ZETRON

Model 640 DAPT XTRA Paging Terminal
Installation and Repair

Part No. 025-9416C

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FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

1. This device complies with Part 68 of the FCC rules. The FCC registration number of this device, the ringer equivalence number, the facility interface code (end-to-end 02LS2 and 02GS2, DID 02RV2-T, E&M TL11M telco end and TL11E Zetron end), service order code (9.0Y and AS.3) and the connection jack type (RJ21X, RJ2GX, RJ2EX), if requested, must be reported to the telephone company. The FCC registration number and the ringer equivalence number may be found on the label attached to the device.
2. The ringer equivalence number (REN) is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. The sum of ringer equivalence numbers for all devices connected to a single telephone line should not exceed five (5.0) for reliable operation. To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.
3. If this device causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice is not practical, the telephone company will notify you as soon as possible. You will also be advised of your right to file a complaint with the FCC if you believe it is necessary.
4. The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of this equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.
5. This device must not be installed on coin-operated telephone lines or party lines.
6. Repair work on this device must be done by Zetron, Inc. or a Zetron authorized repair station. If this device is causing harm to the telephone network the telephone company may request that you disconnect the equipment until the problem is resolved.

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

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

INDUSTRY CANADA REGISTRATION

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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

CANADIAN EMC COMPLIANCE NOTICE

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

AVIS CANADIEN

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

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INTRODUCTION

Zetron Model 640 Paging Terminal

MODEL 640 OVERVIEW

The Model 640 is a low cost, fully automatic dial-access paging terminal. The Model 640 is specifically designed to provide flexible paging for industrial plants, hospitals, and low RCC applications. The Model 640 supplies the interface between the telephone and radio systems for paging applications. It performs selective signaling activation and message transmission.

Through comprehensive advanced software, the Model 640 provides features found on terminals costing significantly more. State-of-the-art microprocessor circuitry combined with meticulous engineering provides paging capabilities which rival much larger paging terminals. Even the newest alphanumeric digital display paging formats can be encoded by the Model 640. In addition, the Model 640 provides a variety of interface capabilities required for connection to the telco network, analog and digital radio systems, health care nurse call systems, and telephone answering service consoles.

FEATURES

Every feature available in the Model 640 is designed to create a small, but versatile and easily managed paging system.

Messaging Formats

The Model 640 supports six types of pages - tone-only (alert), standard voice, live voice (breakthrough), numeric-only display, alphanumeric display, and talkback. A tone-only page alerts the customer that someone has called them, but cannot indicate who or include any other information. Standard voice pages play a caller-recorded voice message over a built-in speaker on the pager. Live voice paging immediately cuts audio through from the calling party out over the air

(like a public announcement system). Numeric pages display a set of numbers (usually a phone number) that the caller keys in by way of DTMF telephone. Alphanumeric pages are text messages sent to alphanumeric-compatible display pagers. Alpha messages can be generated through a variety of input devices, including a standard touch-tone telephone. Talkback paging connects the caller directly with a paging customer who has a portable radio for 2-way communications.

System Voice Prompts

The Model 640 DAPT XTRA comes with prerecorded voice prompts that guide callers through the paging entry process. The prompts can be customized by the system operator, if desired. In addition, voice prompts can be enabled and disabled for the entire system, for a specific trunk, or for an individual subscriber.

Voice Storage

The Model 640 DAPT XTRA stores up to 280 seconds of pooled voice storage to support voice pages. The silence compression feature eliminates pauses in the caller's voice message to maximize storage space. The voice memory also is used to save messages that are interrupted by a breakthrough page for later retransmission.

Telephone Interfaces

The Model 640 is flexible enough to interface with a wide variety of telephone line types. In addition, all four trunks (with two dual-trunk cards installed) can be serviced by a different type of line. The paging terminal is compatible with E&M, DID, and End-to-End phone lines. The telephone interfaces can be initiated by ground start, loop start or wink start, depending on the specific trunk configuration. The 640 can also be connected to a PABX, an RS-232 input device, or a Zetron Model 103 (manual paging entry station).

In addition, the Model 640 can be configured to decode several types of signaling protocols. The dial click and MF (multi-frequency) options allow the paging terminal to accept feed digits other than standard DTMF.

Priority Paging

The Model 640 supports four paging priority levels. The two highest levels of priority are next-out (where the page immediately moves to the front of the queue) and breakthrough (where the page is immediately cut through to live air). Priority can be assigned per-subscriber or trunk line.

Priority paging is essential in emergency response applications, where people must receive notification in a timely manner. In addition, priority allows TNPP-networked systems to give local paging subscribers faster service than roaming customers.

Pager Formats

The Model 640 supports nearly every kind of paging format available on the market (2-tone, 5/6-tone, HSC, Golay, POCSAG, and FLEX are among the standard capabilities). This allows for easy upgrade transitions to newer formats and cost-effective use of older pagers.

Remote Transmitter Control

The Model 640 is equipped with a modem and tone encoder to remotely control transmitters over a radio or wireline link The Model 640 can control any transmitter capable of decoding analog Motorola PURC® tones. A Zetron Model 66 Transmitter can be added to control other types of transmitters that do not use the PURC® protocol.

Remote control is useful when the transmitter cannot be colocated with the paging terminal or when pages are being sent to transmitters in several zones. The Model 640 is capable of sending pages to up to 16 transmitter zones. In addition, pages can be repeated up to four times with different zone addresses, to extend the coverage area without purchasing costly simulcast equipment.

Easy System Management

The Model 640 provides several features that simplify system management. Three separate software programs come with the paging terminal. Each is installed on the office computer or is resident on the paging terminal RAM drive. The software modules are used to view and edit all aspects of the Model 640's operation.

MCU is the software package provided for office computer communications with the paging terminal. It allows the system operator to monitor system traffic (log files) and view statistics and call counts. In addition, the ZLINK portion of MCU enables the user to link into the terminal and execute various commands. Some of the most useful operations include generating test pages and viewing trunk card configuration and activity.

The Model 640 subscriber database is stored in the paging terminal and can be accessed by way of MCU or through another communications program, such as ProComm®. It configures the all system and user operating parameters. The databases determine how the paging terminal communicates with the telco and the transmission equipment.

Wide-Area Networking with TNPP or TAP

The Model 640 provides two optional methods of increasing the paging coverage area. This ensures that customers can travel outside their local area and remain accessible. TNPP (Telocator Network Paging Protocol) paging is a popular means of passing pages over a wide region. When the Model 640 is equipped with the TNPP option, it can exchange tone-only and alphanumeric display pages with other paging terminals. Pages are passed through the TNPP network with a variety of media, including dedicated wireline, packet radio, and satellite downlink. TAP (Telocator Alphanumeric Protocol) is an economical alternative to TNPP networking. It provides many of the same features, but without the expense of an RF transmission media. TAP sends pages from the Model 640 to other terminals on a dial-up phone connection by way of modem.

Other Features

The Model 640 has many other useful features, including:

- 1,500 subscriber capacity
- Two telephone interfaces (expandable to four)

- Repeat paging
- Flexible programming of multiple pager groups
- Support for alpha modem plus voice and numeric message entry on every telephone interface
- Multiple serial interfaces for direct alpha message entry
- Canned alphanumeric messages
- Modem access for programming through any dial-up line
- System alarm output
- Autobauding of the maintenance modem at 300 and 1200 baud
- Flexible password protection for individual databases, subscriber phone numbers, alphanumeric entry access, and paging terminal ZLINK connections

SYSTEM APPLICATIONS

The Model 640 is suitable for a wide variety of paging applications. The paging terminal is flexible and easy to operate, making it the ideal choice for many paging providers.

Health Care and Public Safety

The Model 640 is ideal in systems where fast, reliable paging is essential. The terminal provides priority paging, including live breakthrough, for immediate notification of emergency response teams. Detailed system logs of every page are available to track incident response and manage risk. In addition, most nurse call systems and other alphanumeric input stations are easily interfaced with the paging terminal to send detailed messages to key personnel. The Model 640 also provides an alarm output for immediate recognition of paging terminal failure.

In-Plant Systems

Many in-plant applications, including industrial, government agencies, and institutions, demand specific paging operations. The Model 640 trunks can be individually configured to interface with several telephone line types. This allows possible system access from an internal PABX, a remote telephone company central office, and a local telephone operator. The paging terminal also offers talkback paging for two-way communications with mobile or portable radios. In addition, the Model 640 has one alarm output to identify when the terminal is not operating properly.

Small Market Service Providers

The Model 640 is well suited for smaller RCC and PCP systems. The paging terminal is flexible and allows painless system growth with TNPP networking and a variety of equipment interface capabilities. Call counting, system statistics, and traffic monitoring all make system management simple and efficient, even for first-time paging providers. In addition, the system voice prompts

and voice paging features provide personalized messaging and a professional sound that customers can easily appreciate (DAPT XTRA only).

MANUAL USAGE

Understanding what the manual is saying helps you to install, program, and troubleshoot your system more quickly and easily. This section orients you on the way things are presented, so that we can "speak the same language." Descriptions follow of the way things are identified throughout the manual, and where to find what you are looking for quickly and easily.

Organization of Sections

The manual is split into several sections so that you can find the exact information you need and any related topics. The sections are organized as follows:

Specifications

This section lists the detailed operating characteristics and hardware specifications of the Model 640.

Hardware Overview

This section provides an introduction to the hardware components that make up the Model 640 paging terminal. Each board (standard and optional) is described and illustrated to help familiarize you with the system. This includes locations and settings for all jumpers, potentiometers, and external interfaces.

Communications Setup

This section describes how to link an office computer to the paging terminal. This provides an easily accessible communications link to the paging terminal to simplify the hardware installation described in Section 5.

Installation

This section describes how to install and setup the Model 640. Section 5 covers installation of the radio station (transmitter and receiver) and telco connections. Adjustment procedures are also described in this section.

Adjustment Procedures

This section describes how to adjust many of the hardware components for optimum performance. The procedures include communications with the telco trunks and radio station equipment.

