emphasizes the audio (-6dB/octave beginning at about 200 Hz).

The Push-to-Talk Output is provided by DPDT relay closure on K2, with contact protection by series R/C networks C5/R2 and C6/R3. Jumper JP4 grounds the center contact of K2 for ground to PTT signaling on the PTT NO output.

The COR/BSY input is level-shifted by Q9/Q10 to an internal TTL signal, polarity selected by JP9, and fed into the microprocessor through VIA U10. Just before paging, the processor looks at this input to determine if paging is allowed. If not, it periodically samples the signal until the channel is free or a timeout occurs.

DIGITAL PAGING

Waveforms and timing for binary digital paging are provided from output bit 5 of U10 port B. Software does the complex formatting and timing using timer #1 from U15 to generate a 0-5V TTL switching waveform which is level and amplitude shifted by R20/U3. The final output is RF filtered and slew rate limited by C4 and pulled to ground by a 330-ohm resistor at output P1-12.

A separate output on the rear panel, P1-13, provides digital push-to-talk (paging mode) via Q6/Q7/R10, protected by CR2, and slew rate limited by C5. This mode signal tells the transmitter when to send digital data from P1-12 versus audio from P1-2/3. The mode polarity is selected by JP7.

TELCO INTERFACE

Modular circuit blocks in the telephone interface are interconnected with a Matrix II daughter board to select 2-wire DID Loop, End-to-End, or E&M trunk interfacing. The circuit blocks are a 35mA current-limiting 48V switching supply U7/T2/CR13/C14/U6 with 55V protection diode CR8, a loop current detector U1/CR9-12/Q1/Q2, answer relay K1/Q5, and audio coupling T3/C25. Lightning protection against Telco transients is provided by RV1/RV2.

DID SETTING

In the 2-wire DID Loop setting of Matrix II, the Telco tip and ring leads carry audio and 48V battery, while leads E, M, and GND are not used. The battery is supplied through relay K1 which selects the battery polarity. Audio coupling capacitor C16 in the 48V power supply is low impedance to AC audio signals, thereby giving good audio coupling level. The loop current detector is placed in series with the positive side of the 48V supply and thereby in series with the phone line.

E&M SETTING

With E&M Type I tie-trunks, Tip and Ring just carry audio, and the E, M, and GND leads serve for call supervision. The 48V battery is not used, and a common ground between the PBX and terminal is required. The PBX provides an M-lead which switches between -48V and open circuit. An incoming call on the M-lead draws current through the loop current detector from the return GND lead. The terminal uses K1 in an SPST function to answer the trunk on the E-lead with a closure to GND (not answered is open circuit on E). The split winding of T1 is shorted by the Matrix for audio coupling.

END-TO-END SETTING

In the End-to-End setting of Matrix II, neither the 48V supply nor the loop current detector are used. Only tip and ring Telco wires carry audio and loop current. The split secondary of the transformer is connected by a 150-ohm 2-watt resistor mounted on the Matrix II to carry loop current.

The end-to-end ring detector is always connected across tip-ring regardless of the Matrix II setting. When ringing occurs, AC coupling capacitor C23 and current limiting R30/R31 drive opto-isolator U4. The current flow in the output side of U1 charges C30 through R32. The DC voltage on C4 switches the output of Schmitt gate U16, and provides a logic '0' (ground) to the VIA U10 bit 0 of port B.

DIAL CLICK DETECTOR CARD (702-9010)

This card processes the audio on the terminal's central audio bus on P2 pin 5 and produces a digital logic '1' on P2 pin 6 for each click of audio. The audio passes through a four-pole Chebychev low pass filter U1A with 3dB point of 300 Hz to remove any speech and to increase the noise immunity of the subsequent stages. A variable gain amplifier U1B followed by an AGC amplifier U2 increases the signal amplitude so that all peaks are amplified to a constant level. This amplifier tracks amplitude changes with a 10 msec attack and slow 0.5 sec decay.

The signal is buffered by U3A and passes to two peak detectors U3B and U4A, to catch both the positive and negative peaks onto holding capacitor C12 with 0.1 second decay time. A 100-Hz low pass filter U5A sets up the signal for detection by adjustable hysteresis comparator U5B. The comparator output drives detector lamp DS1 via Q2, and drives the signal output P2 pin 6 via open collector inverter Q3.

TALKBACK INTERFACE

Receiver audio comes in via rear connector pin P1-14 with respect to system ground. The audio is high pass filtered by C8/R16-18 (340 Hz), attenuated by jumper JP5 (-20dB in position 'B'), and amplified (6dB) and low-pass filtered (6000 Hz) by U2/C9. Note that a common ground from the receiver reduces 60-Hz hum on the audio circuit by using twisted pair cabling to P1-14 and P1-15. The audio goes through mute U9 to adjustable gain via amplifier U2/R24 (0 to 14dB) then onto the audio bus via impedance matching R23 and DC blocking C18.

POWER SUPPLY

An external 9V AC or 12V DC power source will operate the terminal. The connection is to rear panel jack J1, then through internal slo-blo fuse F1 to a full wave bridge CR4-CR7. Varistor RV3 and high-voltage capacitors C12/C13 help to reduce transients from the power line. The bridge output provides approximately 10V unregulated DC to the board via jumper JP1. Large filter capacitor C7 reduces ripple and feeds the +5V three-terminal regulator VR1. The 5V output is filtered by C15/C2 and feeds the board via jumper JP3. The rear panel of the terminal acts as a heat sink for VR1.

If a DC power source is used to power the DAPT-Jr, connect '+' to the center of J1 and '-' to the outside ring. Also move JP2 to the B position to convert the full-wave bridge into a simple rectifier, CR5, and to remove CR6 from the ground path.

The 48V power needed to power DID loop start lines is built into every DAPT-Jr. This supply can power a local telephone for on-site programming without requiring two telephone lines. This supply takes the common ground +10V and converts it to a floating 48V. Current limiting is factory set by R28 to be 35mA through a shorted tip-ring phone pair.

9. REPAIR

Continued....

9. REPAIR
(cont'd)

SELF-TEST

By design, the DAPT-Jr is software-intensive and has a minimum of components that can fail. The built-in self-test, which is automatically run when the terminal is powered-on, checks the display, internal digital circuitry (microprocessor and memories), and displays the results in the front-panel display window.

Display	Meaning
CLr	Program Memory Reinitialized to factory settings (prior contents lost)
---	Normal Completion
U23	Failure of Program Memory U23
U18	Failure of Microprocessor U18
055	Partial Loss of Program Memory Contents (program memory should be reinitialized by operator)

DISPLAY TEST

Every time the terminal powers up, it will scroll the message 'dAPt-Jr' through the display, followed by the software configuration, and then flash the XMIT and LINE lights.

If no display appears, check the front panel decimal points. If no decimal points are lit, check the internal fuse. If something lights at random, use a voltmeter to check various points in the power supply (+5, +10) marked near their respective jumpers.

FAULT IDENTIFICATION

Listed below are some possible problems and causes that may assist in troubleshooting faults:

Problem	Possible Causes(s)
No answer or problem on one line, but other lines OK.	Phone Circuitry, Phone Line
No answer, but RING light works.	U10, U15, U22, U25, U17, U26
Continuous beeping, then disconnect.	U23, U18 Fatal Failure
Three beeps before paging, instead of single beep.	U23

No DTMF generated by telephone during local programming.	1. Telephone is not equipped with polarity guard: DTMF disabled by terminal battery reversal 2. Some electronic telephones will not send DTMF indefinitely.
RING light works, LINE lights, but no answer audio click (end-to-end line only).	U10, U9, Q5, K1, MATRIX II
RING light works, LINE lights, but no answer beep (end-to-end line only).	U15, U11, U12, U13, U8, MATRIX II
LINE not flashing correctly for pulsed digits (selector trunk).	48V power supply, CR9, CR10, CR11, CR12, U1, MATRIX II
LINE flashes pulsed digits, but wrong digits on front panel (selector trunk only).	Tip-Ring reversed, MATRIX II
Answer beep, key in pager number, but PAGER CODE wrong (end-to-end line only).	U9, U5, Y1, C27, Q8, U10, U17, Dial Click Board
When time to page, terminal sends busy instead of ring-back.	Pager Number is Invalid
Answer beep, key in pager number, terminal ring-back, but no XMIT light and no tones.	U10, U15
Answer beep, key in pager number, terminal ring-back, XMIT light, but no tones.	U10, U15, U14, U13, U3, Q4, T1, associated components
No ring-back during paging.	U11, U12, U13, U8
No progress tones when expected.	U11, U12, U13, U8, U15 associated components
Wrong paging tones for keyed in pager number.	Pager # is substituted, Wrong tones programmed
1000-Hz test tone off frequency	Crystal Y1 off-frequency
Some pagers work, others do not.	Pager # is substituted, Pager # is invalidated, Transmitter is pre-emphasizing audio
Odd-numbered 5-Tone pagers do not work.	Dual Address format programmed

Second function of 5-Tone pagers does not work.	Single Address format programmed
XMIT light works, paging tones at back panel, but transmitter not keyed.	Keying circuit wiring, K2 relay
Display not responding to dial clicks (dial click card in).	Maladjustment of dial click board (see Section 6)
Distorted background receiver audio from Talkback Card.	Too much audio into Talkback Card. Adjustment required or ATTEN JP5 should be moved to B
Talkback not responding to mobile activity.	COR/BSY polarity wrong, change jumper JP9 panel CH1/2 BSY input.
Difficult for mobiles to perform '*' connect and '#' disconnect.	Audio through base station to main audio bus requires adjustment. See Section 5. on Talkback Adjustment

TRANSMITTER PRE-EMPHASIS

Some radio transmitters provide a one-pole high-pass filter to emphasize audio signals at +6dB/octave beginning at 200 Hz. This pre-emphasis, intended for voice, causes paging tones to be transmitted with increasing FM modulation as the frequency of the tones rises. This non-flat transmission can result in some pagers not being alerted since their FM front-end circuitry saturates, and other pagers not being alerted because there is not enough FM modulation. To solve this problem, move jumper JP6 to position 'B' to de-emphasize the paging tones. To bring the voice up flat again, move JP10 to position 'B'.

MODEL 32 100 CALL TONE PARTS LIST (901-9039E)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.
1.	1	025-9040	MODEL 32 MANUAL	
2.	1	210-0001	#4 KEPT NUT	PCB (VR1)
2.5	1	220-0100	#440x9/16 SCREW	PCB (VR1)
3.	9	220-0107	#440x3/16 SCREW	PCB/TOP COVER
4.	5	220-0108	#440x1/4 SCREW	FRONT/BACK PANEL
4.5	1	250-0105	#440x5/8 W/STUD	DIAL CLICK PCB
5.	1	250-3125	#440x5/16 SPACER	PCB
6.	1	321-6116	2Kx8 CMOS RAM	U23
7.	1	322-7128	16Kx8 400NS EPROM	U24
8.	1	401-0058	15-POS R/A PLUG	
9.				
10.	1	415-9189	RED LENS	FRONT PANEL
11.	1	415-9139-1	TOP COVER	
12.	1	415-9140-1	BOTTOM COVER	
13.	1	415-9141-1	FRONT PANEL	
14.	1	415-9142-1	BACK PANEL	
15.	1	415-9643	ZETRON HOLOGRAM LABEL	NOTE 7
16.	1	415-9669	DECAL, PART 68 FCC/PN/SN	BOTTOM COVER
17.	1	416-1213	28-PIN SKT W/BATT	U23
18.	4	431-0005	FOOT	BOTTOM COVER
19.	1	449-9000	SHIPPING CARTON	
20.	A/R	561-0001	SILICON GREASE	BACK PANEL
21.	A/R	561-0003	CONTACT CEMENT	FOOT
22.	1	601-0055	SOFTWARE	
23.	1	702-9064	MODEL 32 PCB	
24.	1	709-7000	14' TELCO CORD	

MODEL 32 1000 CALL TONE PARTS LIST (901-9042E)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.
1.	1	025-9040	MODEL 32 MANUAL	
2.	1	210-0001	#4 KEPT NUT	PCB (VR1)
3.	1	220-0100	#440x9/16 SCREW	PCB (VR1)
4.	9	220-0107	#440x3/16 SCREW	PCB/TOP COVER
5.	5	220-0108	#440x1/4 SCREW	FRONT/BACK PANEL/PCB
6.	1	250-0105	#440x5/8L W/STUD	DIAL CLICK PCB
7.	1	250-3125	#440x5/16 SPACER	PCB
8.	1	321-6264	8K X 8 CMOS RAM (U23)	
9.	1	322-7128	16K X 8 EPROM (U24)	
10.	1	401-0058	15-POS R/A PLUG	
11.				
12.	1	415-9189	RED LENS	FRONT PANEL
13.	1	415-9139-1	TOP COVER	
14.	1	415-9140-1	BOTTOM COVER	
15.	1	415-9141-1	FRONT PANEL	
16.	1	415-9142-1	BACK PANEL	
17.	1	415-9643	ZETRON HOLOGRAM LABEL	NOTE 7
18.	1	415-9669	DECAL, PART 68 FCC/PN/SN	BOTTOM COVER
19.	1	416-1213	28-PIN SKT W/BATT (U23)	
20.	4	431-0005	FOOT	BOTTOM COVER
21.	1	449-9000	SHIPPING CARTON	
22.	A/R	561-0001	SILICON GREASE	BACK PANEL
23.	A/R	561-0003	CONTACT CEMENT	LENS
24.	1	601-0056	SOFTWARE	
25.	1	702-9064	M32 PCB	
26.	1	709-7000	14' TELCO CORD	

MODEL 32 DAPT-JR PARTS LIST (702-9064D,E)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
1.	1	101-0013	2.2 OHM 1/4W	R26	
2.	2	101-0033	22 OHM 1/4W	R21 42	
3.	3	101-0047	47 OHM 1/4W	R2 3 15	
4.	1	101-0049	100 OHM 1/4W	R27	
5.	1	101-0057	220 OHM 1/4W	R13	
6.	1	101-0061	330 OHM 1/4W	R1	
	1	101-0047	470 OHM 1/4W	R66 (REV E)	
7.	5	101-0066	510 OHM 1/4W	R4 10 77-79	
8.	1	101-0067	560 OHM 1/4W	R19	
9.	1	101-0069	680 OHM 1/4W	R50	
10.	2	101-0073	1K 1/4W	R23 80	
11.	1	101-0075	1.5K 1/4W	R5	
12.	1	101-0081	2.2K 1/4W	R55	
13.	9	101-0085	3.3K 1/4W	R7 14 32 46-48 60 75 76	
14.	4	101-0089	4.7K 1/4W	R17 30 31 54	
15.	25	101-0097	10K 1/4W	R6 9 11 22 29 33-36 40 43 44 45 52 57 59 62-64 67 69 71-74	
16.	3	101-0101	15K 1/4W	R38 39 58	
17.	2	101-0106	24K 1/4W	R25 51	
18.	5	101-0113	47K 1/4W	R8 16 18 37 (R66 REV D)	
19.	4	101-0121	100K 1/4W	R12 49 68 70	
20.	1	101-0145	1M 1/4W	R41	
21.	2	105-0001	VARISTOR	RV1 2	
22.	1	105-0002	VARISTOR	RV3	
23.	1	107-0500	500 OHM POT	R28	
24.	3	107-0502	50K POT	R24 53 61	
25.	1	107-3085	10K POT	R20	
26.	2	119-0008	10K X 7 R-PAK	RP1 2	
27.	2	150-0024	24PF DISC	C45 46	
28.	7	150-0096	1000PF 1KV DISC	C3-6 12 13 24	
29.	15	150-0110	.01µF DISC	C1 2 10 11 21 29 34 35 38 42 44 48 49 51 52	
30.	1	151-0020	.001µF TS	C19	
31.	1	151-0027	270PF TS	C9	
32.	1	151-0090	.0033µF TS	C55	
33.	3	151-0120	.01µF TS	C8 32 54	
34.	2	151-0130	.047µF TS	C20 33	
35.	3	151-0180	.1µF TS	C17 36 41	
36.	3	151-0199	.47µF TS	C37 39 43	
37.	1	151-0047	470PF TS	C22	
38.	1	152-0021	.47µF/250V POLY	C23	
39.	5	154-0100	10µF/16V TANT	C26 28 40 50 56	
40.	8	155-0050	10µF/25V ALUM	C15 18 25 27 30 31 47 53	
41.	2	155-0051	10µF/100V ALUM	C14 16	
42.	1	155-0141	3300µF/16V ALUM	C7	
43.	1	251-0101	SWAGE 1/4"L	XVR1	350-7423-1

MODEL 32 DAPT-JR PARTS LIST (702-9064D,E) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
44.	1	305-0003	AUDIO XFMR 600	T1	42TM016
45.	5	305-0007	FERRITE BEAD	E1-5	
46.	1	305-0012	TRANSFORMER	T2	
47.	1	305-2600	600:600 OHM AUD	T3	
48.	3	311-0008	OPTO-ISOLATOR	U1 4 6	4N26
49.	2	311-0030	DUAL 7-SEG DIS	DS1 2	
50.	1	314-4138	1 OF 8 DECODER	U22	74LS138
51.	1	314-7402	QUAD 2 INPT NOR	U17	74LS02
52.	1	314-7404	HEX INVERTER	U25	74LS04
53.	1	316-0004	TONE FILTER	U14	MF4CN-50
54.	2	316-0082	BIFET OP-AMP	U2 8	LF353
55.	1	316-0358	DUAL OP-AMP	U3	LM358
56.	1	316-7805	5V REGULATOR	VR1	LM340T-5
57.	1	316-7840	REGULATOR 5W	U7	78S40
58.	1	321-0202	DTMF DECODER	U5	SS1202P
59.	1	321-6522	VIA/TIMER	U10	R6522
60.	1	321-6802	MICROPROCESSOR	U18	MC6802P
61.	1	321-6840	PTM	U15	MC6840P
62.	3	323-4015	DUAL 4 BIT REG	U19-21	MC14015B
63.	1	323-4040	BINARY COUNTER	U11	MC14040
64.	2	323-4066	QUAD ANALOG SW	U9 13	MC14066
65.	1	323-4073	TRIPLE AND	U12	MC14073
66.	1	323-4093	QUAD NAND SCHM	U16	MC14093
67.	1	324-7400	QUAD NAND	U26	MC74HC00
68.	3	340-0014	NPN DARLINGTON	Q3 5 13	MPSA14
69.	8	340-3904	NPN	Q1 2 4 6 7 9 10 12	2N3904
70.	4	342-0001	SILICON	CR4-7	1N4002
71.	3	342-3008	GERMANIUM	CR22-24	1N100
72.	6	342-3009	SILICON	CR1-3 19-21	1N4148
73.	5	342-3011	SILICON 1A 1000V	CR9-12 16	1N4007
74.	1	342-4935	SIL FAST 200V	CR13	1N4935
75.	2	343-3029	1W 5.1V ±5%	CR15 25	1N4733A
76.	1	343-3030	1W 6.2V ±5%	CR18	1N4735A
77.	1	343-3108	1W 15V ±5%	CR17	1N4744A
78.	1	343-3113	1W 47V ±10%	CR14	1N4756
79.	1	343-3115	1W 56V ±10%	CR8	1N4758
80.	1	376-0004	XTAL 4.000 MHZ	Y2	
81.	1	376-0358	XTAL 3.58 MHZ	Y1	
82.	2	380-0030	RELAY DPDT	K1 2	
83.	1	401-0013	POWER JACK	J1	
84.	40	401-0052	STAKE PINS	TP1-5 (1EA) XJP3 (2EA) XJP2 4-13 (3EA)	
85.	1	401-0059	15-PIN RA PINS	P1	
86.	1	401-6005	CONN MOLEX 6F	P2	
87.	1	401-7000	TELCO CONN	J2	
88.	12	402-3040	MINI-JUMPER	JP3 IN JP2 4-13 POS A	
89.	2	407-0006	06 PIN DIP SKT	XU1 6	

MODEL 32 DAPT-JR PARTS LIST (702-9064D,E) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
90.	4	407-0008	08 PIN DIP SKT	XU2 3 8 14	
91.	7	407-0014	14 PIN DIP SKT	XU9 12 13 16 17 25 26	
92.	6	407-0016	16 PIN DIP SKT	XU7 11 19-22	
93.	1	407-0018	18 PIN DIP SKT	XU5	
94.	3	407-0028	28 PIN DIP SKT	XU15 23 24	
95.	2	407-0040	40 PIN DIP SKT	XU10 18	
96.	2	407-0108	08 PIN SIP SKT	MATRIX	
97.	1	407-0140	40 PIN SKT RA	XDS1 2	
98.	3.75"	408-0001	24 GA BARE WIRE	XE1-5	
99.	1	410-9064B	PCB, BARE		
100.	1	416-1577	FUSE AGC 1.0A SB	F1	
101.	2	416-3040	FUSE CLIP	XF1	
102.	1	702-9065	MATRIX II PCB		

MODEL 32 DAPT-JR PARTS LIST (702-9064C)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
1.	1	101-0013	2.2 OHM 1/4W	R26	
2.	2	101-0033	22 OHM 1/4W	R21 42	
3.	3	101-0047	47 OHM 1/4W	R2 3 15	
4.	1	101-0049	100 OHM 1/4W	R27	
5.	1	101-0057	220 OHM 1/4W	R13	
6.	1	101-0061	330 OHM 1/4W	R1	
7.	5	101-0066	510 OHM 1/4W	R4 10 77-79	
7.5	1	101-0067	560 OHM 1/4W	RX3	
8.	1	101-0069	680 OHM 1/4W	R50	
9.	3	101-0073	1K 1/4W	R23 38 80	
10.	1	101-0075	1.5K 1/4W	R5	
11.	2	101-0081	2.2K 1/4W	R9 55	
12.	10	101-0085	3.3K 1/4W	R7 14 32 45-48 60 75 76	
13.	4	101-0089	4.7K 1/4W	R17 30 31 54	
14.	27	101-0097	10K 1/4W	R6 11 22 29 33-37 39 40 43 44 52 57 59 62-65 67 69 71-74 X1	
15.	1	101-0101	15K 1/4W	R58	
16.	1	101-0105	22K 1/4W	RX2	
17.	2	101-0106	24K 1/4W	R25 51	
18.	5	101-0113	47K 1/4W	R8 16 18 19 66	
19.	4	101-0121	100K 1/4W	R12 49 68 70	
20.	1	101-0145	1M 1/4W	R41	
21.	2	105-0001	VARISTOR	RV1 2	
22.	1	105-0002	VARISTOR	RV3	
23.	1	107-0500	500 OHM POT	R28	
24.	3	107-0502	50K POT	R24 53 61	
25.	1	107-3085	10K POT	R20	
26.	2	119-0008	10K X 7 R-PAK	RP1 2	
27.	2	150-0024	24PF DISC	C45 46	
28.	7	150-0096	1000PF 1KV DISC	C3-6 12 13 24	
29.	15	150-0110	.01µF DISC	C1 2 10 11 21 29 34 35 38 42 44 48 49 51 52	
30.	1	151-0020	.001µF TS	C19	
31.	1	151-0027	270PF TS	C9	
32.	3	151-0120	.01µF TS	C8 32 X2	
33.	2	151-0130	.047µF TS	C20 33	
34.	5	151-0180	.1µF TS	C17 27 36 40 41	
35.	3	151-0199	.47µF TS	C37 39 43	
36.	1	151-0047	470PF TS	C22	
37.	1	152-0021	.47µF/250V POLY	C23	
38.	3	154-0100	10µF/16V TANT	C26 28 50	
39.	7	155-0050	10µF/25V ALUM	C15 18 25 30 31 47 X1	
40.	2	155-0051	10µF/100V ALUM	C14 16	
41.	1	155-0141	3300µF/16V ALUM	C7	
42.	1	305-0003	AUDIO XFMR 600	T1	42TM016
43.	5	305-0007	FERRITE BEAD	E1-5	

MODEL 32 DAPT-JR PARTS LIST (702-9064C) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
44.	1	305-0012	TRANSFORMER	T2	
45.	1	305-2600	600:600 OHM AUD	T3	
46.	3	311-0008	OPTO-ISOLATOR	U1 4 6	4N26
47.	2	311-0030	DUAL 7-SEG DIS	DS1 2	
48.	1	314-4138	1 OF 8 DECODER	U22	74LS138
49.	1	314-7402	QUAD 2 INPT NOR	U17	74LS02
50.	1	314-7404	HEX INVERTER	U25	74LS04
51.	1	316-0004	TONE FILTER	U14	MF4CN-50
52.	2	316-0082	BIFET OP-AMP	U2 8	LF353
53.	1	316-0358	DUAL OP-AMP	U3	LM358
54.	1	316-7805	5V REGULATOR	VR1	LM340T-5
55.	1	316-7840	REGULATOR 5W	U7	78S40
56.	1	321-0202	DTMF DECODER	U5	SS1202P
57.	1	321-6522	VIA/TIMER	U10	R6522
58.	1	321-6802	MICROPROCESSOR	U18	MC6802P
59.	1	321-6840	PTM	U15	MC6840P
60.	3	323-4015	DUAL 4 BIT REG	U19-21	MC14015B
61.	1	323-4040	BINARY COUNTER	U11	MC14040
62.	2	323-4066	QUAD ANALOG SW	U9 13	MC14066
63.	1	323-4073	TRIPLE AND	U12	MC14073
64.	1	323-4093	QUAD NAND SCHM	U16	MC14093
65.	1	324-7420	GATE	U26	74HC20
66.	3	340-0014	NPN DARLINGTON	Q3 5 13	MPSA14
67.	10	340-3904	NPN	Q1 2 4 6-12	2N3904
68.	4	342-0001	SILICON	CR4-7	1N4002
69.	3	342-3008	GERMANIUM	CR22-24	1N100
70.	6	342-3009	SILICON	CR1-3 19-21	1N4148
71.	5	342-3011	SILICON 1A 1000V	CR9-12 16	1N4007
72.	1	342-4935	SIL FAST 200V	CR13	1N4935
73.	2	343-3029	1W 5.1V ±5%	CR15 X1	1N4733A
74.	1	343-3030	1W 6.2V ±5%	CR18	1N4735A
75.	1	343-3108	1W 15V ±5%	CR17	1N4744A
76.	1	343-3113	1W 47V ±10%	CR14	1N4756
77.	1	343-3115	1W 56V ±10%	CR8	1N4758
78.	1	376-0004	XTAL 4.000 MHZ	Y2	
79.	1	376-0358	XTAL 3.58 MHZ	Y1	
80.	2	380-0030	RELAY DPDT	K1 2	
81.	1	401-0013	POWER JACK	J1	
82.	39	401-0052	STAKE PINS	TP1-5 (1EA) XJP1 3 (2EA) XJP2 4-12 (3EA)	
83.	1	401-0059	15-PIN RA PINS	P1	
84.	1	401-6005	CONN MOLEX 6F	P2	
85.	1	401-7000	TELCO CONN	J2	
86.	12	402-3040	MINI-JUMPER	JP1 3 IN JP2 4-12 POS A	
87.	4	407-0008	08 PIN DIP SKT	XU2 3 8 14	
88.	7	407-0014	14 PIN DIP SKT	XU9 12 13 16 17 25 26	
89.	6	407-0016	16 PIN DIP SKT	XU7 11 19-22	
90.	1	407-0018	18 PIN DIP SKT	XU5	

MODEL 32 DAPT-JR PARTS LIST (702-9064C) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
91.	3	407-0028	28 PIN DIP SKT	XU15 23 24	
92.	2	407-0040	40 PIN DIP SKT	XU10 18	
93.	2	407-0108	08 PIN SIP SKT	MATRIX	
94.	1	407-0140	40 PIN SKT RA	XDS1 2	
95.	3.75"	408-0001	24 GA BARE WIRE	XE1-5	
96.	1	410-9064A	PCB, BARE		
97.	1	416-1577	FUSE AGC 1.0A SB	F1	
98.	2	416-3040	FUSE CLIP	XF1	
99.	1	702-9065	MATRIX II PCB		

MODEL 32 DAPT-JR PARTS LIST (702-9064A,B)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
1.	1	101-0013	2.2 OHM 1/4W	R26	
2.	2	101-0033	22 OHM 1/4W	R21 42	
3.	3	101-0047	47 OHM 1/4W	R2 3 15	
4.	1	101-0049	100 OHM 1/4W	R27	
5.	1	101-0057	220 OHM 1/4W	R13	
6.	1	101-0061	330 OHM 1/4W	R1	
7.	4	101-0066	510 OHM 1/4W	R4 10 77-79	
8.	1	101-0071	820 OHM 1/4W	R50	
9.	3	101-0073	1K 1/4W	R23 38 80	
10.	1	101-0075	1.5K 1/4W	R5	
11.	2	101-0081	2.2K 1/4W	R9 55	
12.	10	101-0085	3.3K 1/4W	R7 14 32 45-48 60 75 76	
13.	4	101-0089	4.7K 1/4W	R17 30 31 54	
14.	27	101-0097	10K 1/4W	R6 11 22 29 33-37 39 40 43 44 52 57 59 62-65 67 69 71-74 X1	
15.	1	101-0101	15K 1/4W	R58	
16.	1	101-0105	22K 1/4W	RX2	
17.	2	101-0106	24K 1/4W	R25 51	
18.	5	101-0113	47K 1/4W	R8 16 18 19 66	
19.	4	101-0121	100K 1/4W	R12 49 68 70	
20.	1	101-0145	1M 1/4W	R41	
21.	2	105-0001	VARISTOR	RV1 2	
22.	1	105-0002	VARISTOR	RV3	
23.	1	107-0500	500 OHM POT	R28	
24.	3	107-0502	50K POT	R24 53 61	
25.	1	107-3085	10K POT	R20	
26.	2	119-0008	10K X 7 R-PAK	RP1 2	
27.	2	150-0024	24PF DISC	C45 46	
28.	7	150-0096	1000PF 1KV DISC	C3-6 12 13 24	
29.	11	150-0110	.01µF DISC	C1 2 10 11 21 29 34 35 48 51 52	
30.	1	151-0020	.001µF TS	C19	
31.	1	151-0027	270PF TS	C9	
32.	2	151-0120	.01µF TS	C8 32	
33.	2	151-0130	.047µF TS	C20 33	
34.	5	151-0180	.1µF TS	C17 27 36 40 41	
35.	3	151-0199	.47µF TS	C37 39 43	
36.	1	151-0047	470PF TS	C22	
37.	1	152-0021	.47µF/250V POLY	C23	
38.	3	154-0100	10µF/16V TANT	C26 28 50	
39.	6	155-0050	10µF/25V ALUM	C15 18 25 30 31 47	
40.	2	155-0051	10µF/100V ALUM	C14 16	
41.	1	155-0141	3300µF/16V ALUM	C7	
42.	1	305-0003	AUDIO XFMR 600	T1	42TM016
43.	5	305-0007	FERRITE BEAD	E1-5	
44.	1	305-0012	TRANSFORMER	T2	
45.	1	305-2600	600:600 OHM AUD	T3	

MODEL 32 DAPT-JR PARTS LIST (702-9064A,B) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
46.	3	311-0008	OPTO-ISOLATOR	U1 4 6	4N26
47.	2	311-0030	DUAL 7-SEG DIS	DS1 2	LN5240K
48.	1	314-4138	1 OF 8 DECODER	U22	74LS138
49.	1	314-7402	QUAD 2 INPT NOR	U17	74LS02
50.	1	314-7404	HEX INVERTER	U25	74LS04
51.	1	316-0004	TONE FILTER	U14	MF4CN-50
52.	2	316-0082	BIFET OP-AMP	U2 8	LF353
53.	1	316-0358	DUAL OP-AMP	U3	LM358
54.	1	316-7805	5V REGULATOR	VR1	LM340T-5
55.	1	316-7840	REGULATOR 5W	U7	78S40
56.	1	321-0202	DTMF DECODER	U5	SS1202P
57.	1	321-6522	VIA/TIMER	U10	R6522
58.	1	321-6802	MICROPROCESSOR	U18	MC6802P
59.	1	321-6840	PTM	U15	MC6840P
60.	3	323-4015	DUAL 4 BIT REG	U19-21	MC14015B
61.	1	323-4040	BINARY COUNTER	U11	MC14040
62.	2	323-4066	QUAD ANALOG SW	U9 13	MC14066
63.	1	323-4073	TRIPLE AND	U12	MC14073
64.	1	323-4093	QUAD NAND SCHM	U16	MC14093
65.	1	324-7420	GATE	U26	74HC20
66.	3	340-0014	NPN DARLINGTON	Q3 5 13	MPSA14
67.	10	340-3904	NPN	Q1 2 4 6-12	2N3904
68.	4	342-0001	SILICON	CR4-7	1N4002
69.	3	342-3008	GERMANIUM	CR22-24	1N100
70.	6	342-3009	SILICON	CR1-3 19-21	1N4148
71.	5	342-3011	SILICON 1A 1000V	CR9-12 16	1N4007
72.	1	342-4935	SIL FAST 200V	CR13	1N4935
73.	2	343-3029	1W 5.1V ±5%	CR15 CRX1 (REV B)	1N4733A
74.	1	343-3030	1W 6.2V ±5%	CR18	1N4735A
75.	1	343-3108	1W 15V ±5%	CR17	1N4744A
76.	1	343-3113	1W 47V ±10%	CR14	1N4756
77.	1	343-3115	1W 56V ±10%	CR8	1N4758
78.	1	376-0004	XTAL 4.000 MHZ	Y2	
79.	1	376-0358	XTAL 3.58 MHZ	Y1	
80.	2	380-0030	RELAY DPDT	K1 2	
81.	1	401-0013	POWER JACK	J1	
82.	39	401-0052	STAKE PINS	TP1-5 (1EA) XJP1 3 (2EA) XJP2 4-12 (3EA)	
83.	1	401-0059	15-PIN RA PINS	P1	
84.	1	401-6005	CONN MOLEX 6F	P2	
85.	1	401-7000	TELCO CONN	J2	
86.	12	402-3040	MINI-JUMPER	JP1 3 IN JP2 4-12 POS A	
87.	4	407-0008	08 PIN DIP SKT	XU2 3 8 14	
88.	7	407-0014	14 PIN DIP SKT	XU9 12 13 16 17 25 26	
89.	6	407-0016	16 PIN DIP SKT	XU7 11 19-22	
90.	1	407-0018	18 PIN DIP SKT	XU5	
91.	3	407-0028	28 PIN DIP SKT	XU15 23 24	

MODEL 32 DAPT-JR PARTS LIST (702-9064A,B) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #
92.	2	407-0040	40 PIN DIP SKT	XU10 18	
93.	2	407-0108	08 PIN SIP SKT	MATRIX	
94.	1	407-0140	40 PIN SKT RA	XDS1 2	
95.	3.75"	408-0001	24 GA BARE WIRE	XE1-5	
96.	1	410-9064A	PCB, BARE		
97.	1	416-1577	FUSE AGC 1.0A SB	F1	
98.	2	416-3040	FUSE CLIP	XF1	
99.	1	702-9065	MATRIX II PCB		

MODEL 32 DAPT-JR PARTS LIST (702-9064AX)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR PART #	MANUFACTURER
1.	1	101-0033	22 OHM 1/4W	R42		
2.	3	101-0047	47 OHM 1/4W	R2 3 14		
3.	1	101-0049	100 OHM 1/4W	R12		
4.	1	101-0057	220 OHM 1/4W	R26		
5.	1	101-0061	330 OHM 1/4W	R1		
6.	1	101-0065	470 OHM 1/4W	R5		
7.	5	101-0066	510 OHM 1/4W	R4 9 X2 X3 X4		
8.	1	101-0071	820 OHM 1/4W	R48		
9.	3	101-0073	1K 1/4W	R22 38 76		
10.	1	101-0075	1.5K 1/4W	R27		
11.	2	101-0081	2.2K 1/4W	R8 53		
12.	10	101-0085	3.3K 1/4W	R13 31 45-47 58 71 72 X1 X5		
13.	4	101-0089	4.7K 1/4W	R16 29 30 52		
14.	26	101-0097	10K 1/4W	R6 10 21 25 33-37 39 40 43 44 50 52 55 57 60-63 65 68-70 X X7		
15.	1	101-0101	15K 1/4W	R56		
16.	2	101-0106	24K 1/4W	R24 49		
17.	1	101-0109	33K 1/4W	R28		
18.	5	101-0113	47K 1/4W	R7 15 17 18 64		
19.	4	101-0121	100K 1/4W	R11 32 66 67		
20.	1	101-0145	1M 1/4W	R41		
21.	1	103-1310	2.2K 1W	R20		
22.	2	105-0001	VARISTOR	RV1 2	V250LA15A	GE
23.	3	107-0502	50K POT	R23 51 59	780-12P-503	VRN
24.	1	107-3085	10K POT	R19	780-12P-103	VRN
25.	2	119-0008	10K X 7 R-PAK	RP1 2		
26.	2	150-0024	24PF DISC	C45 46	DD-240M	CENTRALAB
27.	8	150-0096	1000PF 1KV DISC	C2-7 22 25	DD-102G	CENTRALAB
28.	15	150-0110	.01UF DISC	C1 11 12 14 30 34 35 38 42 44 48 49 51 52 X1	CK-103Z	CENTRALAB
29.	1	151-0020	.001UF TS	C18	CW15C102M	CENTRALAB
30.	1	151-0027	270PF TS	C10	CW15C271K	CENTRALAB
31.	2	151-0120	.01UF TS	C9 32	CW15C103M	CENTRALAB
32.	2	151-0130	.047UF TS	C19 33	CW20C473M	CENTRALAB
33.	5	151-0180	.1UF TS	C16 28 36 39 41	AXXSR205E104MAA	AXX
34.	3	151-0199	.47UF TS	C37 43 X2	CW40C474M	CENTRALAB
35.	1	152-0021	.47UF/250V	C24	713A1KK474PK251SM	MEPCO
36.	3	154-0100	10UF/16V TANT	C27 29 50	ECS-F-16E10	PANASONIC
37.	7	155-0050	10UF/25V POL	C13 15 17 26 31 47 X3	ECE-B1EV100S	PANASONIC
38.	3	155-0051	10UF/100V POL	C20 21 23	ECE-B2AV100S	PANASONIC
39.	1	155-0141	3300UF/16V	C8	ECE-T16R332SW	PANASONIC
40.	1	305-0003	AUDIO XFMR 600	T1	42TM016	MOUSER
41.	5	305-0007	FERRITE BEAD	E1-5		
42.	1	305-2600	600:600 OHM AUD	T3	317-0719	AIE
43.	2	311-0008	OPTO ISOLATOR	U1 4	4N26	GE
44.	2	311-0028	28V LAMP	DS1 2	2185D	GEN INST