Optional Equipment Installation

This section describes how to install each of the optional boards and interfaces available for the Model 640. This section can be used to add field-upgrades, verify factory-installed boards, or familiarize the technician with the components installed in the paging terminal and the entire system architecture.

Voice Prompts

This section describes how to access, backup, customize, and restore the Model 640 system voice prompts. This section only applies to the DAPT XTRA.

Troubleshooting and Repair

This section provides some useful troubleshooting and repair tips. It helps the system operator identify and correct possible problems with the system. This section allows the system operator to perform some simple repairs and modifications without the assistance of Zetron technicians. Included are front panel LED indications, progress tone descriptions, and ZLINK troubleshooting procedures.

Glossary of Terms

This section defines many of the industry-specific technical terms used in this manual.

Schematics and Parts Lists

This section provides the parts lists and schematic diagrams of the Model 640 hardware. This may be useful for troubleshooting, repair, and interfacing the paging terminal with other equipment.

Text Notational Conventions

Notational conventions are the manual text styles that identify specific types of words. For instance, it is important that you know which words refer to filenames, operator commands, screen quotes, manual titles, etc. The notational conventions will help you understand what is being said. Table 1 summarizes the text styles used in this manual.

Table 1. Table 1. Summary of Manual Text Notational Styles

Sample	What it Means
<xxxx>	the text inside the < > identifies a keyboard entry, do not include the < > in your entry (for example, <Tab> means press the “Tab” key)
Xxxx	the text that is Initial Capitalized within a sentence refers to a database or MCU menu or field (for example, Choose Locations from the Edit menu)
XXXX	the text in SMALL CAPITAL LETTERS is a system configuration filename
`xxxx`	the text in `courier font` is a screen view in MCU, the database, or ZLINK [following a plus (+) prompt]
Ⓧ	the number inside a circle identifies a unique part of a diagram or figure
‘xxxx’	the text in the ‘single quotes’ is a database field entry or a system filename

Related Manuals

Two manuals describe the Model 640. Each manual can stand alone, but cannot cover all of the information necessary to install, configure and maintain an efficient system.

The *Model 640 DAPT XTRA Installation and Repair Manual* (Part No. 025-9416) covers the hardware components of the paging terminal, installation and maintenance. This manual should be used to perform the initial installation of the paging terminal. It also provides useful trouble-shooting procedures for situations when the Model 640 is not functioning as expected.

The *Model 640 Operating and Programming Manual* (Part No. 025-9417) describes how to program the database and use the paging terminal effectively. This manual should be used to perform initial programming of the subscribers, telco line types, transmitters, and telephone access databases. It should be used by the system operator(s) to learn the databases and general use of the paging terminal. This manual also provides a useful reference during the hardware installation procedure.

Zetron recommends storing the manuals in a convenient location. For instance, the installation manual should be colocated with the equipment, and the programming manual should be colocated with the office computer. In addition, when contacting Zetron applications engineers it is very helpful if the appropriate manual(s) are handy for quick reference.

SPECIFICATIONS

GENERAL

Call Capacity	1,500 subscribers
Signaling Formats	2-tone Motorola, GE, Reach (plus custom tones and timing) 5/6-tone HSC (Hexadecimal Sequential Code) GSC (Golay Sequential Code) POCSAG (Post Office Code Standardization Advisory Group) 512 and 1200 Baud, plus voice (also known as CCIR) RPC No.1 (International Radio Consultative Committee Radio Paging Code No.1) FLEX NEC D3 Multitone Mark Series I - VI Blick RDS (optional)
Power Supply	115/230 V_{AC} ±15%, 47-63 Hz, 80W

PHYSICAL

Dimensions	5.25 in H × 17 in W × 15.5 in D 19 in rack-mount ears
Weight	16 lb.

ENVIRONMENTAL

Operating Temperature	32°F- 122°F (0°C - 50°C) without floppy disk 41°F- 113°F (5°C - 45°C) with floppy disk
Maximum Humidity	90% non-condensing (without floppy disk) 80% non-condensing (with floppy disk)

ALPHANUMERIC PAGING

Maximum characters	500
Protocols	TAP (Telocator Alphanumeric Protocol) Manual VDT operator support
Canned Alpha Messages	100 field-programmable messages of 30 characters each caller-initiated by telephone DTMF input

Modem Input

Number of Interfaces	One (1) modem per telephone interface. Each trunk is field-configurable for either direct serial or telephone access. Selection of either mode disables the other. Telephone interface can handle modem and tone/voice/numeric traffic on a per-call basis.
Modem Type	Bell 103/212 CCITT V.21/V.22
Baud Rates	300, 1200

Direct Serial Input

Number of Interfaces	One (1) serial port per telephone interface. Each trunk is field-configurable for either direct serial or trunk telephone access. Selection of either mode disables the other.
Baud Rates	150, 300, 600, 1200
Signals Supported	RS-232C - Tx Data, Rx Data, GND Null modem configuration
Connector	(2) DB 9-pin female RS-232 ports

VOICE CAPABILITIES

Pooled Voice Storage	280 seconds
Number of Simultaneous Voice Channels	5 maximum
Silence Compression	65,000 levels of sensitivity programmable 255 levels of time threshold programmable
Voice Prompts Storage	90 seconds Customizable by way of telephone by system operator
No. of Voice Prompts	16

TELEPHONE INTERFACES

Number of Interfaces	2 (expandable to 4)
Line Types	Each telco trunk field-configurable for any one of: • End-to-End (typical "home" type line) • DID (Dedicated Inbound Dialing); immediate start or wink start protocol • PABX E&M Tie Trunk Type I (2-Wire Hybrid audio)
Input Signaling	DTMF or Pulse Feed Digits Optional MF type 2A decoder Optional Dial Click decoder
Line Coupling	600Ω transformer, adjustable balance duplex hybrid
Connector	Male 50-pin connector similar to RJ2GX

TRANSMITTER INTERFACE

Transmit Audio	Balanced 600Ω transformer 250-3500 Hz ±1dB Selectable flat tone or –6 dB per octave de-emphasis Selectable flat voice or +6 dB per octave pre-emphasis
Receive Audio	Balanced 600Ω transformer Adjustable level -20 to +10 dBm Selectable flat tone or –6 dB per octave de-emphasis
Format Encoding	Analog frequency accuracy ± .02% Analog tone distortion < 0.2% Digital data stability ±2 ppm
Control Relays	Analog PTT Digital PTT Auxiliary PTT
Digital Data	RS-232C compatible Null modem cable Field-programmable polarity and timing
CAS / COR Input	Selectable polarity, TTL or contact closure
Transmitter Request	RS-232C
Transmitter Busy	Selectable Polarity, TTL or contact closure
Station ID	Field-programmable, 1200 Hz CW Morse Code at 20 WPM

Zone Address Select	4 binary outputs (for 16 zones) Open collector outputs, 40 mA sink Up to 4 sequenced zones per package
Tone Remote Control	Motorola PURC (analog) transmitter access knockdown tones

SYSTEM MANAGEMENT

Modem Access	Bell 212 Protocol 1200 Baud Accessible through any dial-up telephone interface.
Direct Serial Access	Selectable Baud Rate: 300, 600, 1200, 2400, 4800, 9600 Female DB 9-pin connector with cable (709-7211) (convert to mate with male DB 25-pin)
Pager Groups	50 programmable groups Up to 10 members per group Groups can be members of other groups
System Log Paging Reports	Date, time, input port, pager ID, page type, page length, contents of numeric page
Traffic Statistics	Trunk busy time on hourly basis Page queuing wait time on hourly basis Maximum and average values 7-day history 25 pager service programming templates for easy pager setup
Editing	Operation parameter editor for easy system operator control

TNPP INTERFACE (OPTIONAL)

Number of Direct Connections	2
Number of Addressable Nodes	32 inbound 32 outbound
Network Link Media Capability	Dedicated wireline Packet radio Wireline packet network Satellite downlink (simplex receive)
Baud Rates	300, 1200, 2400
Interface Type	Serial RS-232C Null Modem (Tx Data, Rx Data, GND)
Connectors	Female DB 9-pin Supplied cable (709-7212) (converts to mate with female DB-25)

TAP INBOUND (OPTIONAL)

Number of Interfaces	2
Baud Rates	300, 1200, 2400, 4800, or 9600
Interface Type	Serial RS-232C Null Modem (Tx Data, Rx Data, GND)
Connectors	Female DB 9-pin Supplied cable (709-7212) (converts to mate with female DB-25)

TAP OUTDIAL (OPTIONAL)

Number of Interfaces	1
Baud Rates	300, 1200, 2400, 4800, or 9600
Interface Type	Serial RS-232C Null Modem (Tx Data, Rx Data, GND)
Connectors	Male DB 9-pin

HARDWARE OVERVIEW

MODEL 640 ARCHITECTURE

The Model 640 consists of several circuit boards in a compact, computer-like chassis. The basic unit is comprised of the main processor motherboard, a peripheral motherboard, a dual trunk interface, a ROM disk board, and a RAM disk board. In addition to the standard boards, a TNPP, TAP outdial, or dual serial board can be added for networking purposes. A second dual trunk interface can be added, along with MF or dial click decoder options for the trunks. Each of the standard and optional circuit boards are illustrated and described in the following subsections.

Figure 1 shows a top view photograph of the Model 640 with the top cover removed. The unit shown has one optional board installed - a second dual trunk card.