MODEL 32 DAPT-JR PARTS LIST (702-9064AX) CONT'D

45.	2	311-0030	DUAL 7-SEG DIS	DS3 4	LN5240K	PANASONIC
46.	1	314-4138	1 OF 8 DECODER	U20	74LS138	TI
47.	1	314-7402	QUAD 2 INPT NOR	U15	74LS02	TI
48.	1	314-7404	HEX INVERTER	U23	74LS04	TI
49.	1	316-0004	TONE FILTER	U12	MF4CN-50	NATIONAL
50.	2	316-0082	BIFET OP-AMP	U2 6	LF353	NATIONAL
51.	1	316-0358	DUAL OP-AMP	U3	LM358	NATIONAL
52.	1	316-7805	5V REGULATOR	VR1	LM340T-5	NATIONAL
53.	1	321-0202	DTMF DECODER	U5	SS1202P	SILICON SYS
54.	1	321-6522	VIA/TIMER	U8	R6522	ROCKWELL
55.	1	321-6802	MICROPROCESSOR	U16	MC6802P	MOTOROLA
56.	1	321-6840	PTM	U13	MC6840P	MOTOROLA
57.	3	323-4015	DUAL 4 BIT REG	U17-19	MC14015B	MOTOROLA
58.	1	323-4040	BINARY COUNTER	U9	MC14040	MOTOROLA
59.	2	323-4066	QUAD ANALOG SW	U7 11	MC14066	MOTOROLA
60.	1	323-4073	TRIPLE AND	U10	MC14073	MOTOROLA
61.	1	323-4093	QUAD NAND SCHM	U14	MC14093	MOTOROLA
62.	1	324-7420	GATE	U24	74HC20	MOTOROLA
63.	2	340-0006	NPN 80V	Q7 8	MPSA06	MOTOROLA
64.	2	340-0014	NPN DARLINGTON	Q4 6	MPSA14	MOTOROLA
65.	1	340-0029	NPN PWR 1A 100V	Q1	TIP 29C	TI
66.	10	340-3904	NPN	Q2 3 5 9-15	2N3904	
67.	6	342-0001	SILICON	CR4-7 26 27	1N4002	MOTOROLA
68.	3	342-3008	GERMANIUM	CR28-30	1N100	MOTOROLA
69.	6	342-3009	SILICON	CR1-3 24 25 X1	1N4148	MOTOROLA
70.	9	342-3011	SILICON 1A 1000V	CR11-14 16-19 21	1N4007	MOTOROLA
71.	1	343-3029	1W 5.1V +-5%	CR20	1N4733A	MOTOROLA
72.	1	343-3030	1W 6.2V +-5%	CR23	1N4735A	MOTOROLA
73.	1	343-3108	1W 15V +-5%	CR22	1N4744A	MOTOROLA
74.	1	343-3113	1W 47V +-10%	CR8	1N4756	MOTOROLA
75.	1	376-0004	XTAL 4.000 MHZ	Y2	SKO-DS400A	SEIKO
76.	1	376-0358	XTAL 3.58 MHZ	Y1	SKO-DS357	SEIKO
77.	2	380-0030	RELAY DPDT	K1 2	DS2E-M-DC12V	AROMAT
78	1	401-0013	POWER JACK	J1	16PJ032	MOUSER
79.	30	401-0052	STAKE PINS	TP1-3 (1EA) JP1-9 (3EA)	65500-113	BERG
80.	1	401-0059	15-PIN RA PINS	P1	6923.6	WEIDMULLER
81.	1	401-6005	CONN MOLEX 6F	P2	09-52-3063	MOLEX
82.	1	401-7000	TELCO CONN	J2	09-64-1051	MOLEX
83.	9	402-3040	MINI-JUMPER	JP1-9	65474-004	BERG
84.	4	407-0008	08 PIN DIP SKT	U2 3 6 12	640463-3	AMP
85.	5	407-0014	14 PIN DIP SKT	U7 10 11 14 15	640357-3	AMP
86.	4	407-0016	16 PIN DIP SKT	U9 17-19	640358-3	AMP
87.	1	407-0018	18 PIN DIP SKT	U5	640359-3	AMP
88.	1	407-0020	20 PIN DIP SKT	U20	640464-3	AMP
89.	3	407-0028	28 PIN DIP SKT	U13 21 22	640372-3	AMP
90.	2	407-0040	40 PIN DIP SKT	U8 16	640379-3	AMP
91.	2	407-0108	08 PIN SIP SKT	MATRIX		
92.	1	407-0140	40 PIN SKT RA	DS3 4	40-6823-90	ARIES
93.	3.75"	408-0001	24 GA BARE WIRE	XE1-5		
94.	1	410-9064AX	PCB, BARE			
95.	1	416-1576	FUSE AGC 1A	F1	AGC 1	LITTLEFUSE

MODEL 32 DAPT-JR PARTS LIST (702-9064AX) CONT'D

96.	2	416-3040	FUSE CLIP	XF1	926	COMP RES
97.	1	815-9017	SW 12-48 XFMR	T2		
98.	1	101-0105	22K 1/4W	RX6		

DO NOT INSTALL:

C40

CR9 10 15

R54 73-75

TELCO MATRIX II PARTS LIST (702-9065A.1)

ITEM	QTY	ZETRON P/N	DESCRIPTION	MANUFACTURERS P/N
1	1	103-2015	150 OHM 2W RESISTOR	BWH-150-5%
2	48	401-0052	STAKE PINS	65500-113
3	.5"	408-2802	28GA, WIRE STRANDED, WHT	2842-19
4	1	410-9065A	PCB, BARE	ZETRON
5	.75"	252-0002	INSUL. TUBE	

DIAL CLICK DETECTOR PARTS LIST (702-9010A)

ITEM	QTY	ZETRON P/N	DESCRIPTION	COMPONENT REF.	MFR. PART #	MANUFACTURER
1.	1	101-0049	100 OHM	R22	CARBON FILM	FILMR
2.	1	101-0073	1K	R19		
3.	4	101-0089	4.7K	R8 12 13 34		
4.	7	101-0097	10K	R6 7 10 25 26 27 33		
5.	3	101-0101	15K	R11 24 28		
6.	1	101-0113	47K	R35		
7.	1	101-0117	68K	R23		
8.	4	101-0121	100K	R5 9 30 32		
9.	4	101-0125	150K	R2 4 15 29		
10.	3	101-0133	330K	R3 16 17		
11.	2	101-0137	470K	R1 14		
12.	1	101-0145	1MEG OHM	R21		
13.	1	101-0149	1.5 MEG	R31		
14.	2	107-0502	50K POT	R18 20	760-10-503	VRN
15.	1	151-0027	270 PF 10% TS	C7	CW15C271K	CENTRALAB
16.	3	151-0090	.0033 μF 10% TS	C2 4 5	CW15C332K	CENTRALAB
17.	4	151-0120	.01 μF 10% TS	C1 3 13 14	CW15C103M	CENTRALAB
18.	2	151-0130	.047 μF 10% TS	C8 11	CW20C473M	CENTRALAB
19.	1	155-0010	1 μF 50V	C12	ECE-B1HV010S	PANASONIC
20.	1	155-0051	10 μF 25V	C9	ECE-B1EV100S	PANASONIC
21.	1	155-0055	22 μF 25V	C6	ECE-B1EV220S	PANASONIC
22.	1	155-0080	100 μF 25V	C10	ECE-B1EV101S	PANASONIC
23.	1	311-0010	RED LED	DS1	5082-4650	H-P
24.	4	316-0082	BIFET OP-AMP	U1 3 4 5	LF353	NATIONAL
25.	1	316-3094	AGC AMP	U2	CA3094E	RCA
26.	1	340-2907	2N2907 PNP	Q1	2N2907	
27.	2	340-3394	2N3394 NPN	Q2 3	2N3394	MOTOROLA
28.	2	342-3009	SILICON SWITCH	CR1 2	1N4148	MOTOROLA
29.	1	401-6006	CONN, MOLEX 6M	J1	09-64-1061	MOLEX
30.	5	407-0008	8 PIN DIP SKT	U1-5	640-463-3	AMP
31.	1	410-9010A	PWB, BARE		410-9010	ZETRON

MODEL 32 DAPT-JR SPARE PARTS KIT (951-9032A-C)

ITEM	QTY	ZETRON P/N	DESCRIPTION	MFR PART #
1.	2	105-0001	VARISTOR	
2.	1	105-0002	VARISTOR	
3.	1	107-0500	500 OHM POT	
4.	1	107-0502	50K POT	
5.	1	107-3085	10K POT	
6.	1	119-0008	10K X 7 R-PAK	
7.	1	150-0024	24PF DISC	
8.	1	150-0096	1000PF 1KV DISC	
9.	2	150-0110	.01µF DISC	
10.	1	151-0020	.001µF TS	
11.	1	151-0027	270PF TS	
12.	1	151-0047	470PF TS	
13.	1	151-0090	.0033 TS (REV C)	
14.	1	151-0120	.01µF TS	
15.	1	151-0130	.047µF TS	
16.	1	151-0180	.1µF TS	
17.	1	151-0199	.47µF TS	
18.	1	152-0021	.47µF/250V POLY	
19.	1	154-0100	10µF/16V TANT	
20.	1	155-0050	10µF/25V ALUM	
21.	1	155-0051	10µF/100V ALUM	
22.	1	155-0141	3300µF/16V ALUM	
23.	1	305-0003	AUDIO XFMR 600	42TM016
24.	1	305-0012	TRANSFORMER ASSY	
25.	1	305-2600	600:600 OHM AUD	
26.	1	311-0008	OPTO-ISOLATOR	4N26
27.	1	311-0030	DUAL 7-SEG DIS	LN5240K
28.	1	314-4138	1 OF 8 DECODER	74LS138
29.	1	314-7402	QUAD 2 INPT NOR	74LS02
30.	1	314-7404	HEX INVERTER	74LS04
31.	1	316-0004	TONE FILTER	MF4CN-50
32.	1	316-0353	BIFET OP-AMP	LF353
33.	1	316-0358	DUAL OP-AMP	LM358
34.	1	316-7805	5V REGULATOR	LM340T-5
35.	1	316-7840	REGULATOR 5W	78S40
36.	1	321-0202	DTMF DECODER	SSI202P
37.	1	321-6116	2Kx8 RAM (450NS) (REV B)	HM6116P-4
38.	1	321-6522	VIA/TIMER	R6522
39.	1	321-6802	MICROPROCESSOR	MC6802P
40.	1	321-6840	PTM	MC6840P
41.	1	323-4015	DUAL 4 BIT REG	MC14015B
42.	1	323-4040	BINARY COUNTER	MC14040
43.	1	323-4066	QUAD ANALOG SW	MC14066
44.	1	323-4073	TRIPLE AND	MC14073
45.	1	323-4093	QUAD NAND SCHM	MC14093
46.	1	324-7400	QUAD NAND (REV C)	74HC00
47.	1	324-7420	GATE (REV A B)	74HC20
48.	1	340-0014	NPN DARLINGTON	MPSA14
49.	2	340-3904	NPN	2N3904
50.	2	342-0001	SILICON	1N4002
51.	1	342-3008	GERMANIUM	1N100

MODEL 32 DAPT-JR SPARE PARTS KIT (951-9032A-C) CONT'D

ITEM	QTY	ZETRON P/N	DESCRIPTION	MFR PART #
52.	1	342-3009	SILICON	1N4148
53.	1	342-3011	SILICON 1A 1000V	1N4007
54.	1	342-4935	SIL FAST 200V	1N4935
55.	1	343-3029	1W 5.1V ±5%	1N4733A
56.	1	343-3030	1W 6.2V ±5%	1N4735A
57.	1	343-3108	1W 15V ±5%	1N4744A
58.	1	343-3113	1W 47V ±10%	1N4756
59.	1	343-3115	1W 56V ±10%	1N4758
60.	1	376-0004	XTAL 4.000 MHZ	
61.	1	376-0358	XTAL 3.58 MHZ	
62.	1	380-0030	RELAY DPDT	
63.	1	401-0014	DC POWER CONN M	
64.	1	416-1213	28 PIN SKT/BAT (REV C)	
65.	1	416-1577	FUSE AGC 1A SB	

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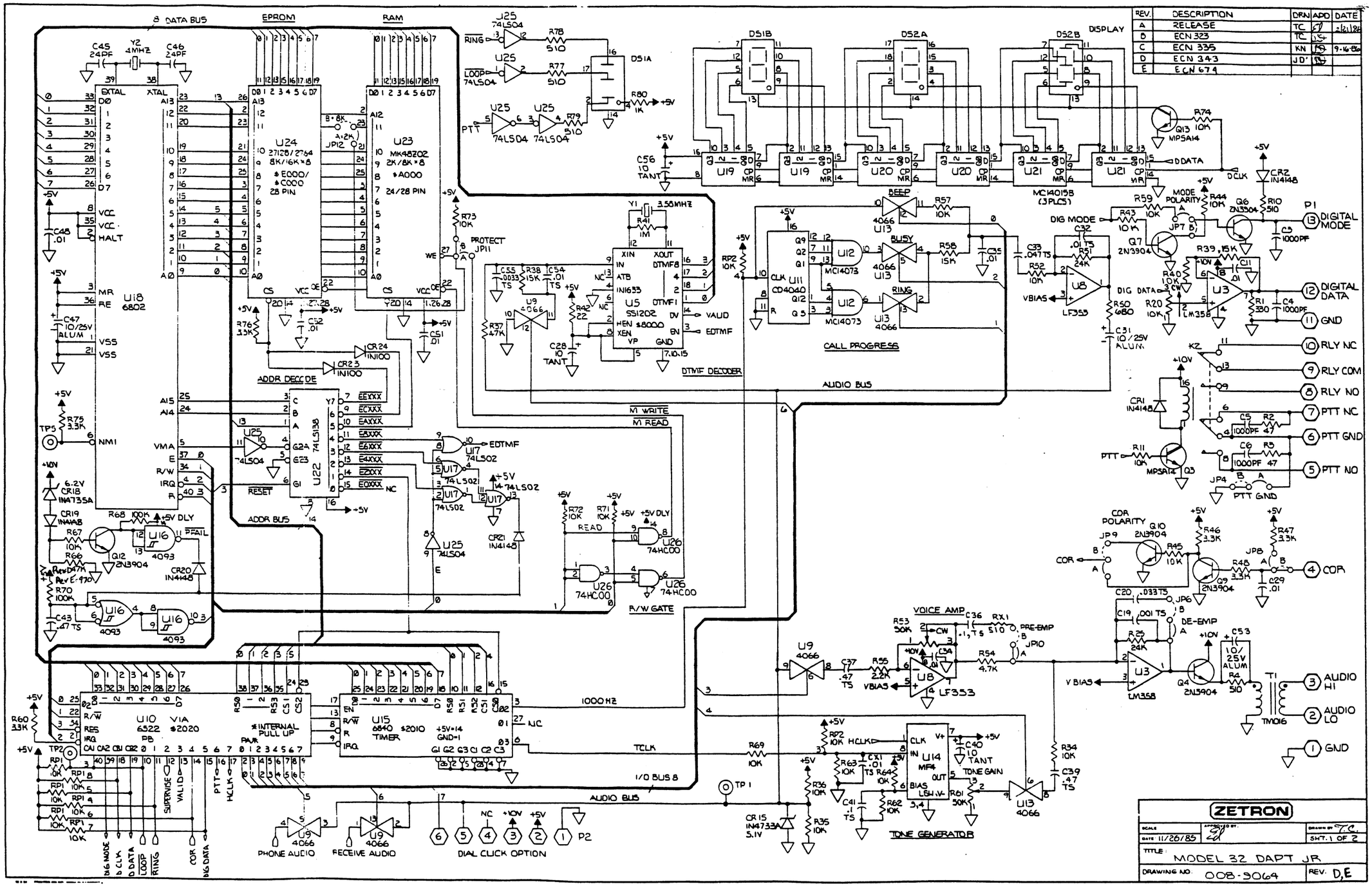
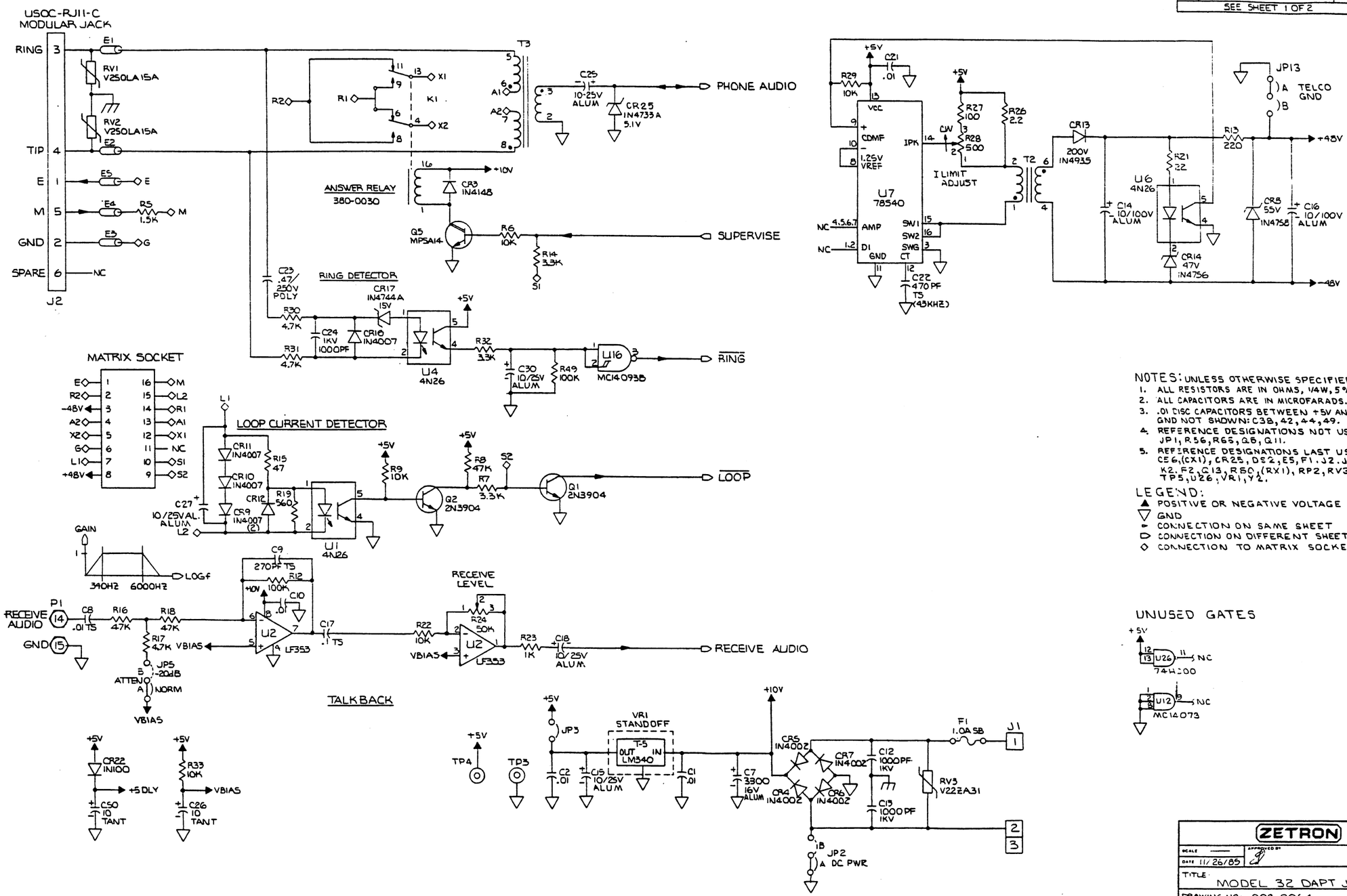
MODEL 32 DAPT-JR SCHEMATIC (008-9064D,E) SHT 1 OF 2