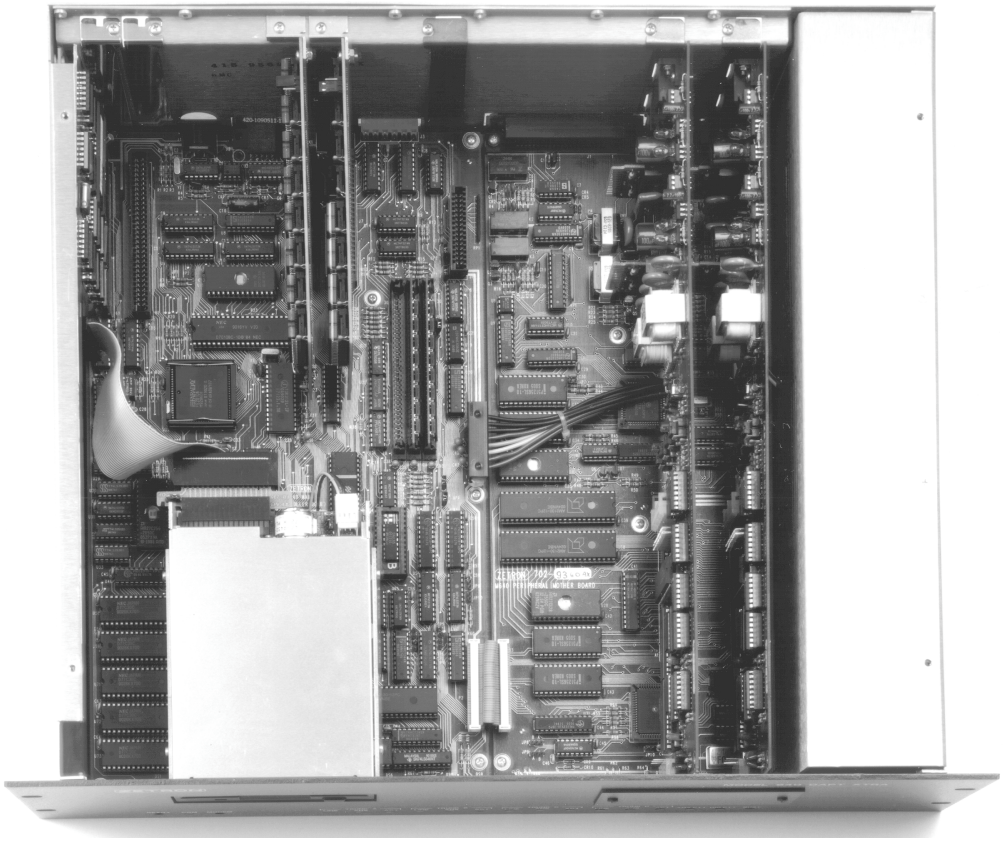


Figure 1. Model 640 with Top Cover Removed

Figure 2 and Figure 3 are provided to help locate each of the main components of the Model 640. Each item in the illustrations is labeled with a number for easy cross-reference from the text in the following subsections (numbers in parenthesis). See Section 11 for more detailed schematics and circuit board silkscreens.

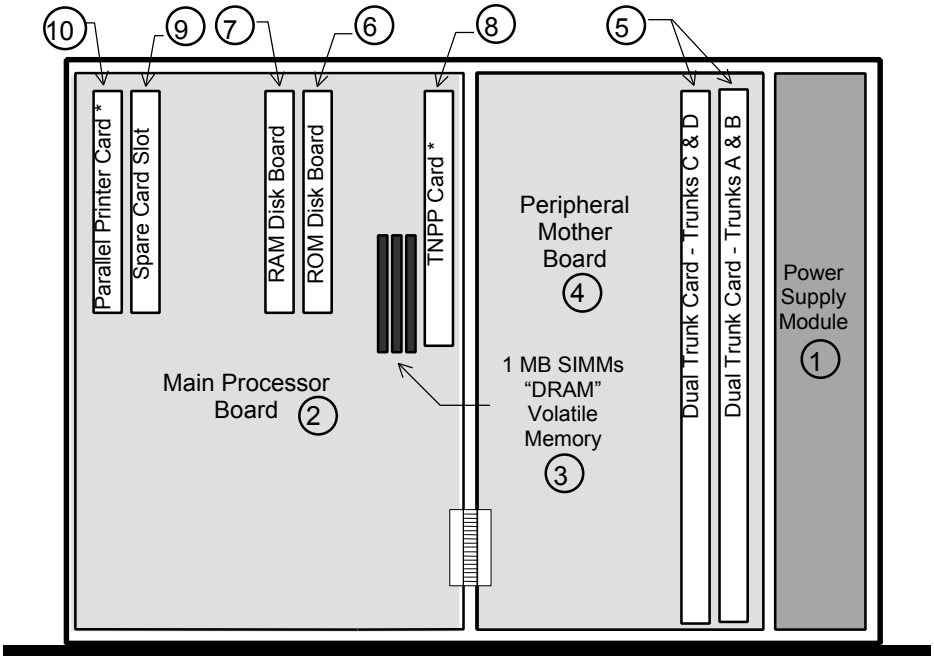


Figure 2. Top View of Model 640 Chassis

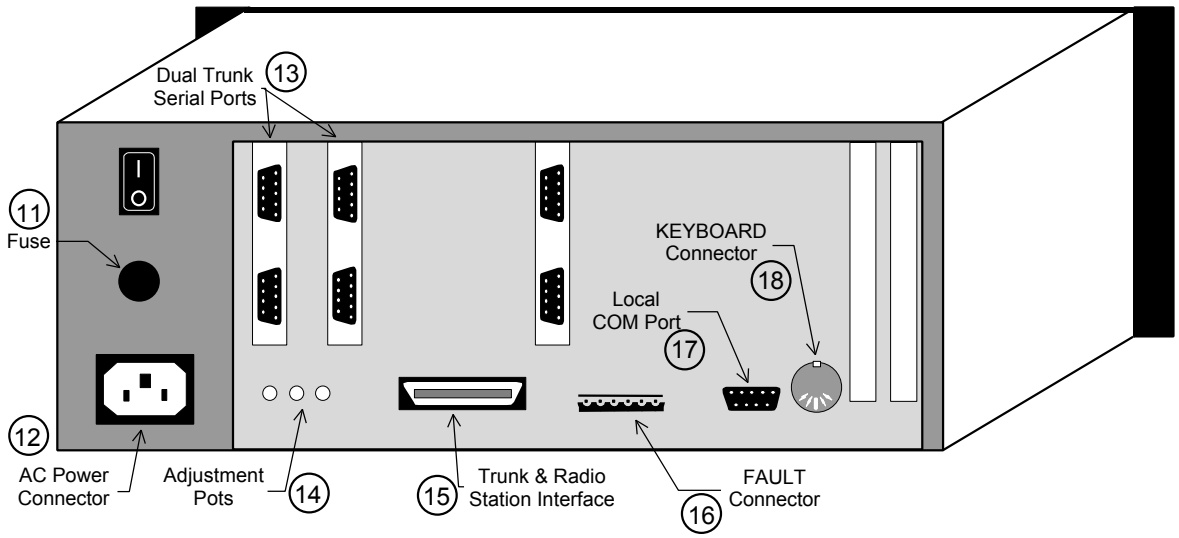


Figure 3. Rear View of Model 640 Chassis

OPERATING POWER

The internal power supply (item #1, Figure 2) in the Model 640 operates from $115V_{AC}$ (item #12, Figure 3) and provides all internal operating voltages, including the 48 volt supply for DID telephone trunks. A power supply configured for $240V_{AC}$ operation may be ordered as an option.

An uninterruptible power supply (UPS) option (Part No. 802-9049) obtains standby power from storage batteries and keeps the system operating through brownouts and blackouts. Zetron's standard UPS is a 400 VA unit with built-in batteries that provide 30 minutes of emergency power.

Higher capacity UPS options may be available as required. Other UPS equipment can provide more capacity and can even power radio equipment. For applications assistance, contact the Zetron Mobile and Paging Systems Division.

The power supply is protected by a 1 amp UL approved fuse (item #11, Figure 3). The fuse can be checked or replaced by unscrewing the cover counter-clockwise.

MAIN PROCESSOR MOTHERBOARD

Advanced large-scale integrated (LSI) circuits comprise an entire computer onto the 8-in × 14-in main processor motherboard (Part No. 702-9673). The main processor (item #2, Figure 2) includes 2 MB or more of volatile DRAM (item #3, Figure 2). Paging software loaded from the plug-in ROM disk (item #6, Figure 2) at power-on operates in the DRAM memory, and acts as traffic manager and diagnostic maintenance controller of the microprocessors on the peripheral motherboard (item #4, Figure 2).

Paging Terminal Timing

The main processor board contains power-on reset timing and a watchdog circuit to help recover from any software faults or high-energy noise interference. The watchdog timer must be written to by the system once a second to keep it from initializing a reset pulse.

A real-time clock also provides the central timing for the PCM digitized audio highway used by the peripheral motherboard for passing audio to and from the trunks and station output.

PCM Highway

The PCM highway is composed of three signals: data, clock, and sync. Data is a time-multiplexed serial signal and can be encoded and decoded by the trunk or station sections of the Model 640. The clock signal is a 1.544 MHz square wave, which synchronizes the serial data. Eight clock pulses constitute a *slot*. Audio is converted into 8-bit words and presented in one slot. 24 slots constitute a *frame*. The sync pulse marks the beginning of a frame and is one clock cycle of duration with a period of about 125 microseconds (8 kHz sampling rate). Each slot can be thought of as a channel carrying unidirectional audio information (just like a radio channel).

Voice Prompts And Storage

The main processor board is the source of all the telephone prompts. Prompting tones are generated on dedicated PCM channel slots for 1 kHz beep, out of service whoop, telco dial tone, telco ringing sound, and telco busy sound.

Voice recording and playback functions are also performed on the main processor board (DAPT XTRA only). Voice to and from the PCM highway is compressed or expanded using ADPCM transcoders. The compressed live voice data is stored in the EMS area of DRAM. Compressed voice prompts are stored on the battery backed non-volatile RAM disk.

DRAM Memory

The DRAM memory (item #3, Figure 2) physically resides in one or more single in-line memory module (SIMM) units installed into J9, J10, and J11. The base area of DRAM memory is loaded with the operating software for the Model 640 paging terminal. This plug-in board is also used for non-volatile storage of the subscriber database. The EMS area of the DRAM memory is used as a storage buffer for the ADPCM voice storage and playback functions.

Maintenance Modem

The main processor board contains a modem for remote communications and system management. The modem is accessed through any one of the trunk interfaces. Once a unique phone number is programmed into the terminal database, the 640 can be called from any remote PC.

Expansion Slots

A custom expansion slot (J8) is provided for installation of the optional TNPP interface card (item #8, Figure 2). This card facilitates wide area networks involving multiple paging terminals.

The main processor board has two PC-type expansion slots, which are used for the printer port or other options. The printer card can be installed in either slot. The printer option (Part No. 950-9758) allows a parallel printer to be connected to the paging terminal for real-time printing of page logging (system activity).

External Hardware Interfaces

The main board has three connections exposed through the rear of the Model 640 chassis. The FAULT connector (item #16, Figure 3) indicates a paging terminal failure for interface to an alarm system. The male 6-pin Wiedmueller connector has three usable output pins from an onboard relay.

The COM PORT connector (item #17, Figure 3) provides an RS-232 interface for local PC or dumb terminal communications. A 10-foot serial cable (Part No. 709-7211) is provided with the Model 640 for this connection. The 9-pin port can be configured for baud rates up to 9600.

The KEYBOARD connector (item #18, Figure 3) was used in conjunction with the Model 640 Console option, which is no longer sold. The connector is identical to a PC keyboard interface.

Jumper Settings

Figure 4 shows the location of each jumper on the currently shipping V53 main processor circuit board.

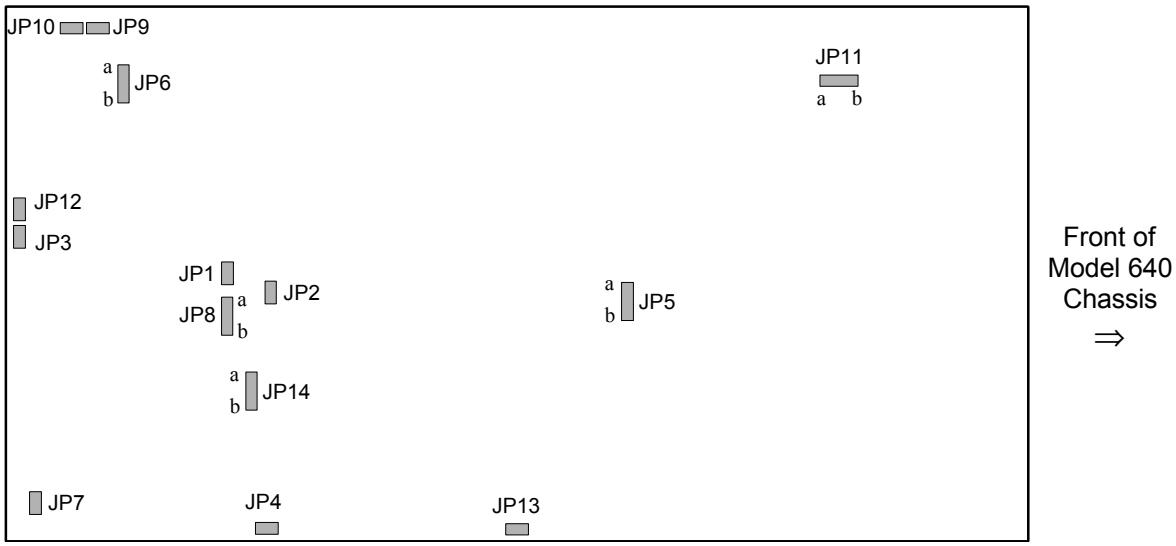


Figure 4. Main Board Jumper Locations (Top View)

The jumpers are used as noted in Table 2.

CAUTION

Jumpers 1-9 and 11 on the main processor motherboard (Part No. 702-9673) should not be changed. These jumpers are factory set, based on the custom system ordered. This information is provided for reference only.

Table 2. Table 2. Main Board Jumper Settings

Jumper	Function	Settings	Default
JP1	Sets ROM memory size	IN OUT	IN
JP2	Identifies ROM memory size	IN OUT	IN
JP3	Provides reset to the keyboard interface port	IN - reset OUT	OUT
JP4	ISA interrupts expansion	IN OUT	OUT
JP5	Disables watchdog timeout during initialization	A B - disabled	A
JP6	RESERVED	A B	B
JP7	Disables RAM parity error interrupt	IN - disabled OUT	OUT
JP8	Sets non-volatile RAM size	A B	A
JP9	Enables RAM disk reformat (in conjunction with JP10)	IN - reformat OUT	OUT

Jumper	Function	Settings	Default
JP10	Disables logon password *Enables RAM disk reformat (in conjunction with JP9)*	IN - password disabled / *reformat* OUT - password enabled	OUT
JP11	Sets voice RAM size	A - 32 to 128 KB B - 256 to 512 KB	A
JP12	System reset	IN - reset OUT	OUT
JP13	Disables system watchdog	IN - disabled OUT	IN
JP14	Sets video display (monitor) type	A - VGA B - TTL mono	A

Note: JP9 and JP10 are used to reformat the RAM disk. Do NOT install both jumpers unless reformatting is required.

PERIPHERAL MOTHERBOARD

The peripheral board (Part No. 702-9360) integrates the CPU functions of the trunk cards with those of the radio station section. A ribbon cable interfaces this board (item #4, Figure 2) with the main processor board. The paging software communicates with the peripheral board processors through two dual-port RAMs (U29, U30). Each RAM has a unique select address and can be individually chosen to appear in the I/O map of the system.

Trunk Card Slots

The dual trunk interface board (item #5, Figure 2) (Part No. 702-9361) or the dual trunk 4-wire audio interface (Part No. 702-9488) installs onto the peripheral motherboard for telco connections. One dual trunk interface is standard on the Model 640. It installs into J3 and J5 on the peripheral board for trunks A and B. An optional second trunk card can be installed into J2 and J4 for trunks C and D. These cards interface the telco, PABX, or RF/μwave link trunk equipment to the paging transceiver through the peripheral motherboard.

Trunk And Radio Station Interface

An RJ21 connector (item #15, Figure 3) on the rear of the peripheral board provides the telco trunk and radio station external interfaces. This male 50-pin connector facilitates signals for up to four telco trunks, each following the RJ2DX convention (6-wire modular telco jack), and a radio station interface for control of up to 16 zones.

Adjustment Pots

Three adjustment pots (item #14, Figure 3) on the peripheral board control audio levels to and from the radio station card. They are accessed from the rear panel of the Model 640 chassis. The RX adjustment controls the audio input level for the talkback feature. The TONE adjustment controls the paging tone output level to the transmitter, while the VOICE pot controls the voice audio output level to the transmitter.

Refer to Section 6 for details on adjustment procedures.

Jumper Settings

The jumpers on the Model 640 peripheral board control RF broadcast station interface parameters. Figure 5 shows the locations of each jumper on the peripheral processor circuit board.

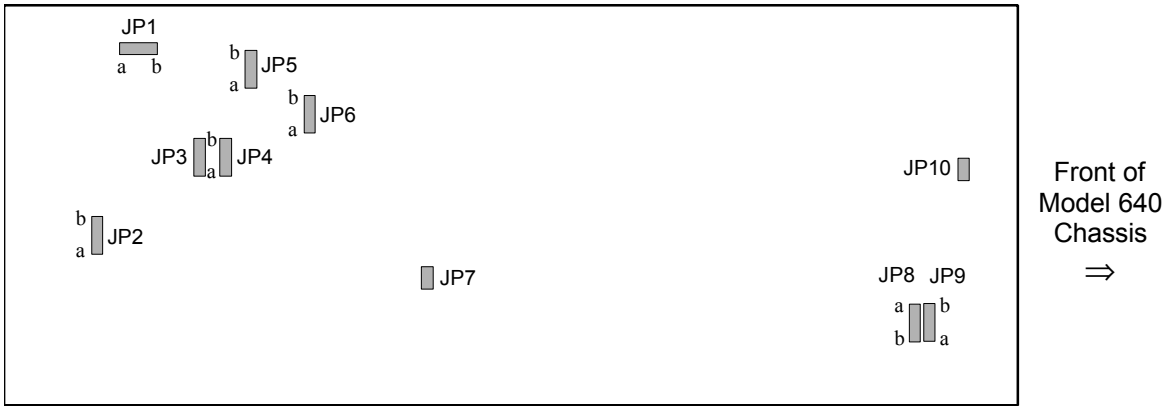


Figure 5. Peripheral Board Jumper Locations (Top View)

The jumpers on the peripheral motherboard are used as noted in Table 3.

Table 3. Table 3. Peripheral Mother Board Jumper Settings

Jumper	Function	Settings	Default
JP1	Receive voice audio from Talkback pager	A - flat B - de-emphasized	A
JP2	Transmit tone to transmitter	A - flat B - pre-emphasized	A
JP3	Enables Talkback audio path or separate tone output	A - tone output B - Talkback enabled (tx and rx audio)	B
JP4	COR (busy) polarity	A - active high B - active low	B
JP5	Transmit voice audio to transmitter	A - flat B - pre-emphasized	A
JP6	Terminal busy polarity	A - active high B - active low	B
JP7	Factory test *only* (µProcessor U20 XIRQ)	IN OUT	OUT

Jumper	Function	Settings	Default
JP8	Factory test *only*	IN OUT	OUT
JP9	Factory test *only*	IN OUT	OUT
JP10	Factory test *only* (μProcessor U33 XIRQ)	IN OUT	OUT

DUAL TRUNK INTERFACE BOARD

The dual trunk interface board (Part No. 702-9361) connects two telephone lines to the paging terminal. Telephone lines are brought to the dual trunk interface board (item #5, Figure 2) through the peripheral board from the male 50-pin connector on the rear of the unit (item #15, Figure 3). The lines associated with trunks A and B are brought to the dual trunk installed in the rightmost slot, J3/J5. The lines associated with trunks C and D are brought to the dual trunk installed in the leftmost slot, J2/J4.

Line Type Matrix Card

The dual trunk interface board can service four telephone line types. A four-position dual trunk matrix card (Part No. 702-9122) determines the type of interface for *each* line of the trunk card. The two trunks need not be set to the same line type. Each position of the matrix card enables the Model 640 to interface to one or more telephone line types as indicated below:

- DID — Loop start trunks:
  - C.O. selector level
  - Local
  - PABX
- E-E — End-to-End loop start trunks (also called "POTS"- plain old telephone service)
  RS-232 port for TAP input
- E&M — DID trunk, reverse battery supervision
  PABX tie trunk with 2-wire audio signaling
- GND ST — Ground start End-to-End trunks

Note: The matrix cards and line types are factory set for the custom application described to Zetron technical staff when ordering. In general, the matrix cards should be left in the factory settings unless the telephone line configuration changes.