MODEL 32 DAPT-JR SCHEMATIC (008-9064D,E) SHT 2 OF 2

REV	DESCRIPTION	DRN	APD	DATE
	SEE SHEET 1 OF 2			



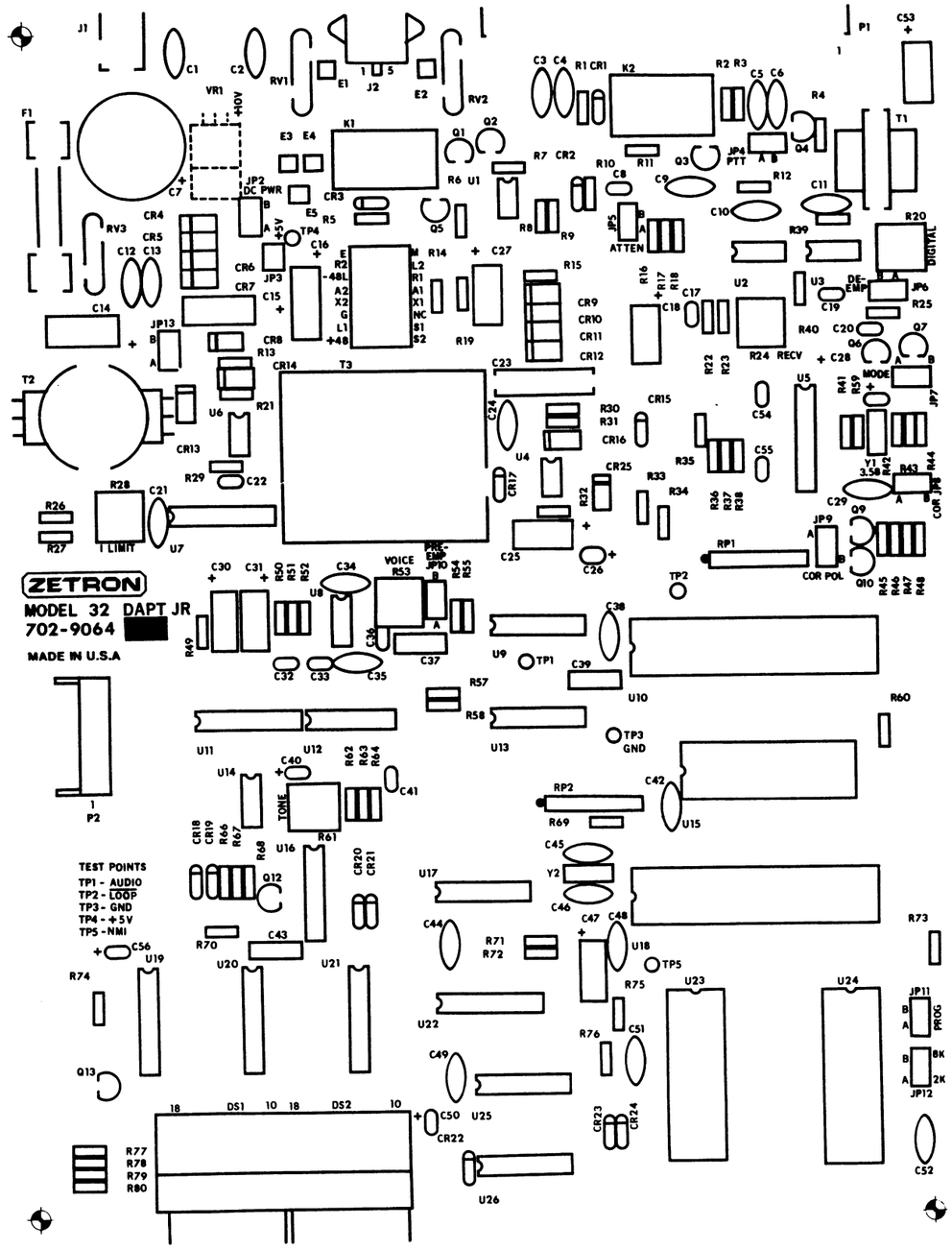
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. .01 DISC CAPACITORS BETWEEN +5V AND GND NOT SHOWN: C38, 42, 44, 49.
4. REFERENCE DESIGNATIONS NOT USED: JP1, R56, R65, Q8, Q11.
5. REFERENCE DESIGNATIONS LAST USED: CE6, (CX1), CR25, DS2, E5, F1, J2, JP13, K2, F2, C13, R60, (RX1), RP2, RV3, T3, TP5, U26, VR1, Y2.

LEGEND:
- ▲ POSITIVE OR NEGATIVE VOLTAGE
- ▽ GND
- ▬ CONNECTION ON SAME SHEET
- ▷ CONNECTION ON DIFFERENT SHEET
- ◇ CONNECTION TO MATRIX SOCKET

UNUSED GATES

ZETRON		
SCALE —	APPROVED BY	DRAWN BY CZ
DATE 11/26/85		SHT 2 OF 2
TITLE MODEL 32 DAPT JR		
DRAWING NO. 008-9064		REV. D,E

MODEL 32 DAPT-JR SILKSCREEN (702-9064D,E)



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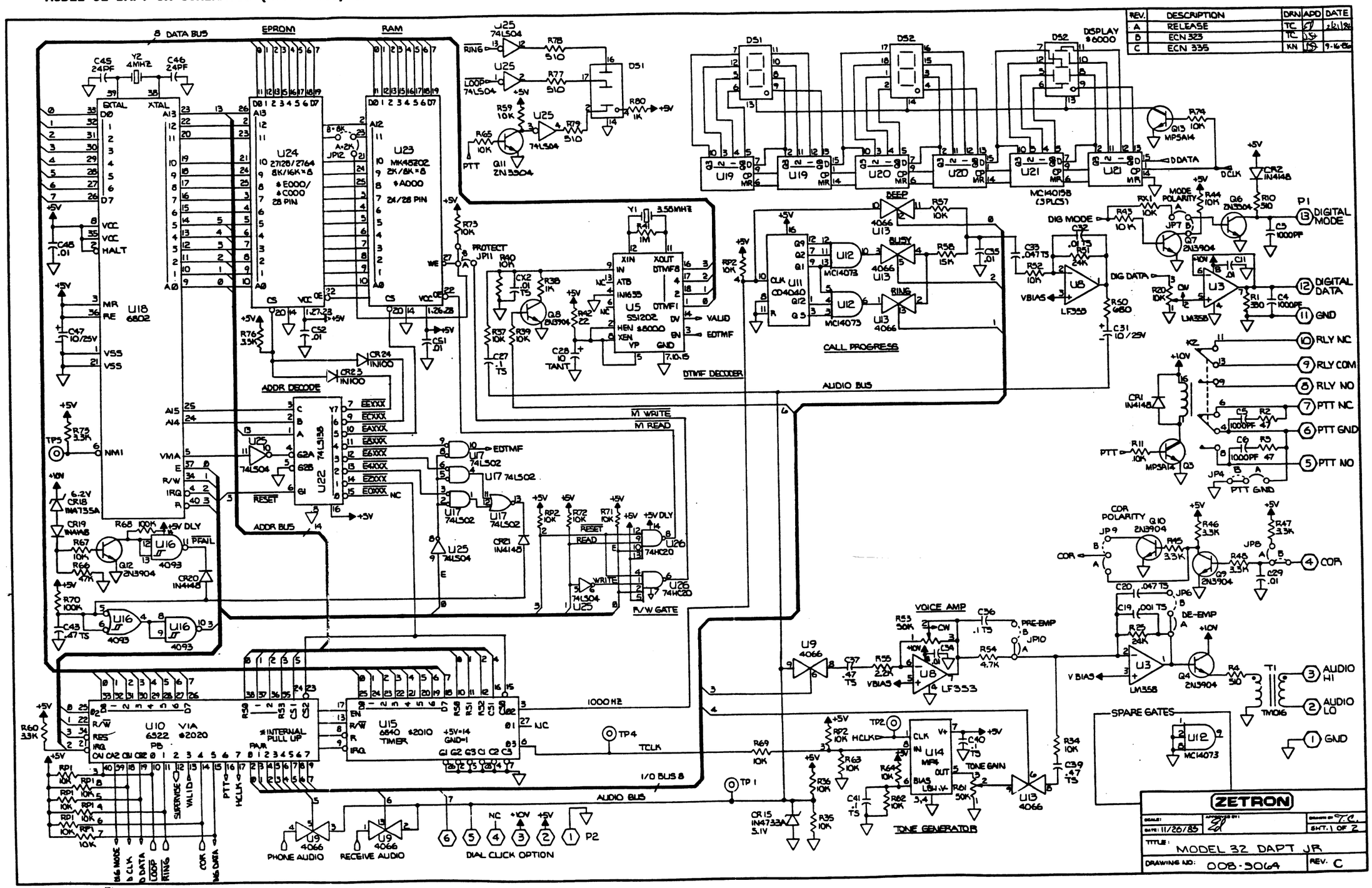
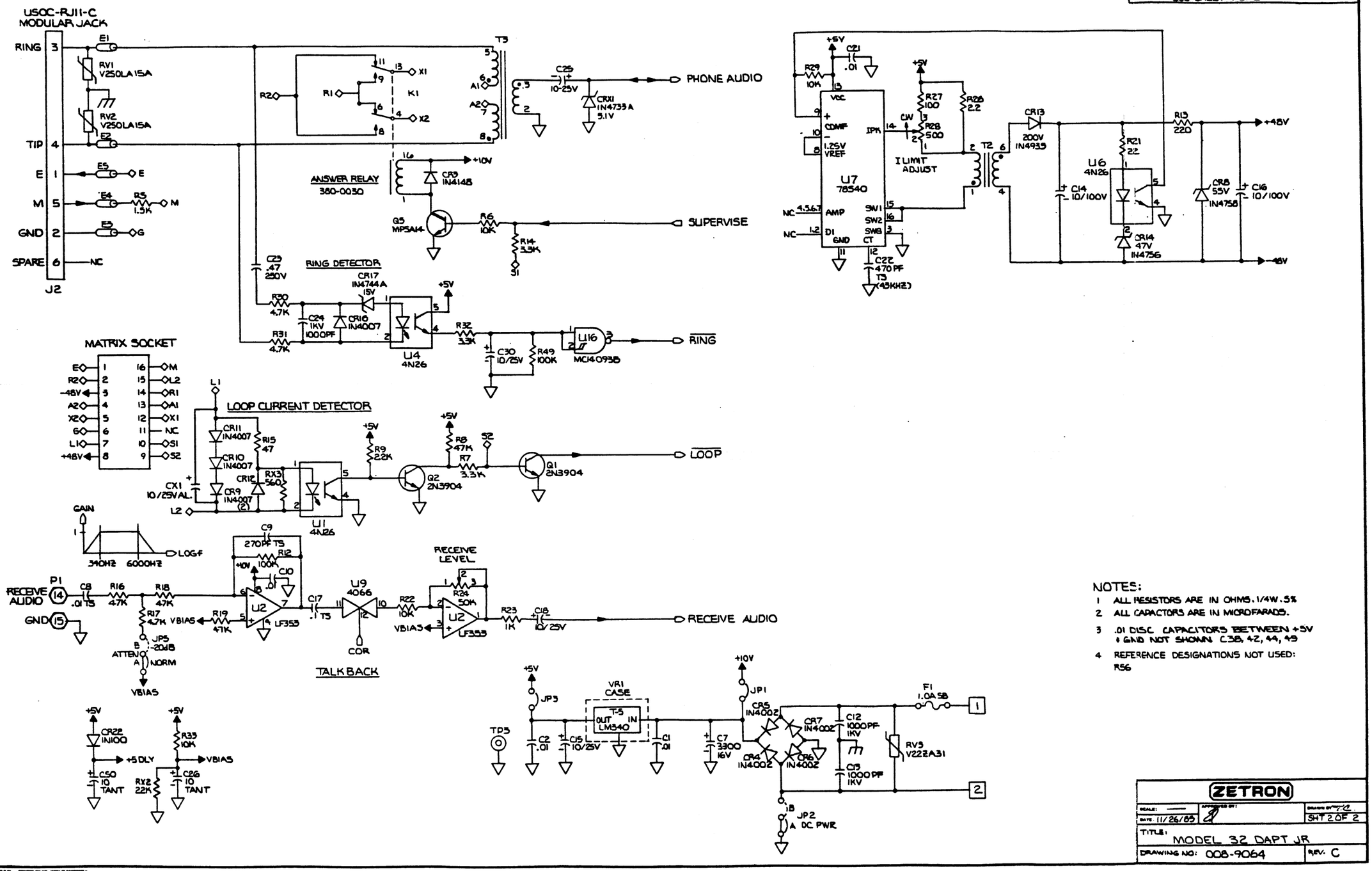
MODEL 32 DAPT-JR SCHEMATIC (008-9064C) SHT 1 OF 2



MODEL 32 DAPT-JR SCHEMATIC (008-9064C) SHT 2 OF 2

REV.	DESCRIPTION	DRN	APD	DATE
	SEE SHEET 1 OF 2			

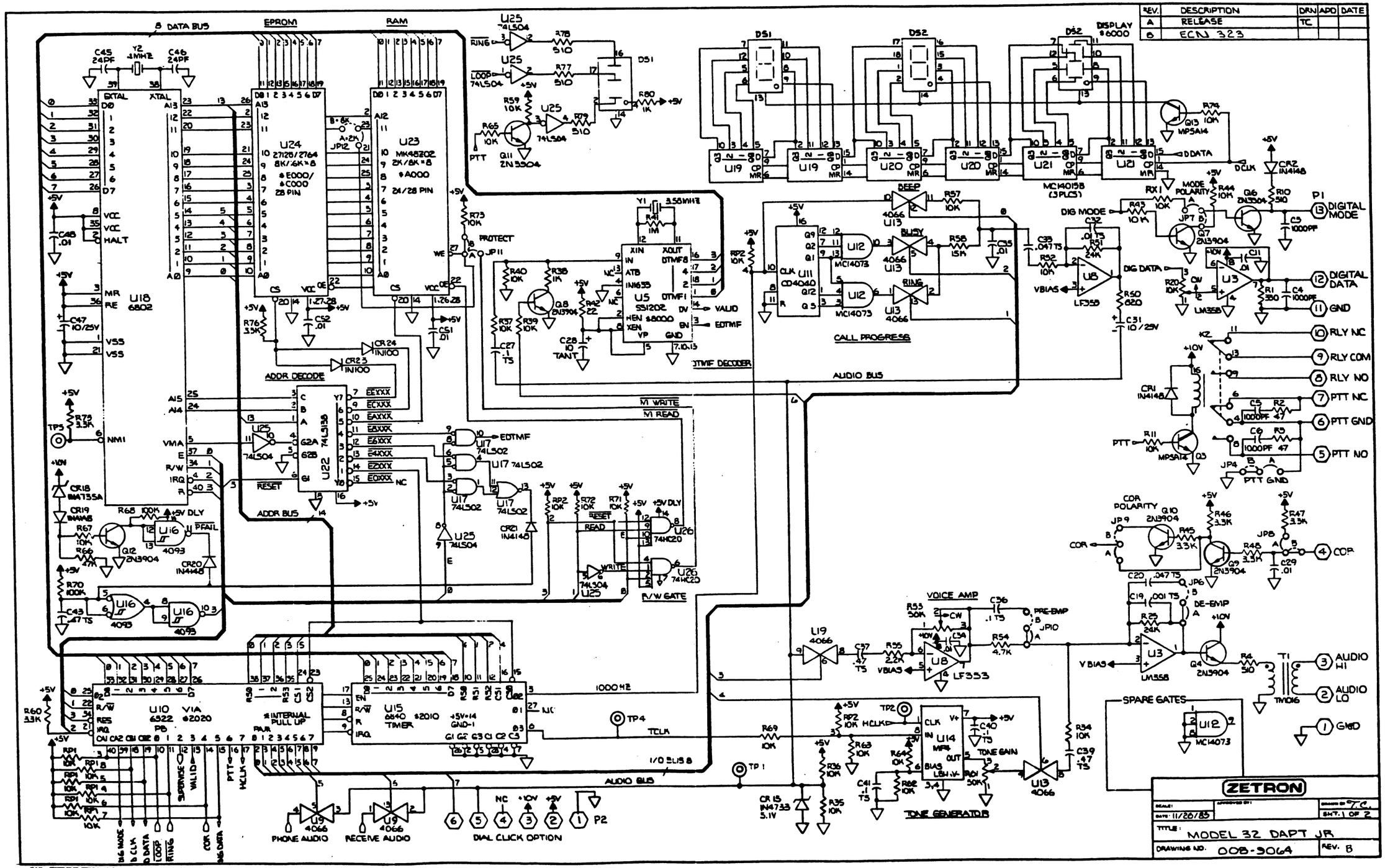


NOTES:

1. ALL RESISTORS ARE IN OHMS. 1/4W. 5%
2. ALL CAPACITORS ARE IN MICROFARADS.
3. .01 DISC CAPACITORS BETWEEN +5V & GND NOT SHOWN. C38, 42, 44, 49
4. REFERENCE DESIGNATIONS NOT USED: R56

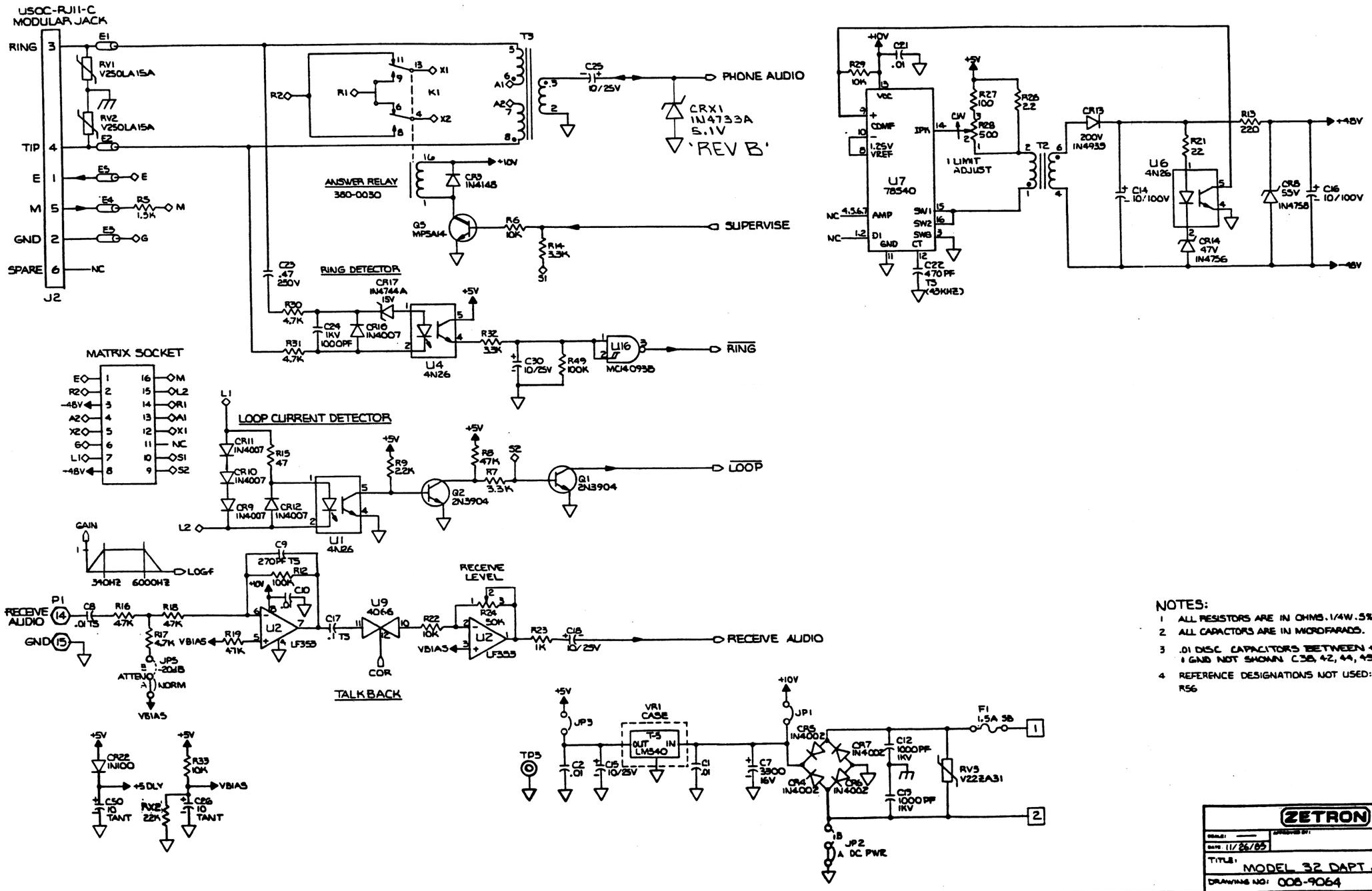
ZETRON		
SCALE: ——	APPROVED BY:	DRAWN BY: TC
DATE: 11/26/85		SHT 2 OF 2
TITLE: MODEL 32 DAPT JR		
DRAWING NO: 008-9064		REV. C

MODEL 32 DAPT-JR SCHEMATIC (008-9064A,B) SHT 1 OF 2



MODEL 32 DAPT-JR SCHEMATIC (008-9064A,B) SHT 2 OF 2

REV	DESCRIPTION	DRN	APD	DATE
	SEE SHEET 1 OF 2			

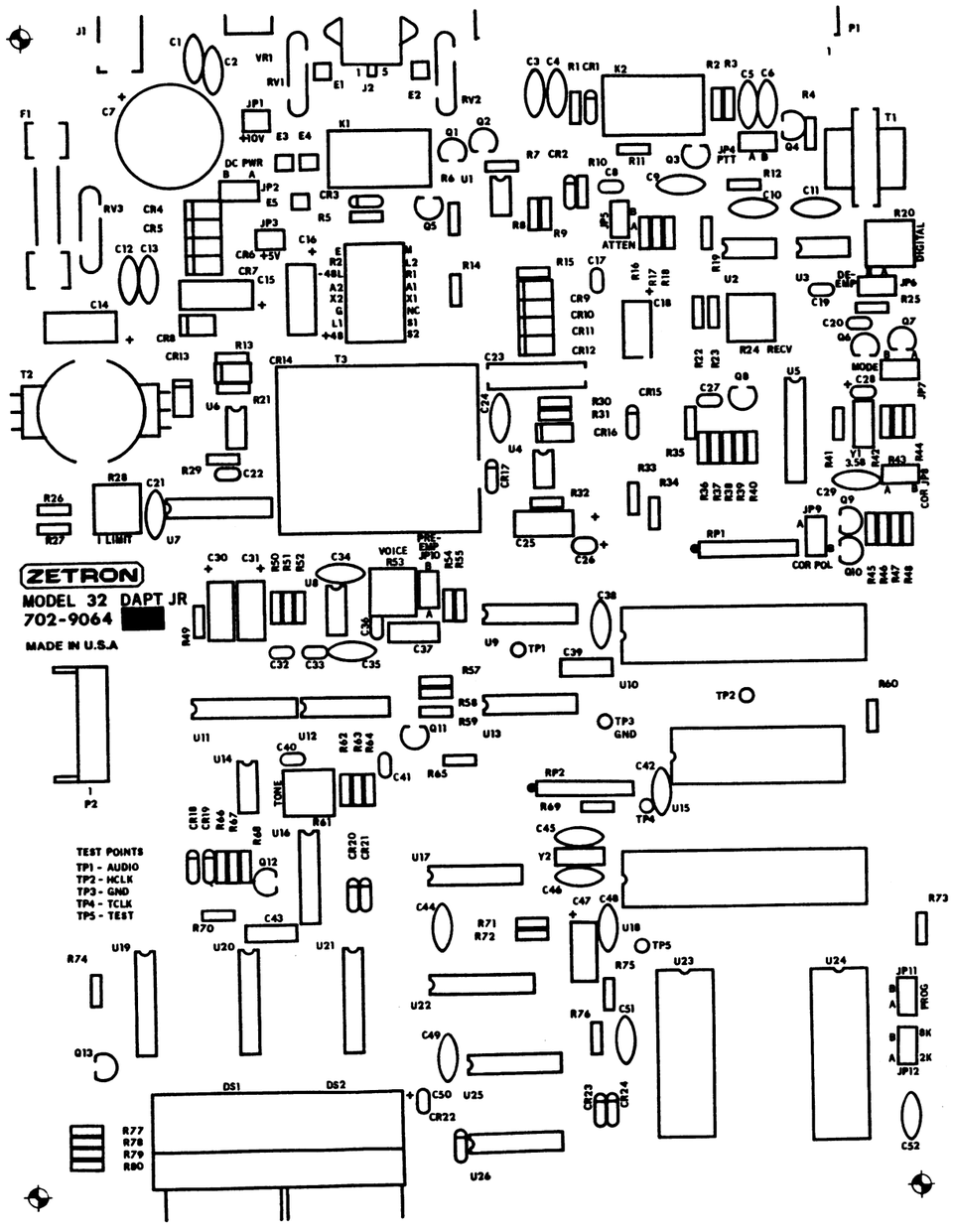


NOTES:

1. ALL RESISTORS ARE IN OHMS. 1/4W. 5%
2. ALL CAPACITORS ARE IN MICROFARADS.
3. .01 DISC. CAPACITORS BETWEEN +5V & GND NOT SHOWN. C38, 42, 44, 45
4. REFERENCE DESIGNATIONS NOT USED: R56

ZETRON		
SCALE: —	APPROVED BY:	DRAWN BY: TC
DATE: 11/26/85		SHT 2 OF 2
TITLE: MODEL 32 DAPT JR		
DRAWING NO: 008-9064		REV: B

MODEL 32 DAPT-JR SILKSCREEN (702-9064A-C)



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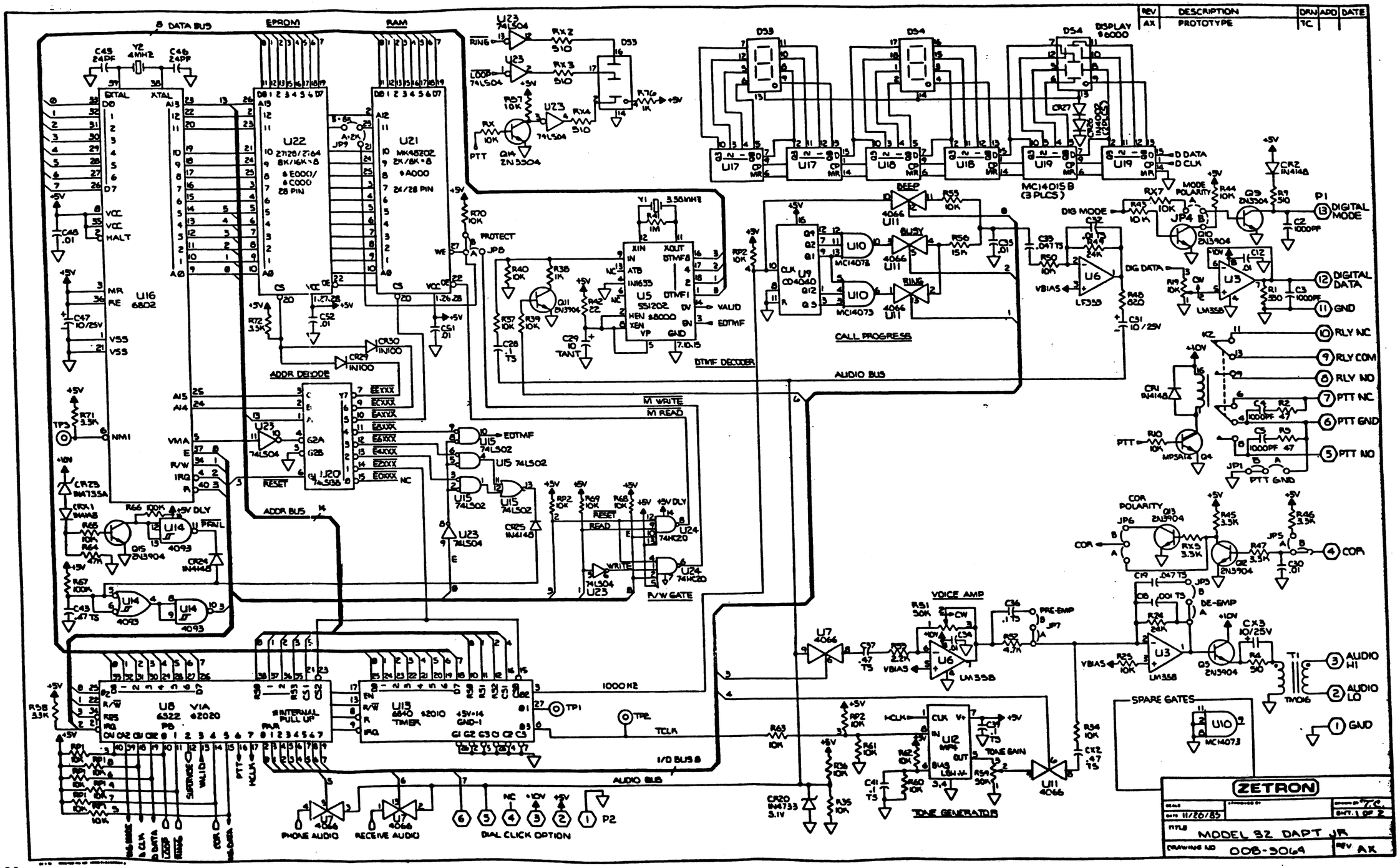
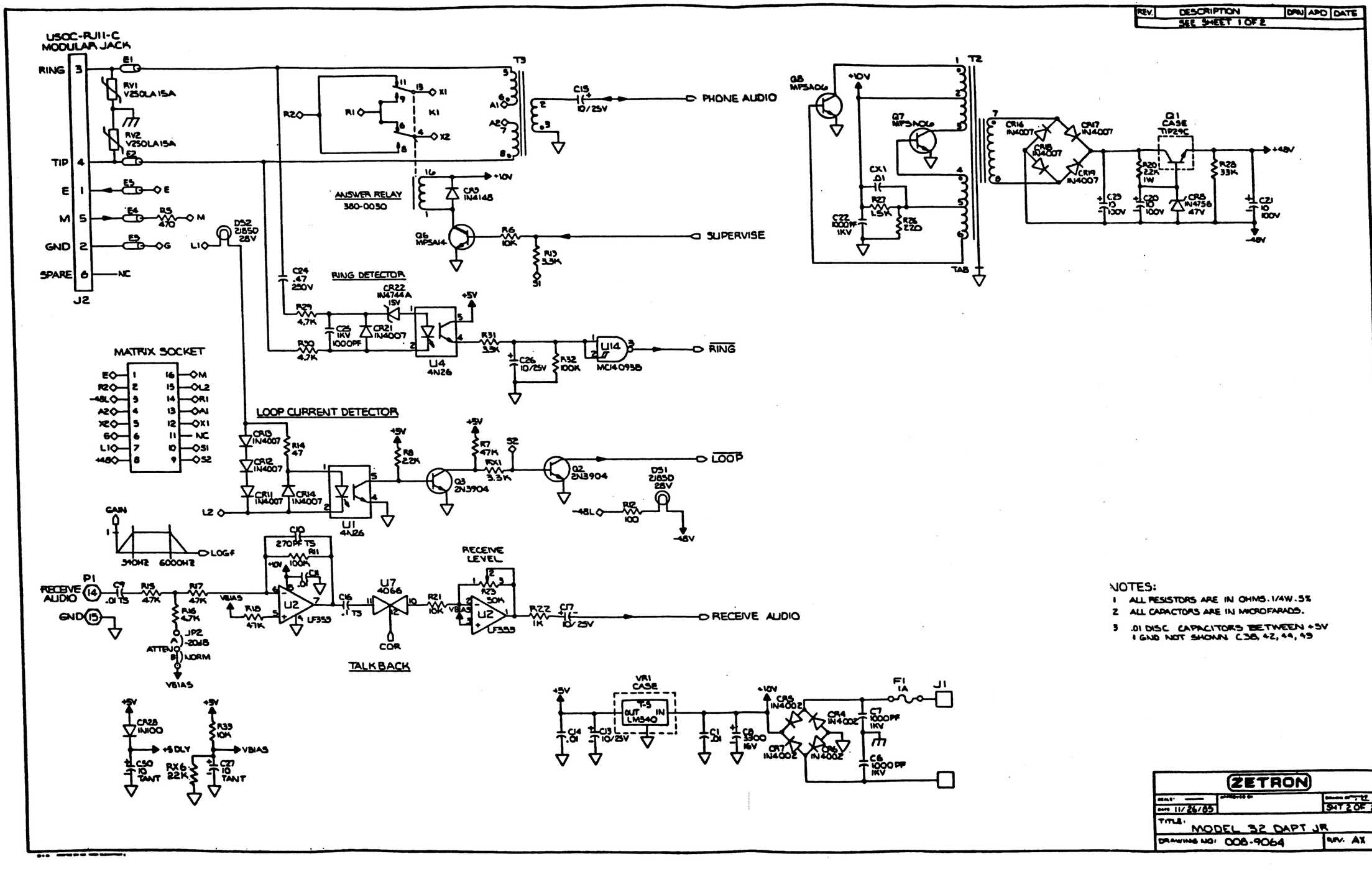
MODEL 32 DAPT-JR SCHEMATIC (008-9064AX) SHT 1 OF 2



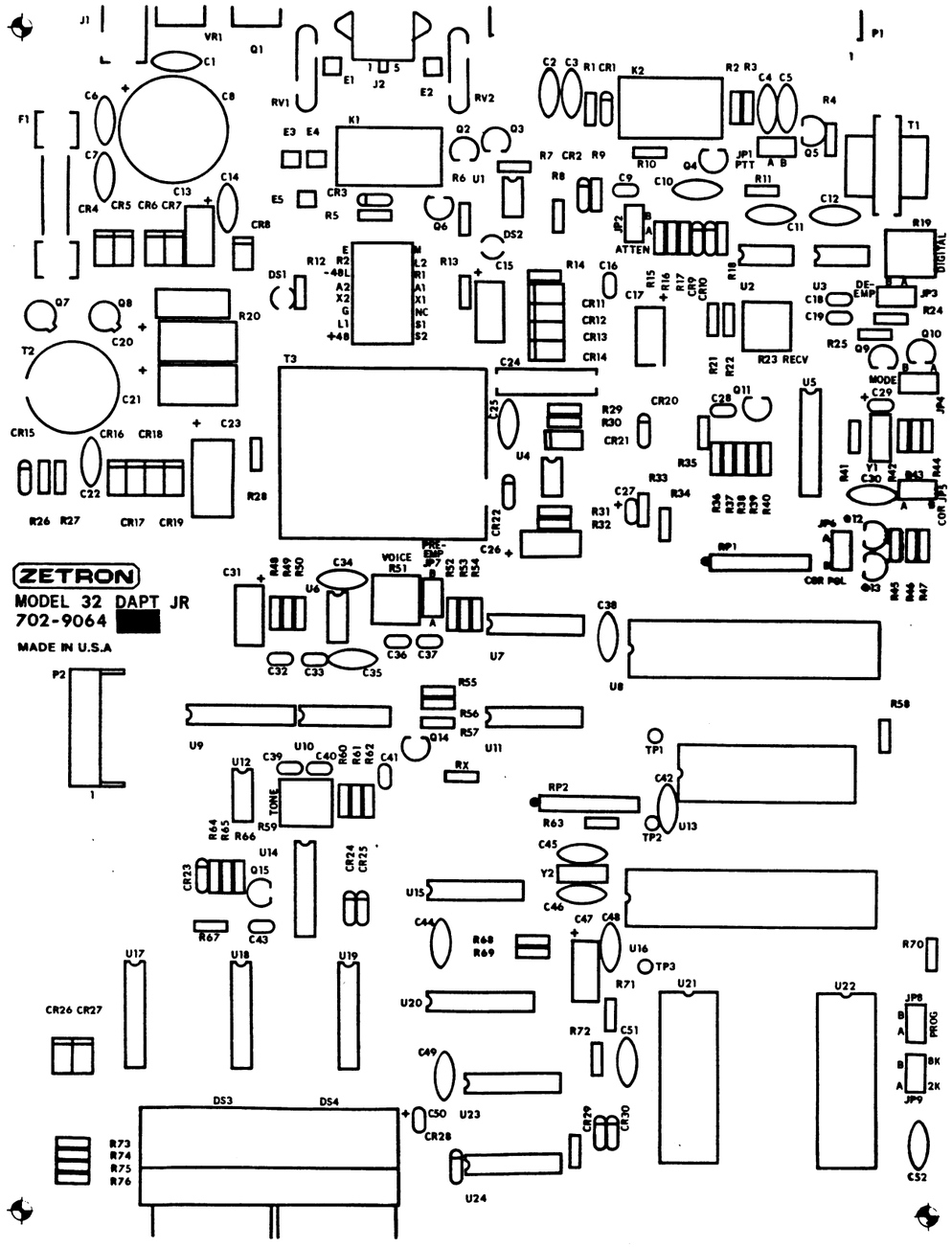
MODEL 32 DAPT-JR SCHEMATIC (008-9064AX) SHT 2 OF 2