The matrix card in socket J3 of the dual trunk interface board configures trunk A and the matrix card in J4 configures trunk B. The selected line type is indicated by the matrix card marking that is on the bottom side of the socket (when trunk card is installed on peripheral board) labeled "1" on the dual trunk board as shown in Figure 6.

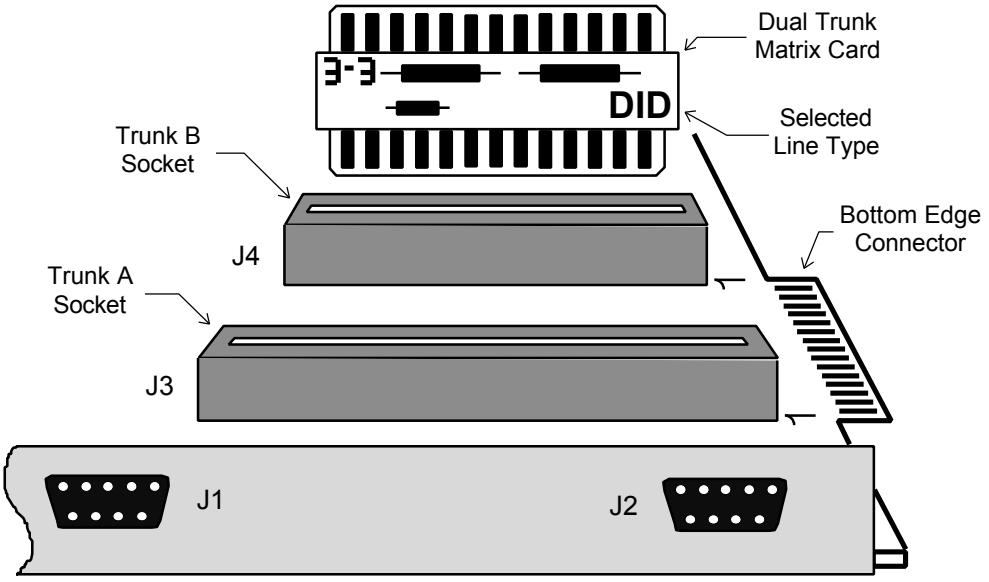


Figure 6. Dual Trunk Interface Matrix Cards

For Simplified schematic diagrams of the four telco trunk types serviced by the matrix card, see "Configuration Diagrams" in Section 11.

External RS-232 Ports

Two 9-pin serial ports on the rear of the trunk card provide interface to an alphanumeric input device. The Model 640 supports the TAP (Telocator alphanumeric protocol) for alphanumeric display paging. A paging entry station can be directly connected to the DB-9 ports to enable an operator to manually enter alphanumeric pages into the paging terminal.

Note: Each RS-232 port that is active replaces a trunk. As a result, the total number of inputs always remains 4 (if a second trunk card is installed). For example, if one TAP port is used, then only 3 trunks remain available for telco paging activity.

Modem Interfaces

A DUART (U15) on each dual trunk board interfaces the standard modems (U21, U22) with the peripheral board processor. It also provides some general purpose I/O functions for the processor. The modem interfaces may be disabled in order to enable RS-232 alpha interfaces through standard rear panel DB-9 connectors.

Audio Level Adjustments

Four audio level adjustment are located on the front of the dual trunk interface for each trunk. Figure 7 shows the front panel of the Model 640. Each trunk has three pots and one switch that define the audio levels. In addition, three front-panel LEDs identify operation of each trunk (12 total).

See Section 6 for detailed adjustment procedures.

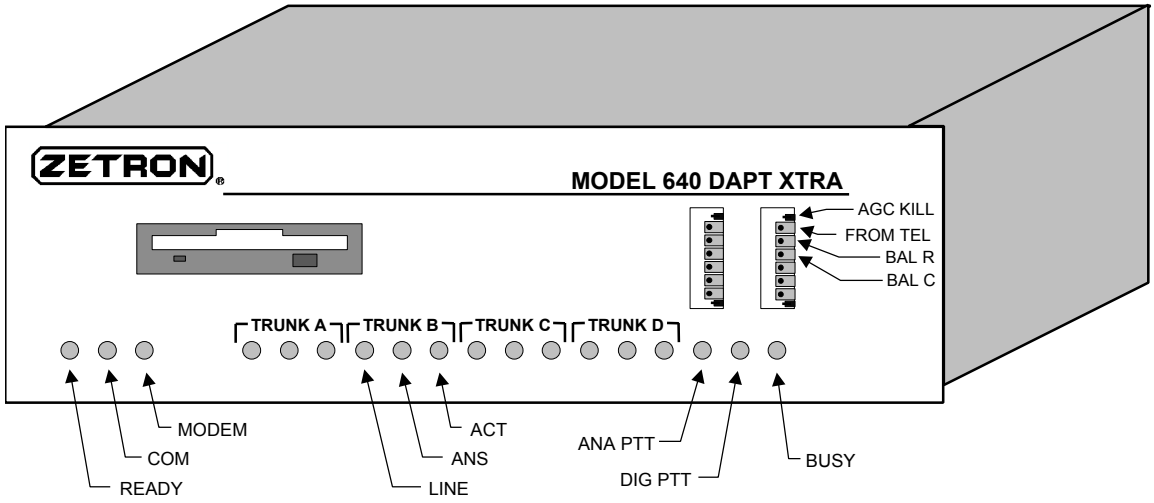


Figure 7. Model 640 DAPT XTRA Front Panel

Notes On Figure 7:

1. The trunk LEDs (ACT, ANS, and LINE) are identical for each of the four available trunks.
2. The adjustment pots are identical for each of the four available trunks, but the AGC KILL switch is on the outside of the associated pots (above the top banks, and below the bottom banks). The four upper adjustments on the left bank define audio for trunk C; the lower four define audio for trunk D. The four upper adjustments on the right bank define audio for trunk A; the lower four define audio for trunk B.
3. The floppy disk drive shown is optional. The slot is covered when no disk drive is installed.

The AGC KILL (automatic gain control) switch adjusts voice audio levels on the telephone interface line. The AGC compensates for the call-to-call changes in the loudness of the caller's voice and the gain of each phone call. The voice audio signal is appropriately amplified and then fed to an envelope detector, modem, DTMF detector, and CODECs for each trunk.

The FROM TEL adjustment controls silence deletion in the audio provided on the telco trunk. Generally, silence deletion is increased by turning the pot counterclockwise.

The BAL R and BAL C pots effectively cancel out the outgoing audio from the incoming audio (that is, "sidetone"). Full-duplex hybrids separate the incoming and outgoing audio. The two balance controls are used to "match" the hybrid to the telephone lines. A better impedance match yields less reflected impedance and improved audio isolation.

DID Trunk Configuration

The DID configuration, illustrated in Section 11 (Part No. 024-0076), provides a balanced $48V_{DC}$ battery current with full-duplex hybrid audio signaling to the TIP1 / RING1 pair of the telco interconnect. A loop closure at the telco CO or PABX is sensed by the resistor bridge and transistor circuitry, which drives the loop detect opto-isolator. When the telco equipment closes the loop and begins to send feed digits, the loop detect alerts the dual trunk card to receive the inbound signaling (feed digits), which may be pulse, MF, or DTMF format. After feed digit transmission is completed, the call enters page entry mode.

The call is terminated from the telco CO or PABX by opening the TIP/RING LOOP. The Model 640 reverses battery to disconnect the DID line.

End-to-End Trunk Configuration

The end-to-end trunk configuration is illustrated in Section 11 (Part No. 024-0077). Battery voltage is provided by the telco equipment; typically TIP (+), RING (-). A bi-directional opto-isolator monitors the TIP/RING pair to detect inbound ringing from the telco or PABX equipment. After ring detection, the loop relay closure completes the TIP/RING circuit loop to answer inbound ringing. After the telco equipment detects loop current, ringing is halted and audio is connected for conversation mode.

To initiate an outbound call, the TIP/RING loop is closed by the loop relay. After the telco equipment has detected loop current, dial tone is transmitted from telco, until dialed digits are received from the subscriber equipment (Model 640 trunk card). After dialing is complete, the line is placed into conversation mode while the destination telco equipment processes dialout, etc.

The call is terminated from the telco CO or PABX by opening the TIP/RING loop. The Model 640 opens the loop relay to break the TIP/RING current and disconnect the end-to-end line.

Ground Start Trunk Configuration

The PABX ground start trunk configuration is illustrated in Section 11 (Part No. 024-0079). This circuit is an inbound-only configuration; that is, the Model 640 cannot originate ground start calls to PABX equipment. This is not a problem since paging is one-way communication. For the PABX ground start trunk, -48 V_{DC} battery is provided from the Model 640 DAPT *(as opposed to being provided by the TELCO CO for subscriber ground start service)*.

When idle, the TIP is floating (not connected) and the RING is biased to -48 V_{DC} through the ground start detection opto-isolator (lower 4N26 shown in 024-0079). The PABX or telco equipment must short the RING to ground briefly to initiate inbound dialing to the Model 640. Once the ground pulse has been detected, the loop relay closes, isolating the ground start detector and connecting battery to the TIP/RING loop. A brief period of time lapses wherein the PABX continues to hold the RING to ground until loop current is detected by the PABX. During this interval the -48 V_{DC} ballast lamp glows brighter than normal (appears as a brighter flash). Once the PABX has detected loop current, the ground start is removed and the TIP/RING loop is closed. Digits are dialed into the Model 640 and conversation mode is initiated.

The call is terminated by either the PABX or the Model 640 opening the TIP/RING loop.

E&M Trunk Configurations

There are two E&M configurations available for the Model 640 chassis. The Dual Trunk Interface card (Part No. 702-9361) can be configured for E&M trunks using the matrix plug or an optional Dual Trunk 4-Wire Audio Interface (Part No. 702-9488) can be installed in the second trunk card slot.