NOTES:
1. ALL RESISTORS ARE IN OHMS. 1/4W. 5%
2. ALL CAPACITORS ARE IN MICROFARADS.
3. .01 DISC CAPACITORS BETWEEN +5V & GND NOT SHOWN C38, 42, 44, 49

ZETRON		
DATE 11/26/85		SHT 2 OF 2
TITLE: MODEL 32 DAPT JR		
DRAWING NO: 008-9064		REV. AX

MODEL 32 DAPT-JR SILKSCREEN (702-9064AX)



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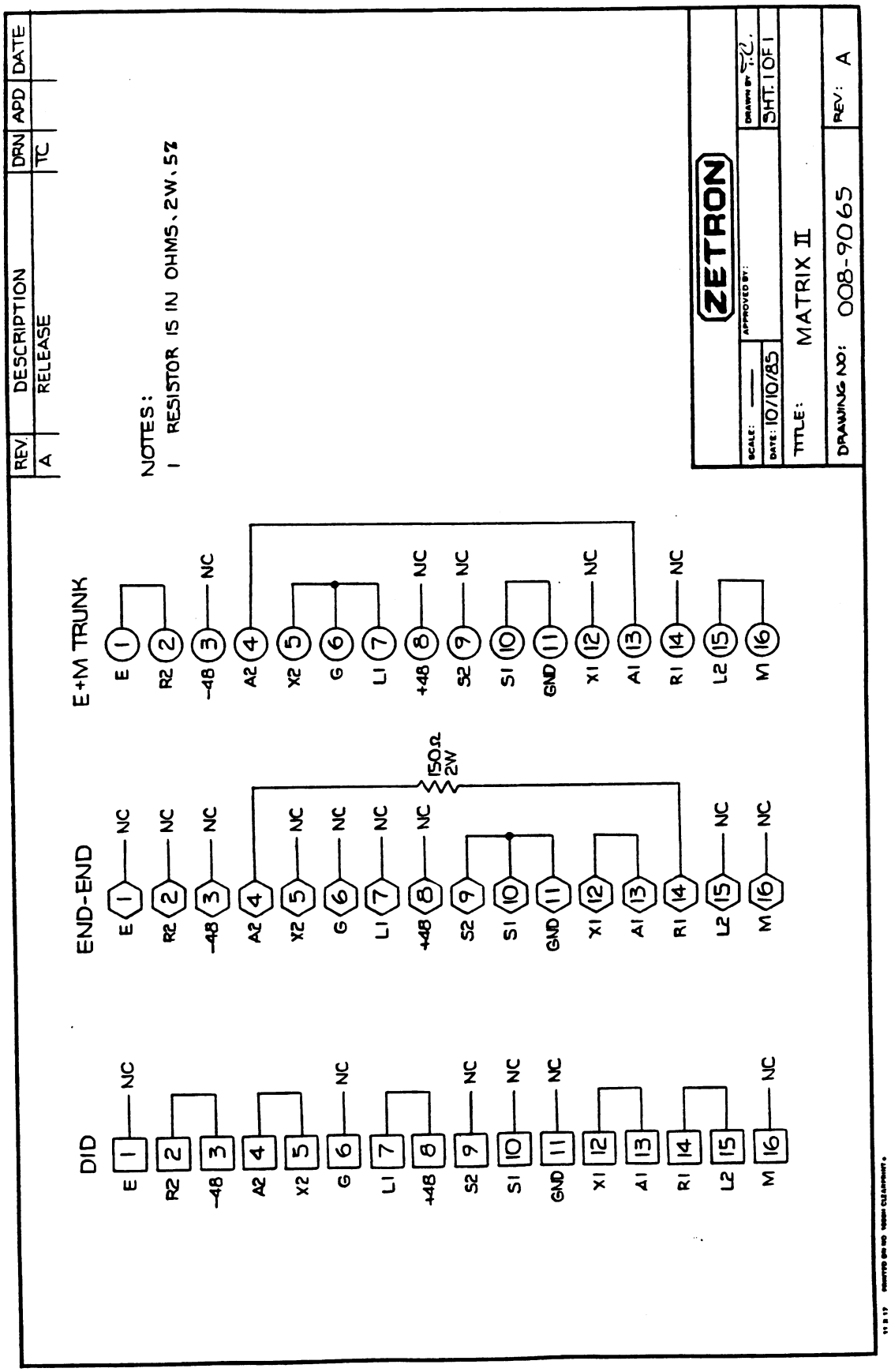
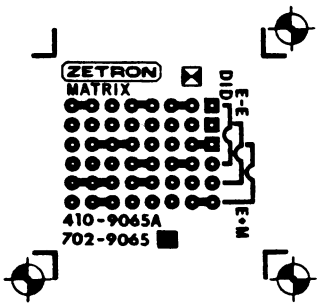
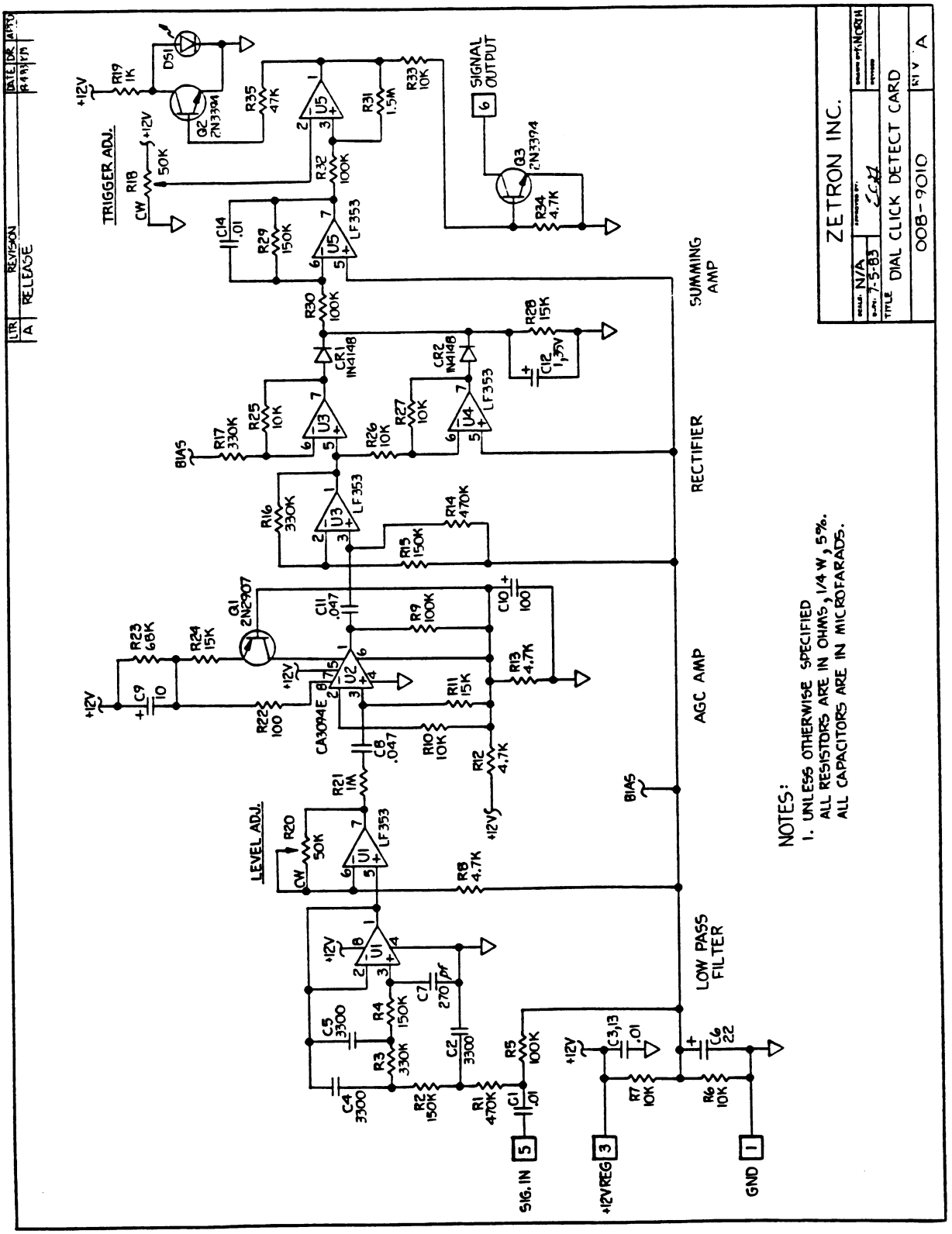
TELCO MATRIX II SCHEMATIC (008-9065A)



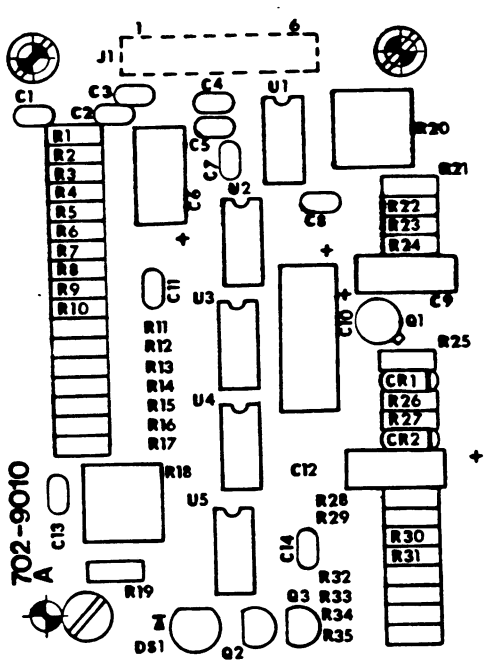
TELCO MATRIX II SILKSCREEN (702-9065A.1)



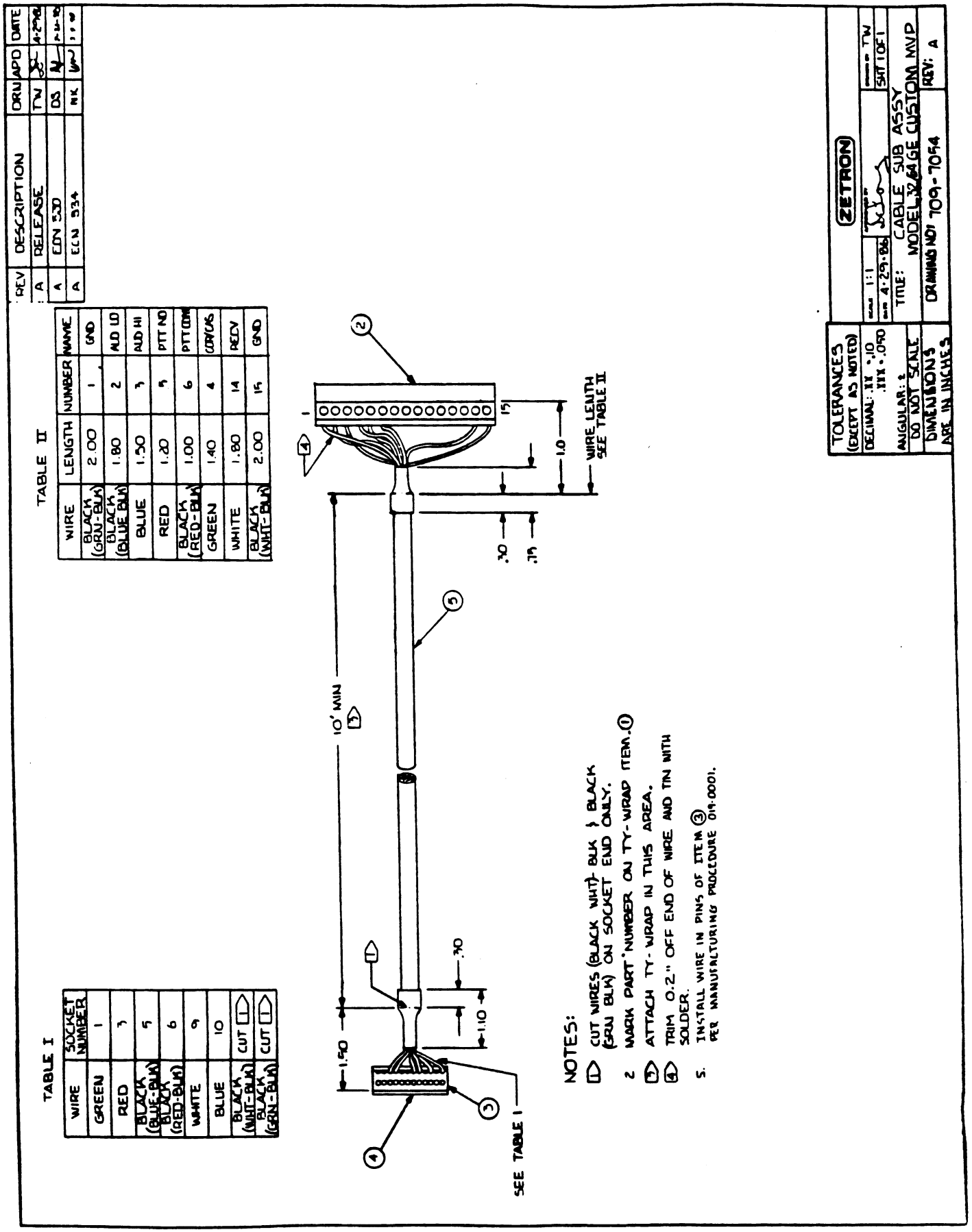
DIAL CLICK DETECTOR SCHEMATIC (008-9010A)



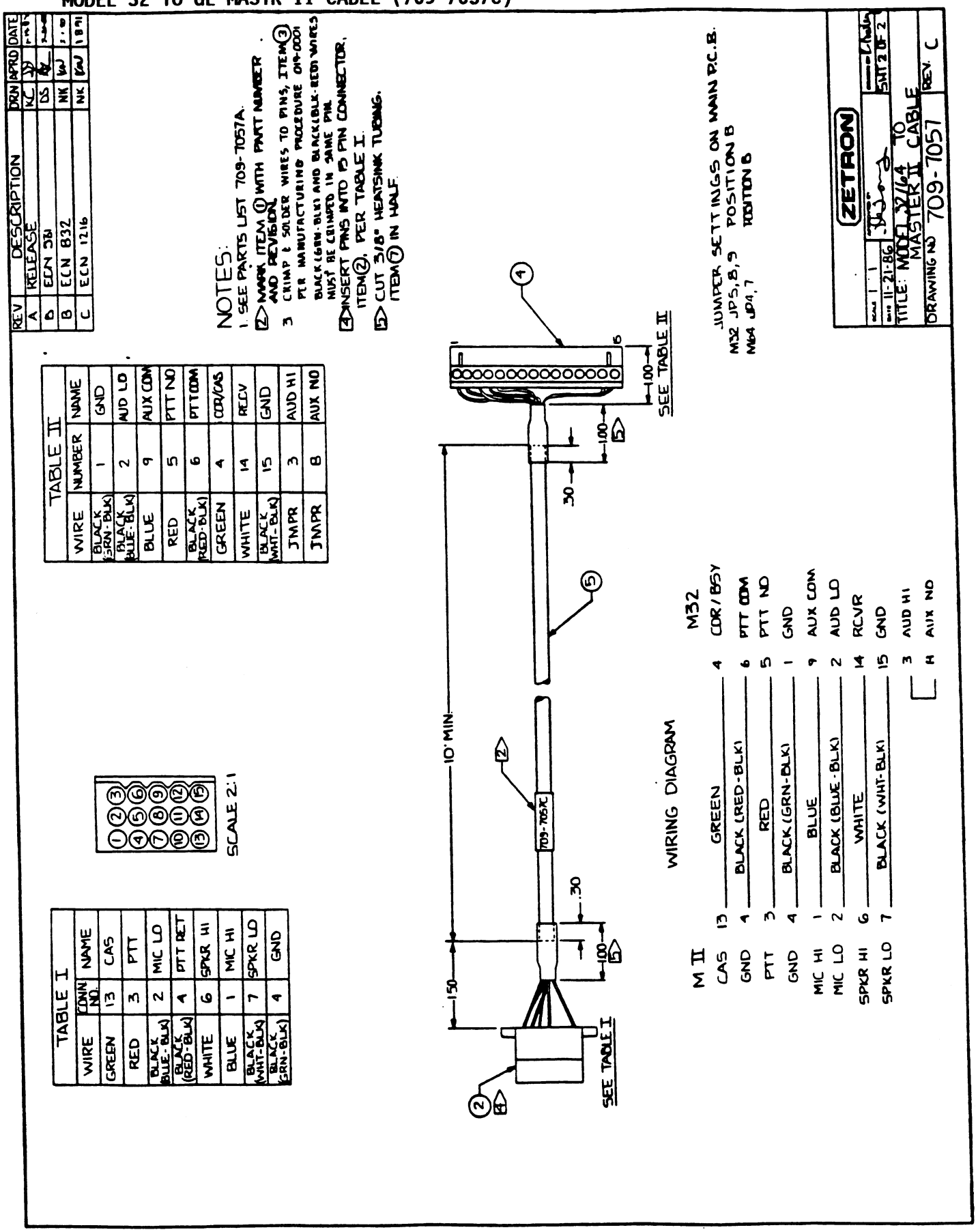
DIAL CLICK DETECTOR SILKSCREEN (702-9010A)



MODEL 32 TO GE CUSTOM MVP CABLE (709-7054A)



MODEL 32 TO GE MASTR II CABLE (709-7057C)



MODEL 32 GENERIC RADIO CABLE (709-7149A)

REVISIONS				
REV	DESCRIPTION	DRAWN	APPRVD	DATE
A	RELEASE	NK		
A	ECN 1299	NK	[illegible]	4-22-91

NOTES:

1. ON ONE END OF CABLE, ITEM 3, STRIP OUTER JACKET 4.50".
2. CUT WIRES PER TABLE 1.
3. MARK PART NUMBER & REVISION ON CABLE, PER MANUFACTURING PROCEDURE 019-0001.
4. PUT CABLE AND INSTALLATION NOTE IN PLASTIC BAG, ITEM 5.