The configurations are compared in Table 4. The major difference between the two setups is the number of signaling leads used for the audio portion of the channel. The TO TEL and FROM TEL audio paths are completely isolated between the two directional signal pairs in the 4-wire configuration.

Table 4. Table 4. E&M Trunk Configurations

	# of Leads	Immediate Start	Wink Start	Lead Supervision	Hybridized Full-Duplex
Dual Trunk Interface in E&M Configuration	2	✓	✓	✓	✓
Dual Trunk 4-Wire Audio Interface Configuration	4	✓	✓	✓	

For a simplified configuration schematic of the E&M signaling, see "Configuration Diagrams" in Section 11.

E&M Immediate Start

Telco, PABX, or RF/μwave link equipment initiate inbound calling to the Model 640 through M-lead signaling. When -48 V_{DC} (-24 V_{DC} OK) is applied to the M-lead, the loop detect line goes low initiating pulse, DTMF, or MF detection as programmed. The dialup equipment transmits the feed digits to the Model 640. After the dialed digits have been decoded, the E-lead is grounded, conversation mode begins, and the calling party is prompted for their page entry.

The call is terminated when the telco equipment drops the M-lead voltage, or when the Model 640 opens the E-lead.

E&M Wink Start

Telco, PABX, or RF/μwave link equipment initiate inbound calling to the Model 640 through M-lead signaling. When -48 V_{DC} (-24 V_{DC} OK) is applied to the M-lead, the loop detect line goes low. The Model 640 "winks" to the dialup equipment by flashing the E-lead to ground for approximately 240 mS. After the wink has been recognized, the dialup equipment transmits the feed digits to the Model 640. After the dialed digits have been decoded, the E-lead is grounded, conversation mode begins, and the calling party is prompted for their page entry.

The call is terminated when the telco equipment drops the M-lead voltage, or when the Model 640 opens the E-lead.

Note: -5 V_{DC} or -12 V_{DC} M-lead detection can be obtained by removing R6 (Trunk A) or R9 (Trunk B) from the Dual Trunk 4-Wire Audio Interface board (Part No. 702-9488).

DUAL TRUNK 4-WIRE AUDIO INTERFACE BOARD

The dual trunk 4-wire audio interface card (Part No. 702-9488) is essentially a dual trunk interface board with the telco *hybrid* circuitry removed to provide separate TO TEL and FROM TEL audio paths with no sidetone. The board is loaded with a dual matrix card (Part No. 702-9122) for each trunk in order to provide E-lead signaling. These *must* be configured for E&M operation as described on page 22.

CAUTION

DID, end-to-end, and ground start matrix configurations do NOT function properly for the Dual Trunk 4-Wire Audio Interface Board.

Refer to "E&M Trunk Configurations" on page 25 for operational descriptions of this interface.

ROM DISK BOARD

The ROM (read-only memory) disk (Part No. 702-9389) stores all of the paging software for the peripheral and main processor boards. It plugs directly into an expansion slot on the main processor board. The paging terminal reads from the ROM disk on power up.

The ROM disk (item #6, Figure 2) consists of four 128KB (1MB configuration) ROM chips in most applications. It is designed to support a total of eight ROM chips which can be 128KB or 256KB (1M or 2M bit) devices.

Updated software is supplied on a new ROM disk. The single board approach simplifies field installation of new software.

Jumper Settings

Figure 8 shows the locations of each jumper on the ROM disk board.

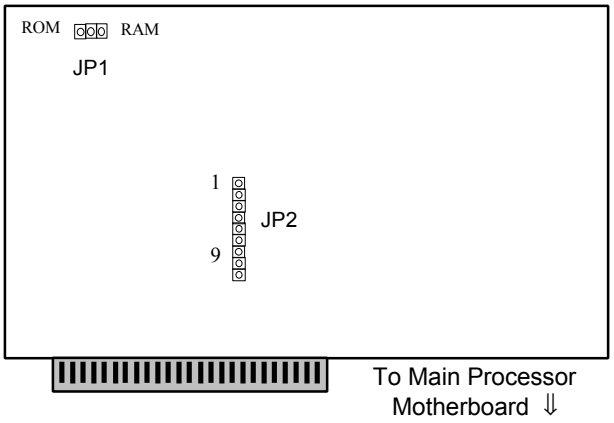


Figure 8. ROM/RAM Disk Board Jumper Locations (Side View)

The jumpers on the ROM disk are used as follows:

JP1 This 9-pin jumper determines the memory configuration for the ROM disk. Four, 2-pin jumpers should connect the pins, based on the type of memory chips.

For a standard 1MB setup (128KB chips), jumpers should connect pins 2 and 3, 4 and 5, 6 and 7, 8 and 9.

For a 2MB setup (256KB chips), jumpers should connect pins 1 and 2, 3 and 4, 5 and 6, 7 and 8.

JP2 This jumper selects the card as a ROM or RAM disk. The 2-position jumper should be installed next to the appropriate label.

RAM DISK BOARD

The RAM (random access memory) disk (Part No. 702-9386) stores the voice prompts and database information. It could also contain paging software in some circumstances to avoid updates to the ROM disk board. The RAM disk (item #7, Figure 2) is essentially like a hard drive in a computer.

The RAM disk board is very similar to the ROM disk in design. It usually includes four 128KB RAM chips along with the associated battery back-up circuitry. Some applications will require more storage. There can be a total of eight 128KB RAM chips installed for a total of 1MB of non-volatile storage.

While the RAM disk is protected by plastic on the solder-side, care should be taken when working around the RAM disk board. If it becomes corrupt (due to static discharge, lightning, etc.), the contents will be lost and a reformat process must take place. Refer to Section 9 for information on reformatting the RAM disk. After the reformat, the database and prompts must be reloaded by the restore process. Contact the factory if you suspect the RAM disk is damaged.

Jumper Settings

The jumper locations and settings on the RAM disk are identical to those on the ROM disk. They should be set appropriately for the installed configuration as shown in Figure 8 and described in the preceding paragraph.

TNPP INTERFACE

The TNPP (Telocator Network Paging Protocol) interface board (Part No. 702-9362) enables the Model 640 to receive and pass pages to increase the paging region. The TNPP interface plugs into the main processor motherboard at J8. The board (item #8, Figure 2) comes with two bidirectional 9-pin serial ports for easy connection to the network link. The TNPP Options (Part No. 950-9294 dual interface and Part No. 950-9470 unidirectional interface for satellite downlink or ZAPP! alphanumeric entry stations) setup the paging terminal for wide-area network paging. See Section 9 for details on the six LEDs on the TNPP interface.

The Dual Serial Card Option (Part No. 950-9469) enables the Model 640 to receive alphanumeric input. The DB-9 connectors are used just like the trunk card RS-232 serial ports.

TAP Inbound

The Model 640 can support inbound TAP (Telocator Alphanumeric Protocol) calls by way of the modem capability built into the dual trunk interface boards. Any one of the four possible telephone trunk inputs may be configured to handle the inbound TAP calls.

TAP Outdial

The TNPP board is also used for TAP outdial applications. When an external modem is interfaced with this card, the Model 640 can send display pages to other TAP-compatible paging terminals on a dial-up connection.

PARALLEL PRINTER CARD

The parallel printer option (Part No. 950-9758) enables the Model 640 to print the system log data in real-time. When the printer card is installed in either expansion slot (items #9 and #10, Figure 2), a printer can be connected to the DB-25 that is exposed through the rear of the chassis. Any standard serial printer cable works.

DUAL DIAL CLICK CARD

The dual dial click decoder option (Part No. 702-9119) enables the Model 640 to process digits dialed by rotary telephones. Dial clicks are different from dial pulses. The Model 640 can decode dial pulses without the optional dial click decoder board.

DUAL MF DECODER CARD

The dual multifrequency decoder option (Part No. 702-9197) allows the Model 640 to accept MF digit feed from DID and E&M 2- or 4-wire trunks. MF is a dual-tone signaling format similar to standard touch-tone (DTMF).

FRONT PANEL LEDS

The Model 640 has 18 red LEDs on its front panel. Many of the LEDs serve the same function, but for different trunks. Refer to Figure 7 for the location of each LED. Table 5 describes the operation of each LED.

Note: The Model 640 has four LINE, ANS, and ACT LEDs - each trunk has its own set. They operate identically for each trunk.

Table 5. Operation of Front Panel LEDs

LED Label	Description	Solid ON Conditions	Blinking ON/OFF Conditions
READY	Indicates the Model 640 is powered up and ready for operation.	Whenever power is on and boot-up cycle is complete.	Not during normal operation.
COM	Indicates local ZLINK communication between the office computer (or dumb terminal) and the Model 640.	May flicker rapidly enough to appear solid-on during data transfers.	Blinks intermittently during boot-up cycle. Short flash every 3 seconds indicates ZLINK connection is active, but no data is being transferred.
MODEM	Indicates modem ZLINK communication between the office computer and the Model 640.	May flicker rapidly enough to appear solid-on during data transfers.	Blinks intermittently during boot-up cycle. Short flash every 3 seconds indicates ZLINK connection is active, but no data is being transferred.
LINE	Indicates the trunk (phone line) is in use; that is, loop current is being drawn from a DID telco line.	During DID DTMF telco calls. When the trunk is initially answered and during active telco calls.	Blinks during end-to-end and pulse telco calls
ANS	Indicates trunk supervision (answer status) between the CO and the Model 640.	When the trunk is initially answered and during active telco calls.	Blinks during DID DTMF telco calls.
ACT	Indicates digit feed or voice activity on the trunk.	During most of initial boot-up cycle. During pulse telco calls and DTMF digit decoding	Blinks twice at beginning of boot-up and then flickers rapidly at end of boot cycle.
ANA PTT	Indicates paging (voice or tones) transmission to radio station.	When sending analog pages.	
DIG PTT	Indicates paging (binary digital) transmission to radio station.	When sending digital pages.	
BUSY	Indicates the radio channel is busy. The transmitter may be shared (cross-busy applications).	When the transmission equipment asserts a busy condition (pin 41 of trunk and radio station interface connector).	