ITEM	QTY	PART NUMBER	DESCRIPTION
6.	1.5"	525-0375	3/8" SHRINK TUBE
5.	1	449-9041	7x10 PLASTIC BAG
4.	72"	408-0016	8 COND SHLD CABLE
3.	1	401-0058	15-POS BLOCK FEMALE
2.	2	265-0001	TY-WRAP STANDARD
1.	1	011-7149	INSTALLATION NOTE

DRN NK 4-4-90
CHK
APV

TOLERANCES (EXCEPT AS NOTED): DECIMAL ±.XX ±.01, ±.XXX ±.005; ANGULAR ± 1°; SCALE: 1 = 1; SHEET: 1 OF 1

ZETRON
ZETRON, INC. 12335 134TH COURT N.E., REDMOND, VA 98052

TITLE: MODEL 32 GENERIC RADIO CABLE

DRAWING NUMBER 709-7149 REV: A SIZE: B

DO NOT SCALE DRAWING

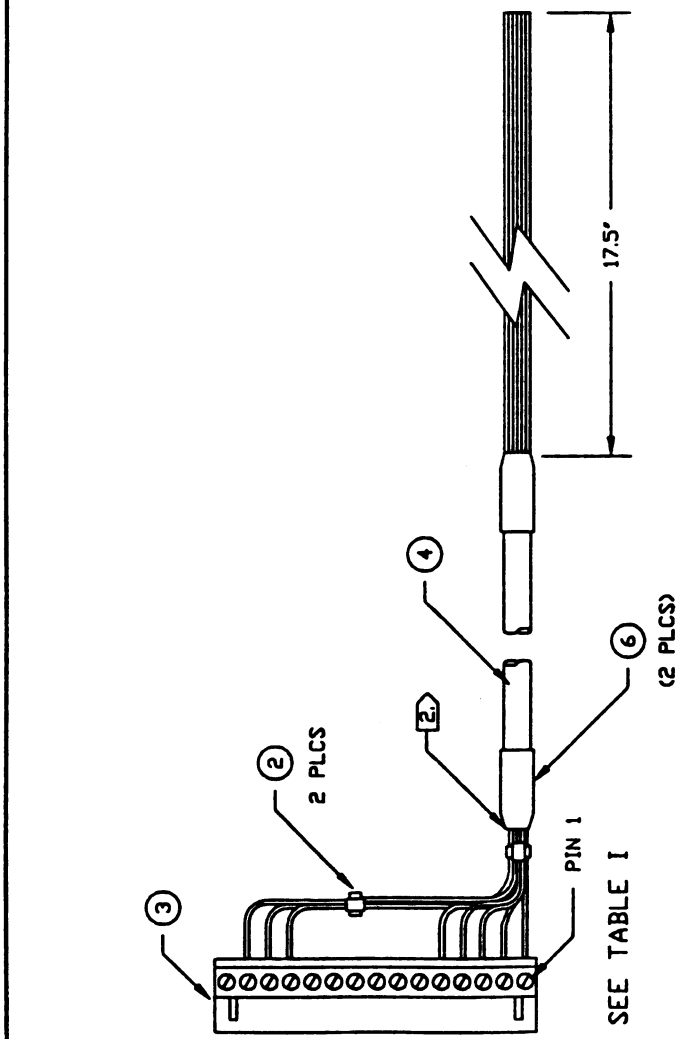


TABLE 1

COLOR	LENGTH	PIN	FUNCTION
BRAID/BLK	1.70"	1	GROUND
BROWN	1.90"	2	AUDIO LOW
BLUE	2.10"	3	AUDIO HIGH
YELLOW	2.30"	4	COR/BUSY
ORANGE	2.50"	5	PTT N.O.
RED	3.90"	12	DIGITAL DATA
GREEN	4.10"	13	DIGITAL MODE
WHITE	4.30"	14	RX AUDIO

10. QUICK REFERENCE

PAGER SETTINGS

Pager Number or Range xxx-xxx	Valid/ Invalid V/I	Substituted to xxx-xxx	Talk Code 0/1/2/3	One-Way/ Two-Way 1/2
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__
____-____	__/__	____-____	__/__/__/__	__/__

PROGRAMMING RECORD

In the space below, record the special programming commands that you always use to configure your DAPT-Jr after a Full Setup (#30 000 200) or just a Pager Setup (#30 000 201):

	Command	on DTMF	Phone	Action Performed
1.	_____	_____	____	_____
2.	_____	_____	____	_____
3.	_____	_____	____	_____
4.	_____	_____	____	_____
5.	_____	_____	____	_____
6.	_____	_____	____	_____
7.	_____	_____	____	_____
8.	_____	_____	____	_____
9.	_____	_____	____	_____
10.	_____	_____	____	_____
11.	_____	_____	____	_____
12.	_____	_____	____	_____
13.	_____	_____	____	_____
14.	_____	_____	____	_____
15.	_____	_____	____	_____
16.	_____	_____	____	_____
17.	_____	_____	____	_____
18.	_____	_____	____	_____
19.	_____	_____	____	_____
20.	_____	_____	____	_____
21.	_____	_____	____	_____
22.	_____	_____	____	_____
23.	_____	_____	____	_____

INTERNATIONAL MORSE CODE TABLE

Character	International Morse	Character	International Morse
A	·−	S	···
B	−···	T	−
C	−·−·	U	··−
D	−··	V	···−
E	·	W	·−−
F	··−·	X	−··−
G	−−·	Y	−·−−
H	····	Z	−−··
I	··	1	·−−−−
J	·−−−	2	··−−−
K	−·−	3	···−−
L	·−··	4	····−
M	−−	5	·····
N	−·	6	−····
O	−−−	7	−−···
P	·−−·	8	−−−··
Q	−−·−	9	−−−−·
R	·−·	0	−−−−−

PROGRAMMING COMMAND NOTES

The programming command summary on the following page is a quick reference to all of the Model 32 DAPT-Jr programming commands. Some of these commands only work with terminals that have certain Options installed as follows:

Std = Standard (no special options needed)
2Way = Talkback Paging Option (with 1000-call)
2T = 2-Tone Paging Format Option
5/6T = 5/6-Tone Paging Format Option
POC = POCSAG Paging Format Option
HSC = HSC Paging Format Option
GOL = GOLAY Paging Format Option
Clik = Dial Click Detector Option

The following table also contains certain special codes as a shorthand way of representing what to key in on the DTMF programming phone.

nnn, fff = Three separate number keys (0-9), representing a 3-digit pager code (000-999). On 100-call terminals, the pager code must be 3 digits long; the leading 0 MUST BE KEYED!

000 = Just that. Key 0 0 0 on the DTMF phone pad.

ccc or sss = Any three keys available on a full 16-key DTMF keypad. This includes 0-9, #, ABCD, but not *.

kk kk ... = Special pairs of 2-digit DTMF keys used for entering the Station IDs. See Section 4.

d or dd = Number digits 0-9
t or tt = One- or two-digit number representing a time. In some cases, a decimal point or trailing 0 is assumed.

COMMAND	OPT	DESCRIPTION	DEFAULT SETTINGS
000 180 tt	Std	Set Tx Key-Up Delay in Tenths of Seconds	1.0 sec
000 181	Std	Enable Mobile Channel ID (for Shared Mobile Channels)	
000 182	Std	Disable Mobile Channel ID	Paging Ch.
000 183	Std	Set ID interval to 15 Minutes	15 min
000 184	Std	Set ID interval to 30 Minutes	
000 185	Std	Inverted Digital Data Polarity	
000 186	Std	Normal Digital Data Polarity	Normal
000 187	Clik	Normal Dial Click Detection	Normal
000 188	Clik	Auto-Calibrating Dial Click Detection	
000 189	Std	Enable Unattended Auto-Page	
000 190	Std	Disable Unattended Auto-Page	Disable
000 194	Std	Start Selector Testing Mode	
000 198	Clik	Start Dial Click Check Mode; with beeps	
000 199	Clik	Start Dial Click Adjust Mode; no beeps	
000 200	Std	Set up all memory parameters to defaults	
000 201	Std	Set up Pager memory only to defaults	
nnn 202	Std	Validate Pager nnn	All Pagers Valid
nnn 203	Std	Invalidate Pager nnn	
nnn 205	Std	Clear Substitution for Pager nnn	
nnn 206 mmm	Std	Substitute Pager mmm for Pager nnn	None Substituted
nnn 207 d	Std	Assign Talk Code d (0-3) to Pager nnn	
000 208 d	Std	Assign Talk Code d (0-3) to All Pagers	All Talk Code 1
000 209 tt	Std	Set Talk Code 0 to tt (00-99 sec)	0 sec
000 210 tt	Std	Set Talk Code 1 to tt (00-99 sec)	10 sec
000 211 tt	Std	Set Talk Code 2 to tt (00-99 sec)	20 sec
000 212 tt	Std	Set Talk Code 3 to tt (00-99 sec)	30 sec
000 213	Std	Display All Invalid Pagers	None Invalid
000 216	Std	Display All Pager Substitutions	None Substituted
000 217	Std	Verify Station ID	Empty ID
000 219 kk kk..	Std	Set Station ID	
sss 221	Std	Set Security Code to sss (Off is 000)	No Security
ppp 222	Std	Set Program Mode Access Code to ppp	#30
nnn 225	2Way	Set Pager as Two-Way for Talkback	
nnn 226	2Way	Set Pager as One-Way	All One-Way
000 227 tt	Std	Set Rings-before-Ans Delay (0.0-9.9 rings)	1.0 rings
000 234 tt	2Way	Set Two-Way Call Time tt0 (000-990 sec)	90 sec
000 235 tt	2Way	Set Mobile Activity Time tt (00-99 sec)	30 sec
000 236 tt	2Way	Set Warning Beep Time tt0 (000-990 sec)	10 sec
000 238 tt	2Way	Set Mobile COR Hold Timet.t (0.0-9.9 sec)	0.5 sec
000 241	2Way	Disable Mobile Originate	Originate Off
000 242	2Way	Enable Mobile Originate	
000 244 nnnn	2Way	Set 8-digit Auto Dial Phone Number to nnnn	Empty
000 245	2Way	Disable Landline Security Checking	No Checking
000 246	2Way	Disable Mobile Security Checking	No Checking
000 247	2Way	Disable Toll Call Checking	No Checking
000 248	2Way	Set 1- Toll Call Checking	
000 249	2Way	Set 0- Toll Call Checking	
000 250 n	2Way	Set Dialing Mode 0=Pulse, 1=Straight Thru	0 = Pulse
000 255	Std	Exit Program Mode ('*' key also works)	

For the following commands a 100-call block of pagers must first be selected using the 000 100 b (select block of pagers for programming) command above. If no block has been selected then these commands will not operate.

COMMAND	DESCRIPTION	DEFAULT SETTINGS
000 100 b	Set 100 pager block for programming*	No Block Selected
000 101	Clear block of pager memory	
000 102	Validate block of pagers	Block Validated
000 103	Invalidate block of pagers	
000 104	Clear Substitutions in selected block	
000 105	Set block as Two-Way for Talkback	
000 106	Set block as One-Way	Block One-Way
000 107 d	Assign Talk Code d (0-3) to selected block	Talk code 1

* Note: for 1000-call terminal only

2-TONE COMMAND SUMMARY (2T OPTION)

000 120	Assign 2-Tone Format to selected block	2-TONE Initial
000 121 d	Set Tone Timing (per Table 1)	0 = 1/0/3/8
000 122 d	Set Diagonal Tone/Group Call (per Table 2)	0 = Group Call
000 123 d	Set Diagonal Placement. 1=1st, 2=2nd Tone	1 = 1st Tone
000 124 dd	Set 2-Tone 1st Tone Group (per Table 3)	01 = Mot 1
000 125 dd	Set 2-Tone 2nd Tone Group (per Table 3)	01 = Mot 1
000 126 d	Set Reach Block, Fast Timing (selects Reach format)	
000 127 d	Set Reach Block, Slow Timing	

HSC FORMAT COMMAND SUMMARY (HSC OPTION)

000 130	Assign HSC format to selected block	HSC Initial
000 131 nnn	Set capcode prefix digits	000xx = capcode
000 132 d	Set pager function to d (per Table 4)	0 = Tone Only
000 133 d	Set service block to d (0-9)	0
000 134 d	Set beep duration to d (x 1.25 sec)	3
000 135 d	Set group call to d (per Table 5)	0 = none
000 136 d	Set repeat page count d (0-3)	0
000 137 tt	Set HSC battery saver interval to tt sec	0 = off

* battery saver interval is used for all HSC pagers

000 138 ccccc s Reprogram a pager's RCC ID 'NNN', capcode 'ccccc', service block 's', and beep duration 's'.

5/6-TONE COMMAND SUMMARY (5/6T OPTION)

000 150	Assign 5/6-Tone Format to selected block	5/6-TONE Initial
000 151 pnnn	Set capcode prefix digits. n=digits p=preamble (use DTMF # key for no preamble)	0-000
000 152 f	Set Function; 1=Single, 2=Dual Addressed Pagers	1
000 153 d	Set Tones and Timing (per Table 6)	0 = EIA/USA
000 154 d	Set Repeat Page Count d (0-3)	0 = No Repeat

POCSAG FORMAT COMMAND SUMMARY (POC OPTION)

000 160	Assign POCSAG Digital Format to selected block	POCSAG Initial
000 161 nnnnn	Set capcode prefix digits nnnnn	00000xx = capcode
000 162 f	Set Pocsag function digit (per Table 7)	1 = Tone Only

GOLAY FORMAT COMMAND SUMMARY (GOL OPTION)

000 170	Assign Golay Digital Format	GOLAY Initial
000 171 nnnn	Set capcode prefix digits nnnn	0000xx capcode
000 172 f	Set Golay function digit (per Table 8.)	0
000 173 d	Set Display Type; 0=numeric, 1=alpha	0 = Numeric

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Table 1. - 2-TONE TIMING SELECTION (COMMAND 000 121)

Entry	1st	Gap	2nd	Group	Type
0	1.0	0.0	3.0	8.0	MOT T&V (default)
1	1.0	0.25	3.0	8.0	GE T&V
2	0.4	0.0	0.8	8.0	MOT TONE
3	1.0	0.0	3.0	6.0	NECB
4	1.0	0.25	3.0	6.0	NECA
5	1.0	0.0	1.0	4.0	NECC
6	0.4	0.0	0.8	4.0	NECM
7	0.5	0.0	0.5	3.0	NECL
8	0.4	0.0	0.4	3.0	NECD

Table 2. - 2-TONE DIAGONAL TONE SELECTION (COMMAND 000 122)

Entry	Diag. Freq.
0	Group Call (default)
1	Standard
2	569.1 Hz
3	979.9 Hz
4	742.5 Hz
5	953.7 Hz

Table 3. - 2-TONE TONE GROUP SELECTION (COMMAND 000 124 / 000 125)

Entry	Group
01	MOT 1 (default)
02	MOT 2
03	MOT 3
04	MOT 4
05	MOT 5
06	MOT 6
07	MOT A
08	MOT B
09	MOT Z
10	GE A'
11	GE B'
12	GE C'
13	MOT 10
14	MOT 11

Table 4. - ZETRON HSC FUNCTION PLAN (COMMAND 000 132)

Entry	Function
0	Tone only (default)
1	Tone + Voice
2	Tone + Display, "C" + 12 digits
3	Tone + Display, Large Phone + 12 digits
4	Tone + Display + Voice, "C" + 12 digits
5	Tone + Display + Voice, Large Phone + 12 digits
6	Priority; Tone + Display, "C" + 12 digits
7	Priority; Tone + Display, Large Phone + 12 digits
8	Priority; Tone + Display + Voice, "C" + 12 digits
9	Priority; Tone + Display + Voice, Large Phone + 12 digits
#	User enters function digit (see note 1)

Table 5. - HSC GROUP CALL (COMMAND 000 135)

Entry	Meaning
0	Individual calls (default)
1	Groups of 9 pagers accessed by b00, b11, . . . b88, b99
2	Groups of 99 pagers accessed by b00 (b=HSC block number)

Table 6. - 5-TONE TONE/TIMING SELECTION (COMMAND 000 153)

Entry	STD.
0	EIA (default)
1	ZVEI
2	CCIR
3	CCITT
4	EURO

Table 7. - ZETRON POCSAG FUNCTION PLAN (COMMAND 000 162)

Entry	Function
0	Invalid
1	Tone Only, pager function 1 (default)
2	Tone Only, pager function 2
3	Tone Only, pager function 3
4	Tone Only, pager function 4
5	Display, pager function 1
6	Display, pager function 2
7	Display, pager function 3
8	Display, pager function 4
9	Invalid
#	User enters function digit (see note 1)

Table 8. - ZETRON GOLAY FUNCTION PLAN (COMMAND 000 172)

Entry	Function
0	Tone Only function 0 (default)
1	Tone + Voice function 1
2	Tone + Voice function 2
3	Tone + Voice function 3
4	Tone + Voice function 4
5	Display function 5
6	Display function 6
7	Display function 7
8	Display function 8
9	Tone Only function 9
#	User enters function digit (see note 1)

Notes on message entry for HSC & POCSAG formats;
"*" shows as a hyphen "-".
"#" signals end of message.
"**" will erase current message and start over.

Special notes:
1- User entered functions will not work with mobile to mobile paging.

UNDERSTANDING THE TWO-TONE CODING SYSTEM

This is a brief guide to the two-tone coding system. It defines the terminology, such as "tone group' and "code plan", and tells how to use the coding charts to determine the tone frequencies of a certain two-tone pager.

The Reeds

The first step in understanding the two-tone coding system is understanding the distinguishing characteristics of a two-tone sequential pager. Two-tone pagers contain two reeds or active filters tuned to specific frequencies. These reeds can be referred to as the A reed and the B reed. They set off the pager's alerting mechanism (e.g. bell or vibrator) or open the receiver for a voice transmission when they detect tone A followed by tone B over the radio channel.

Tone Groups

To coordinate paging equipment, standardized sets of frequencies for the A and B tones have been developed by pager manufacturers such as Motorola and GE. Two-tone sequential pagers use the 140 tones that fall between 288.5 Hz and 2468.2 Hz. For organizational purposes, these 140 tones have been divided into the 14 "tone groups" shown in table 2.

Code Plans

Each pager contains two reeds, and because 140 frequencies are available for each reed, there are about 19,600 possible reed combinations. To bring order to the reed coding process, the possible combinations are organized into groups of 1000 pager codes known as "code plans" (table 1). About 25 conventional code plans have been created from the different combinations of the 140 tones. There is a Mot B code plan, a Mot C code plan, and so on.

Each code plan in table 1 is broken down into 10 blocks of 100 pager codes. The blocks are numbered 0 through 9. As you look at a certain 100-block within a certain code plan in table 1, you'll see that it's referred to with a pair of numbers, such as 1+2 or 5+3. This pair of numbers signifies all pagers whose A reed is from the first digit's tone group and whose B reed is from the second digit's tone group. For instance, 5+3 refers to all pagers with an A reed from tone group 5 and a B reed from tone group 3.

A block can be referred to according to its position on the chart. The fourth block in Code Plan B (1+2), labeled 4xx in the table, can be called the 400-block of Code Plan B. The seventh block in D (5+1) can be called the 700-block of Code Plan D, and so on.

Pager Capcode

Each two-tone pager is given a four-character code or address that tells which two tones activate it. Examples of pager addresses are B123, F561, and T625. From this address, the frequencies of the two tones can be determined.