COMMUNICATIONS SETUP

OVERVIEW OF MODEL 640 COMMUNICATION

Communicating with the Model 640 can be achieved several ways. Zetron has designed the paging terminal to allow for programming flexibility and convenience.

A communications link with the Model 640 should be established before the system is interfaced to the radio station and telco. This order of installation aids the technician in "seeing" what is going on with the paging terminal. Diagnostics and testing are simplified when the communication link is already available. In addition, the three software modules included with the Model 640 can help any technician understand how the system is designed and meant to be operated.

Setting up the communications link is established in four major steps:

1) Determine the type of communication link best for the custom system application.
2) Install MCU on the office PC (if applicable).
3) Make the appropriate hardware connections between the terminal and the Model 640.
4) Establish the ZLINK communication with the paging terminal.

Each of the four installation procedures in this section lists and describes the specific steps to access the paging terminal. Carefully follow each checklist, in order. Some of the subsections may not be required. Simply skip the procedures that do not apply to the specific application.

Note: This section only includes the basics on using MCU for ZLINK communications. Refer to the Model 640 Operating and Programming Manual (Part No. 025-9417) for details on the software operation of the paging terminal.

Interface Flexibility

The Model 640 is very flexible regarding programming access. The system programmer can gain access by way of several hardware configurations:

- Local serial-interfaced PC running dumb terminal emulator software (MCU or equivalent)
- Remotely located PC with a modem interface running dumb terminal emulator software
- Local serial-interfaced dumb terminal

Communications Software

Each of the hardware interfaces may require one or more of the three software tools shipped with the Model 640. Each software module is designed for use with the others or as a stand-alone interface. Refer to the *Model 640 Operating and Programming Manual (Part No. 025-9417)* for more details on software programming and operation.

MCU (Model 640 Communications Utility)

MCU is a user-friendly interface to all aspects of the Model 640 programming. It can be accessed only from a personal computer connected to the Model 640 by way of modem or local serial cable. MCU provides easy-to-follow pull-down menus, on-screen help, and a useful tutorial that overviews the hardware and software of the paging terminal.

MCU allows the system operator to monitor system traffic (log files) and view statistics and call counts. MCU also provides system management with ZLINK interface to the paging terminal.

ZLINK (Plus Prompt "+" Commands)

"Plus Prompt" commands are available either through MCU, ZLINK connection or by way of an alternate communications program, such as ProComm® or Kermit™. ZLINK programming is intended for use by advanced programming personnel only. ZLINK is much like DOS in format and provides over 60 commands for monitoring and managing the paging terminal's operation.

These commands are generally diagnostic in nature, but also include commands to access the database and common service-related items. In addition, ZLINK provides commands to generate test pages and view trunk card configuration and activity.

Model 640 Subscriber Database

The Model 640 database can be accessed by way of MCU or another communications program. Any dumb terminal or personal computer can link directly into the Model 640 database, stored on the RAM disk. The database configures system parameters such as subscribers, telephone line operation, transmitter operation, and general system operation.

Computer Requirements

The following minimum computer configuration is required to operate MCU:

- IBM-compatible PC
- 640 KB of RAM
- 1 MB of available hard disk space
- 3½-in floppy disk drive
- Microsoft DOS® Version 3 and above, or Windows 95, 98
- Modem (internal or external) if the office computer and Model 640 are not located within 60 feet of one another

MCU INSTALLATION

The MCU communications program should be installed on the office computer's hard drive.

Note: MCU cannot be used with a dumb terminal or console kit communications setup. If the system application is not using a computer, skip this section.

To install MCU on the office computer, follow the steps below:

- ❑ 1. Start up the office computer. From the Windows Desktop, switch to the DOS command-line prompt.
- ❑ 2. Insert the MCU installation diskette into the appropriate floppy drive. (Drive A: in the following examples.)
- ❑ 3. Switch to drive A: (if the blinking DOS prompt is not already "A:\>"), by typing:
  A:
- ❑ 4. At the DOS "A:" prompt, type:
  INSTALL <Enter>
  The installation program presents the screen shown in Figure 9.
- ❑ 5. Enter "y" if the default installation directory is acceptable.

  Enter "n" to choose a different installation directory. The instructions shown below appear. Restart the installation at the DOS prompt using a command that specifies the desired installation directory as described in the help screen.

```
------------------------------------------------------------------------------
          This installs MCU, the Zetron 640 Series Office
          Computer Software, onto a HARD DISK IBM PC or clone.

_
    This will install from the floppy disk in drive:    A:
    This will install to the drive and directory:       C:\MCU

_
           (if you get a DOS error next, choose Fail)

_
Are the above drive letters and path OK? (y/n)
```

Figure 9. MCU Installation Screen

- ❑ 6. Enter "y" at the "Do you wish to do the installation (y/n)?" prompt to begin transferring the files to the office computer.

  The installation process is done automatically and the DOS prompt returns.

```
Are the above drive letters and path OK? (y/n) n
------------------------------------------------------------------------------
 To specify different floppy drive, hard drive, or path, do:
     floppy:install1   floppy   harddisk   directory

_
 for instance, doing just "install1" from drive A is equivalent to specifying:
     a:install1  A  C  MCU

_
_where the "a:" specifies the drive where the floppy disk is,
 the "A" specifies the same drive (don't include a colon),
 the "C" specifies the drive letter where the Office Software will be installed
 (no colon), and the "MCU" specifies the directory where the Office Software
 will be placed.
   (the directory will be created if it doesn't exist, but any parent
   directories must already exist; don't specify a leading backslash).
 You can type upper or lower case letters, it doesn't matter.
 You can leave out the harddisk and directory if C:\MCU destination is OK.

_
 Returning to DOS now, please wait a moment.
A:\ >
```

Figure 10. MCU Installation Help Screen

TERMINAL HARDWARE CONNECTIONS

This subsection describes the four installation procedures available for Model 640 communications. Follow the steps for the connection type selected above.

Note: Even though several console interfaces are available, only one ZLINK connection can be active at any given time.

Local Serial Connection

Use an RS-232 serial connection if the computer is located close to the Model 640 (distances under 60 feet). A direct connection between the serial port of the Model 640 Paging Terminal and a serial port on the office computer can communicate at rates up to 9600 baud. The communication rates are lower with longer cables.

Serial cables longer than 60 feet are not recommended, since induced EMI and other problems may arise, causing communications interference. Worse yet, a long serial cable in the wrong RF environment could possibly inject RFI into the Model 640 system, creating background noise or operational interference.

The advantages of the serial interface are:

- no additional phone lines are required to link up to the terminal
- the communications rate is usually faster and more reliable
- one of the paging terminal trunks does not have to be tied up for ZLINK programming and database modification

Installation Procedure

To setup the system for local RS-232 connection, follow the steps below:

- ❑ 1. Determine the office computer's serial communication port (usually COM1 or COM2) and the connector type (DB-9 or DB-25).
- ❑ 2. Obtain or make an appropriate RS-232 connector cable. It should have a male 9-pin connector at one end and a female 9-pin or 25-pin connector for the computer's serial port at the other end. A Zetron ZLINK (Part No. 709-7565) cable provides connection to a 9-pin computer COM port.

  If the office computer has a 25-pin COM port, a standard adapter (DB-9 male to DB-25 female) can be used to mate the Zetron cable to the computer. Otherwise, a cable can be constructed using the pinouts as described in Figure 11.

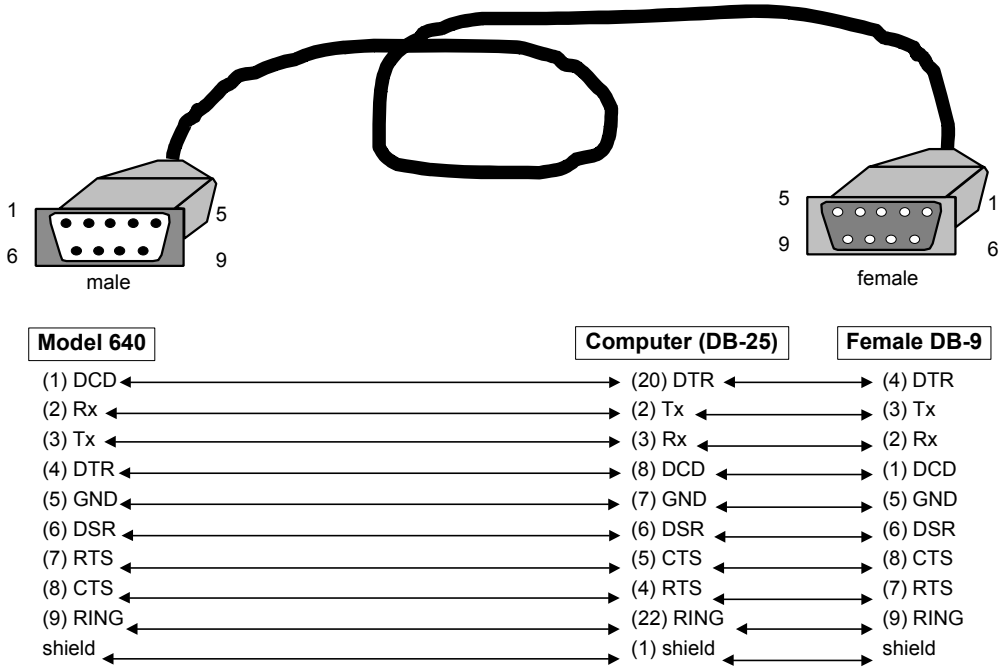


Figure 11. ZLINK Cable (Part No. 709-7565) Pin Configuration

- ❑ 3. Make the hardware connections between the computer and the Model 640 as shown in Figure 12. Note that there are several 9-pin serial inputs on the back panel of the paging terminal. The local connection port (labeled "COM PORT") is located on the lower right back panel of the Model 640 chassis.