The first two characters of an address specify the 100-block to which the address belongs. If a pager address begins with B5, for instance, it belongs to the 500-block of Code Plan B. When this block is looked up on the charts, a designation of 1+3 is found; thus, the B5 pager has a first tone that comes from tone group 1, and a second tone that comes from tone

group 3. The last two digits of a pager address simply point to specific A and B tones within the two tone groups.

Example
As an example, consider pager address B542. Looking up B5 in table 1 gives us 1+3, which means the tones for A and B are taken from tone groups 1 and 3 respectively. The 4 in B542 means the A tone is the fourth tone in tone group 1, which, from table 2, is 410.8 Hz. The 2 means the B tone is the second tone in tone group 3, or 296.5 Hz.

Summary
The letter of an address selects a code plan. The first number selects a code plan. The first number selects a 100-block, which is all the possible combinations of two tone groups. The last two digits locate a combination within the 100-block.

TABLE 1. MOTOROLA AND GE CODE PLANS

	Code Plans								
Pager Capcode	Mot B Groups	Mot C Groups	Mot D Groups	Mot E Groups	Mot F Groups	Mot G Groups	Mot H Groups	Mot J Groups	Mot K Groups
0xx	2+4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1xx	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1	1+1
2xx	2+2	2+2	2+2	2+2	1+3	1+3	1+3	1+4	1+4
3xx	3+3	1+2	1+2	1+2	3+3	3+3	3+3	4+1	4+1
4xx	1+2	4+4	1+5	2+1	4+4	3+1	3+1	4+4	4+4
5xx	1+3	1+4	5+5	1+6	3+1	5+5	1+6	5+5	1+6
6xx	2+1	2+1	2+1	6+6	1+4	1+5	6+6	1+5	6+6
7xx	3+1	4+1	5+1	6+1	4+1	5+1	6+1	4+5	6+1
8xx	2+3	2+4	2+5	2+6	3+4	3+5	3+6	5+4	4+6
9xx	3+2	4+2	5+2	6+2	4+3	5+3	6+3	5+1	6+4
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

	Code Plans								
Pager Capcode	Mot L Groups	Mot M Groups	Mot N Groups	Mot P Groups	Mot Q Groups	Mot R Groups	Mot S Groups	Mot T Groups	Mot U Groups
0xx	N/A	4+2	4+2	4+2	4+2	4+2	4+2	4+2	4+2
1xx	1+1	2+3	2+3	2+3	2+4	2+4	2+5	3+4	3+4
2xx	1+5	2+2	2+2	2+2	2+2	2+2	2+2	4+3	4+3
3xx	5+1	3+3	3+3	3+3	4+2	4+2	5+2	3+3	3+3
4xx	1+6	4+4	3+2	3+2	4+4	4+4	2+6	4+4	4+4
5xx	5+5	3+2	5+5	2+6	5+5	2+6	5+5	5+5	3+6
6xx	6+6	2+4	2+5	6+6	2+5	6+6	6+6	3+5	6+6
7xx	6+1	4+2	5+2	6+2	4+5	6+2	6+2	4+5	6+3
8xx	5+6	3+4	3+5	3+6	5+4	4+6	5+6	5+4	4+6
9xx	6+5	4+3	5+3	6+3	5+2	6+4	6+5	5+3	6+4
Groups:	1,5,6	2,3,4	2,3,4,5	2,3,4,6	2,4,5	2,4,6	2,5,6	2,3,4,5	2,3,4,6

	Code Plans							
Pager Capcode	Mot V Groups	Mot W Groups	Mot Y Groups	Mot MT Groups	GE X Groups	GE Y Groups	GE Z** Groups	Special Groups
0xx	4+2	4+2	N/A	4+2	A′+A′	B′+B′	A′+A′	Z+Z
1xx	3+5	4+6	A+A	1+1	B′+A′	C′+B′	C′+A′	1+1
2xx	5+3	6+4	B+B	2+2	B′+B′	C′+C′	C′+C′	2+2
3xx	3+3	5+6	Z+Z	1+2	A′+B′	B′+C′	A′+C′	3+3
4xx	3+6	4+4	A+B	4+4	C′+C′	N/A	N/A	4+4
5xx	5+5	5+5	A+Z	5+5	C′+A′	N/A	N/A	5+5
6xx	6+6	6+6	B+A	2+1	C′+B′	N/A	N/A	6+6
7xx	6+3	4+5	Z+A	4+5	A′+C′	N/A	N/A	A′+A′
8xx	5+6	5+4	B+Z	5+4	B′+C′	N/A	N/A	B′+B′
9xx	6+5	6+5	Z+B	2+4	N/A	N/A	N/A	C′+C′
Groups:	2,3,4,5,6	2,4,5,6	A,B,Z	1,2,4,5	A′,B′,C′	B′,C′	A′,C′	

Notes: **GE 100-call plan Z is tone groups C′+C′; use (100-Call format).
For capcodes ending in double-digits using tone group twice, (example: 122 in code plan C), use diagonal as one of the tones.

TABLE 2. MOTOROLA AND GE TONE GROUP FREQUENCIES

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

Tone Number	Tone Groups Mot B	Mot Z	GE A′	GE B′	GE C′	Mot 10	Mot 11
0	371.5	346.7	682.5	652.5	667.5	1472.9	1930.2
1	412.1	384.6	592.5	607.5	712.5	1513.5	1989.0
2	457.1	426.6	757.5	787.5	772.5	1555.2	2043.8
3	507.0	473.2	802.5	832.5	817.5	1598.0	2094.5
4	562.3	524.8	847.5	877.5	862.5	1642.0	2155.6
5	623.7	582.1	892.5	922.5	907.5	1687.2	2212.2
6	691.8	645.7	937.5	967.5	952.5	1733.7	2271.7
7	767.4	716.1	547.5	517.5	532.5	1781.5	2334.6
8	851.1	794.3	727.5	562.5	577.5	1830.5	2401.0
9	944.1	881.0	637.5	697.5	622.5	1881.0	2468.2
Diagonal Tone:	979.9	979.9	742.5	742.5	742.5	none	none

GENERAL ENCODING PLANS

Pager Capcode	General Plan Tone Groups	General Plan Diagonal Tone	Modified General Plan Tone Groups	Modified General Plan Diagonal Tone	General Alternate Plan Pager Capcode	General Alternate Plan Tone Groups
0xx	4+2	N/A	N/A	N/A	0xx	N/A
1xx	1+1	569.1	1+1	569.1	1xx	953.7 + Mot 1
2xx	2+2	979.9	2+2	979.9	2xx	953.7 + Mot 2
3xx	1+2	N/A	3+3	569.1	3xx	979.9 + Mot 2
4xx	4+4	569.1	4+4	569.1	4xx	953.7 + Mot 4
5xx	5+5	979.9	5+5	979.9	5xx	953.7 + Mot 5
6xx	2+1	N/A	6+6	979.9	6xx	979.9 + Mot 1
7xx	4+5	N/A	N/A	N/A	7xx	979.9 + Mot 5
8xx	5+4	N/A	N/A	N/A	8xx	979.9 + Mot 4
9xx	2+4	N/A	N/A	N/A		
**Axx	3+3	569.1	N/A	N/A		
Tone Groups:	1,2,3,4,5		1,2,3,4,5,6			

Notes: 1) On General and Modified General plans, there are different diagonal tones for different pager blocks.
2) **General has an eleventh pager block with capcodes 'Axx', which is not coded on the Model 15.
3) For General Alternate Code Plan, last two digits of capcode are the same as each other.

5/6-TONE - FREQUENCIES (IN HERTZ) AND TIMINGS (IN MILLISECONDS)

Tone Number	Tone Series EIA	CCIR	ZVEI	CCITT	EURO	EEA
0	600	1981	2400	400	980	1981
1	741	1124	1060	697	903	1124
2	882	1197	1160	770	833	1197
3	1023	1275	1270	852	767	1275
4	1164	1358	1400	941	707	1358
5	1305	1446	1530	1209	652	1446
6	1446	1540	1670	1335	601	1540
7	1587	1640	1830	1477	552	1640
8	1728	1747	2000	1633	511	1747
9	1869	1860	2200	1800	471	1860
X	2010	2247	970	N/A	N/A	N/A
Repeat	459	2110	2600	2300	1063	2110
Tone Len	33	100	70	100	100	40
Preamble	690	690	690	690	690	690
Pream-Gap	65	65	65	65	65	65
X Tone	65	100	70	N/A	N/A	N/A

Note: Group call tones are not supported. Use the Zetron Editable Stack option to provide pager groups.

5/6-TONE - CAPCODES

Five-Tone	NNNNN D	(in each format block of 100 pagers, the first three digits are factory set)
Six-Tone	P NNNNN D	(in each format block of 100 pagers, the preamble and first three digits are factory set)

P	= preamble digit 0-9	(battery saver tone)
NNNNN	= address, digits 0-9	
D	= dual address X-tone	(in each format block of 100 pager numbers, the even numbers call the 1st address, and the odd numbers call the 2nd addr)

HSC DISPLAY FORMAT

The HSC format, based upon circuit chips distributed by MX-COM, uses tones and timing similar to 5/6-Tone. HSC (Hexadecimal Sequential Code) adds six new tones to the ten 5/6-Tone tones for a total of 16 (hence the name hexadecimal). These extra tones activate special functions in the pagers such as voice mode, display mode, battery saver, and display symbols. The HSC paging protocol provides display paging on systems using traditional analog transmitters without the expense of digital FSK transmitters. However, to guarantee flat low distortion and to maximize performance the system audio design for HSC paging requires more care than other tone formats. See paragraphs below for design recommendations.

HSC TONE FREQUENCIES AND TIMINGS

HSC Tone	EIA/ USA	CCIR	ZVEI	EEA
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
A	2151	2400	2800	1055
B	2435	930	810	930
C	2010	2247	970	2247
D	2295	991	886	991
E	459	2110	2600	2110
F				
Tone Length	33	100	70	40
Pream-Gap	64	290	140	100

HSC CAPCODES

NNNNN S B (in each block of 100 pagers, the first three address digits are factory set, along with the service block. Group call is available to call ten groups of 9 pagers, or one group of 99 pagers. The group call numbers are those ending in double digits 11, 22...)

NNNNN = pager address
S = service block (0-9) (battery saver block)
B = beep delay (normally 3, in 1.25-second steps)

HSC MESSAGES

The DAPT-Jr supports tone-only, tone+voice, message only, priority message, or tone+voice+message for each block of 100 pager numbers. For messages, the HSC pager will come on with the "C" code letter lit and display the message entered by the phone caller. The digits 0-9 and a hyphen (by pressing the '*' key) will allow easy reading of messages that look like telephone numbers.

DTMF key	Character in Pager Display
0-9	0-9
*	- (hyphen)

HSC SYSTEM DESIGN

As you can see, the tone range for HSC tone format encompasses a wide range of frequencies of very short durations. This places a good deal of importance on audio pre-emphasis/de-emphasis in a radio to guarantee flat tone transmission. A single pole filter present in many microphone circuits pre-emphasizes the tones generated by the terminal to a point where decoding by a pager is not possible.

FM Transmitter deviation for HSC should be set for about ±3.5 kHz to maximize paging range, but not much more to avoid tone clipping distortion which can cause unreliable pager decoding. Also be careful that any link equipment between the DAPT-Jr and the transmitter does not introduce tone distortion or produce much audio level compression which may fool HSC tone decoders.

Also note that the HSC "A" tone of 2151 Hertz is very close to the 2175 Hertz tone often used and removed by tone remote transmitter control equipment. This tone is important for group calling and for voice enabling functions in the HSC pager. Therefore, it is NOT recommended that tone remote control equipment be engineered into the paging system. Instead, co-locate the paging terminal and the transmitter. If this is not possible, then a DC remote should be used. Call a Zetron Applications Engineer for further information.

REACH ENCODING PLAN

Tone Number	Freq.	Tone Number	Freq.	Tone Number	Freq.	Tone Number	Freq.
0	3960.0	15	2354.0	30	1400.0	45	832.0
1	3824.0	16	2274.0	31	1352.0	46	804.0
2	3694.0	17	2196.0	32	1306.0	47	776.0
3	3568.0	18	2121.0	33	1261.0	48	750.0
4	3446.0	19	2049.0	34	1219.0	49	725.0
5	3329.0	20	1980.0	35	1177.0	50	700.0
6	3215.0	21	1912.0	36	1137.0	51	676.0
7	3106.0	22	1847.0	37	1098.0	52	653.0
8	3000.0	23	1784.0	38	1061.0	53	631.0
9	2898.0	24	1723.0	39	1025.0	54	609.0
10	2799.0	25	1664.0	40	990.0	55	588.0
11	2704.0	26	1608.0	41	956.0	56	568.0
12	2612.0	27	1553.0	42	923.0	57	549.0
13	2523.0	28	1500.0	43	892.0	58	530.0
14	2437.0	29	1449.0	44	862.0	59	512.0
						60	495.0

ZETRON TONE GROUPS FOR REACH ENCODING

Tone Number	Tone Groups Z1	Z2	Z3	Z4	Z5
0	1980.0	1177.0	1400.0	832.0	588.0
1	2704.0	1608.0	1912.0	1137.0	804.0
2	2612.0	1553.0	1847.0	1098.0	776.0
3	2523.0	1500.0	1784.0	1061.0	750.0
4	2437.0	1449.0	1723.0	1025.0	725.0
5	2354.0	1400.0	1664.0	990.0	700.0
6	2274.0	1352.0	1608.0	956.0	676.0
7	2196.0	1306.0	1553.0	923.0	653.0
8	2121.0	1261.0	1500.0	892.0	631.0
9	2049.0	1219.0	1449.0	862.0	609.0

REACH CODE PLAN

Pager Capcode	Indiv. Call Tone Groups x + y
0yx	Z5+Z3
1xy	Z1+Z2
2yx	Z2+Z1
3xy	Z3+Z4
4yx	Z4+Z3
5xy	Z1+Z4
6yx	Z4+Z1
7xy	Z1+Z5
8yx	Z5+Z1
9xy	Z3+Z5

Note that the ones/tens digit encoding, shown by 'x' and 'y' reverses position for each 100 pager block. In GE/Motorola plans, 1st tone is always tens digit, and 2nd tone is ones digit.

For REACH group call, ten group calls are accessible using pager codes b00, b11, b22,... b99, that generate the ten group call tones from the tone group Z1. The group calls activate 1st tone Z1 pagers (capcodes 1xx, 5xx, and 7xx).

MODEL 32 DAPT JR HARDWARE CONFIGURATION SHEET

Zetron Order Number: 50939

Serial Number: _____

Software Version: 1.1

Terminal Type: 100-Call [] 1000-Call [X]

Paging Format: 2-Tone [X] HSC [] 5/6-Tone [] POCSAG [X] Golay []

Dial Click Detector Option []

Radio Cable: GE Custom MVP [] GE MASTR II [] Motorola PURC []

240V AC Wall Transformer []

Notes: You can change the settings below; mark them for future reference
if different from the configuration sheet from the factory.
* or (---) are normal factory settings.

Telephone Setting: (see Manual- Section 7.)

Selector Level []:	Matrix DID []	Selector Feed Digits: ____ (factory set)
PBX Loop Trunk []:	Matrix DID []	
PBX E&M Tie Trunk []:	Matrix E&M []	
End-to-End Line [X]:	Matrix E-E [X]	
Ground Start []:	Matrix E&M []	

Jumpers: (see Manual- Section 7.)

JP1- +10V	: IN*[] OUT []		JP7- MODE	: A*[]	B []
JP2- DC PWR	: A*[] B []		JP8- COR	: A*[]	B []
JP3- +5V	: IN*[] OUT []		JP9- COR POL	: A*[]	B []
JP4- PTT	: A*[] B []		JP10-PRE-EMP	: A*[]	B []
JP5- ATTEN	: A*[] B []		JP11-PROG	: A*[]	B []
JP6- DE-EMP	: A*[] B []		JP12-2K 8K	: A*[]	B [X]

MODEL 32 DAPT JR PROGRAMMING CONFIGURATION SHEET

(Factory default values are indicated in parentheses or by a *.)

Programmed Settings: (see Manual- Section 4.)
Station ID (Empty):_____
Security Code (000):_____
Program Access Code (#30):_____
Answer Delay (1.0 rings):_____
Key-up Delay (1.0 sec):_____
Digital Polarity: Norm*[] Rev []

Talk Code 0 (0sec):_____
Talk Code 1 (10sec):_____
Talk Code 2 (20sec):_____
Talk Code 3 (30sec):_____
Advanced Dial Click: On*[] Off []
Unattended Auto-Page: On [] Off*[]

Talkback Settings: (see Manual- Section 5.)
Originate: Off*[] On []
Auto Phone(empty):_____
Security Check: Off*[] Land [] Mobl []
Toll Restrict: Off*[] 1- [] 0- []

Times (seconds) for:
2-Way Time Limit (090): _____
Mobile Answer (30): _____
Warning Beep (010): _____
Mobile COR Hold (0.5): _____

Paging Format Settings: (see Manual- Section 4.)

BLOCK 0_____ BLOCK 5_____

BLOCK 1_____ BLOCK 6_____

BLOCK 2_____ BLOCK 7_____

BLOCK 3_____ BLOCK 8_____

BLOCK 4_____ BLOCK 9_____

ZETRON

ZETRON MODEL 32 GENERIC RADIO INTERFACE CABLE INSTALLATION NOTE

This application note is for interfacing a Zetron Model 32 using cable # 709-7149.

ZETRON END			RADIO END
Function	Pin	Color	Connection / notes
Ground	1	Black	System Ground
	1	Braid	
Audio Low	2	Brown	600 ohm balanced input low
Audio High	3	Blue	600 ohm balanced input high
COR/Busy	4	Yellow	Channel Busy indicator
PTT N.O.	5	Orange	Transmitter Keying Analog PTT
Digital Data	12	Red	Transmitter Data input
Digital Mode	13	Green	Transmitter Mode input Digital PTT
RX Audio	14	White	Receiver Audio

RADIO INSTALLATION NOTES:

- For Tone and Voice input to the transmitter, a 600 ohm, transformer coupled audio output is provided on pins 2 and 3. For connection to pre-emphasized microphone inputs, put JP6 in "B" and JP10 in "B". For flat inputs, put JP6 in "A" and JP10 in "B" for pre-emphasized voice, or JP10 in "A" for flat voice.

- For PTT requiring a closure to ground, put JP4 in "A" to ground the common contact of the relay. For radios requiring some voltage/signal, put JP4 in "B" and connect the required voltage/signal to pin 6.

- Connect a logic signal that follows channel activity to pin 4. JP8 selects a 5V pull-up resistor. JP8 in "A" = pull-up in. JP8 in "B" = pull-up out. JP9 selects COR polarity. JP9 in "A" = active low. JP9 in "B" = active high.

- If using a binary digital format, pin 12 provides the digital data output. This is typically connected to the direct modulation input of the transmitter. Polarity can be changed via DTMF programming in the DAPT-Jr.

- If using both digital and tone, pin 13 provides a digital output mode signal. This tells the transmitter when to send digital or tone. JP7 selects the polarity of the mode signal. JP7 in "A" = digital = low. JP7 in "B" = digital = high.

- For complete installation and adjustment procedures, refer to the installation and programming sections in the manual.

011-7149A 1/1

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