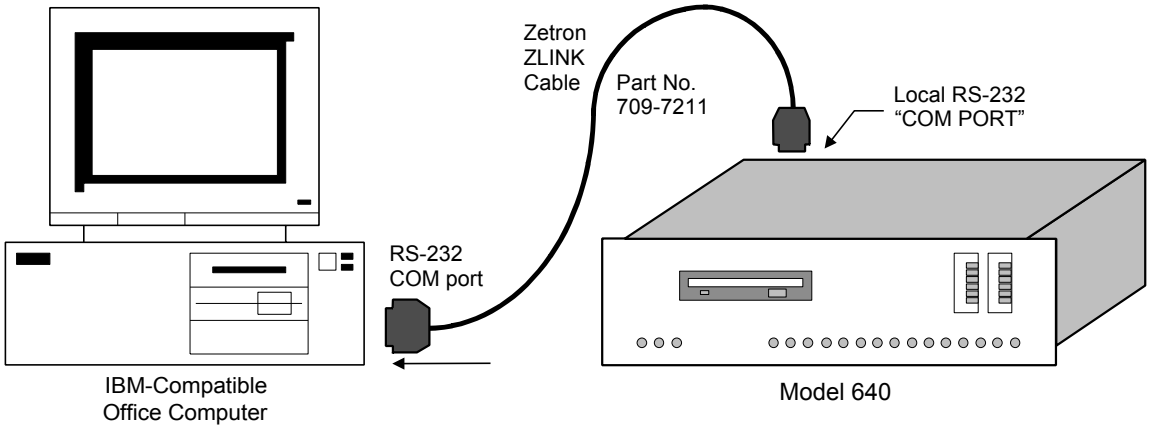


Figure 12. Local Serial Connection to Model 640

Remote Modem Connection

Note: Zetron recommends that a temporary local connection (usually with a laptop PC) be made for installation diagnostics. Refer to "Local Serial Connection" on page 34 for details. Once you have completed all the installation procedures described in Section 5, return to this subsection and modify the communications link accordingly.

If a temporary local connection cannot be made for installation purposes, skip to Section 5 and complete the "Telco Connections" procedure before trying to make a remote modem connection.

Use a modem connection if the office computer cannot be located at the Model 640 site. A PC modem and two separate phone lines are required for this type of communication. One phone line interfaces to the computer's modem, and the other interfaces to any trunk of the Model 640 (with internal modem).

A dedicated phone line is not required for the computer's modem. However, a separate line is more efficient for data transfer and system monitoring, since customer traffic is not impeded. Zetron recommends that the modem phone line:

- is separate from any of the lines into the paging terminal trunk cards
- is a standard end-to-end, loop start line
- does not have a Call Waiting feature
- is dedicated to ZLINK maintenance use

Installation Procedure

Figure 13 illustrates the hardware connections between the office computer and a remotely located Model 640.

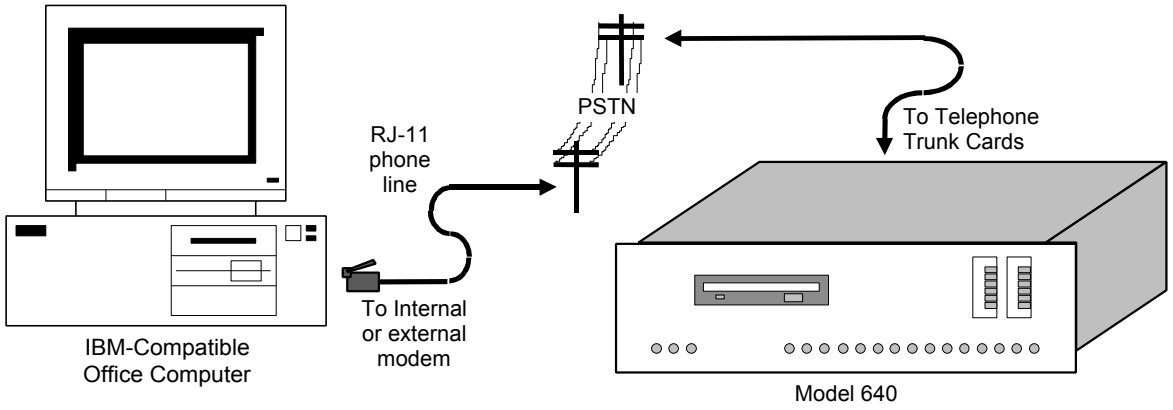


Figure 13. Modem Connection to the Model 640

To setup the system for modem connection, follow the steps below:

- ❑ 1. Determine which trunk of the Model 640 to use for modem maintenance.
- ❑ 2. Connect the office PC modem to a standard telco line using RJ-11 cable. If the PC modem is external, connect the modem to the computer's serial COM port using RS-232 cable (usually standard 25-pin male connectors on both ends).

Note: Make sure to use the modem jacks labeled "LINE" or "TELCO" if an external PC modem is installed. Do not connect to the "PHONE" or "LOCAL" jacks, as they are for telephone sets only.

- ❑ 3. Connect the desired Model 640 trunk to an end-to-end, loop start telco line. Use the 50-pin trunk and radio station interface for connections.

ESTABLISHING ZLINK COMMUNICATIONS

A communications link must be established once the physical connections have been completed between the Model 640 and the office computer, console, or dumb terminal. Follow one of the procedures below to initiate a ZLINK connection.

Note: This subsection gives only an overview of how to setup MCU for test purposes. Refer to the Model 640 Operating and Programming Manual (Part No. 025-9417) for details on the software operation of the paging terminal.

ZLINK Connection Through MCU

This procedure describes how to establish communications with the Model 640 using MCU. Recall that MCU can only be run on an IBM-compatible office computer. If the ZLINK connection is made with a dumb terminal only, skip this subsection.

Follow the steps below to configure MCU for ZLINK communications.

CAUTION

Do not attempt to run MCU from MS Windows. The computer will not be able to link properly to the paging terminal and a system crash may result.

- ❑ 1. Boot up the office computer in MS DOS.
- ❑ 2. Change to the MCU installation directory (default \MCU), by typing:

  CD MCU
- ❑ 3. Run MCU, by typing:

  MCU
- ❑ 4. From the MCU main menu, select Edit, Locations. The Locations Index window appears.
- ❑ 5. Press <F9> to start a new record. The Comm Window shown in Figure 14 appears.

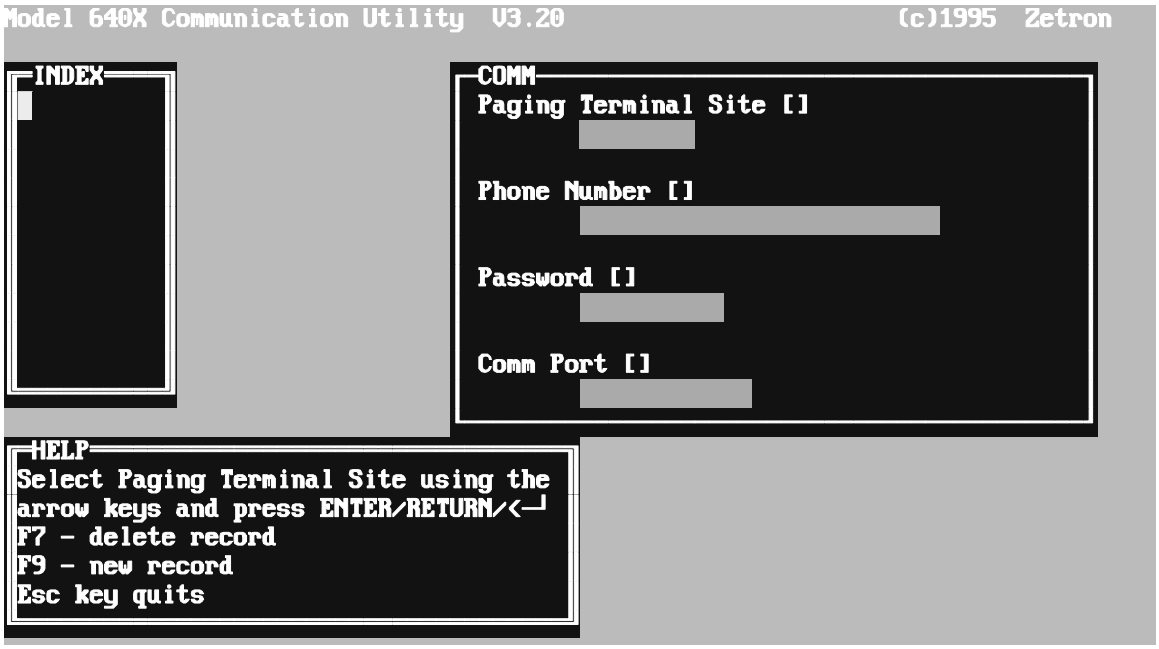


Figure 14. MCU Comm Window

- ❑ 6. Enter an appropriate name for the Paging Terminal Site. The name is a text string, up to 8 characters in length.
- ❑ 7. If the ZLINK connection is made by a remotely located PC modem, enter the complete Phone Number to dial for site connection. Use the following special characters as needed (refer to modem manual for supported commands):

  , = insert a pause in the dialing sequence

  P = use pulse dialing

  Example: For DID lines that require (4-digit) overdial of the subscriber PhoneNumber,

enter “1-aaa-xxx-xxxx,,,,,0555”.

1-aaa-xxx-xxxx = paging terminal phone number; 1 + area code (aaa)

,,,,, = pauses to allow the paging terminal to prepare for overdialing

0555 = default ConsoleNumber

❑ 8. Alternately, if the ZLINK connection is local (computer or dumb terminal), indicate the appropriate baud rate for serial communications and identify the connection is local as “B#L”.

B = indicates the baud rate is to follow

= the communications speed (any rate between 512 and 9600)

L = local connection

Example: For 4800 baud local communication enter “B4800L”.

❑ 9. Enter the Password for ZLINK access to the paging terminal. The password is a text string, up to 9 characters in length. Spaces are allowed and the password is case-sensitive.

CAUTION

Write the password down in a safe place, in case it is forgotten. Do NOT give the password to unauthorized personnel.

❑ 10. Enter the number of the computer’s Comm Port used to connect to the Model 640. 1-4 are the allowed entries. If the communication port is a non-standard type, identify the port as follows:

pBASEaaaIRQx

p = port # (5 -9 allowed)

aaa = base I/O address of the port

x = IRQ address to use (2 - 7 allowed, usually 3 or 4)

❑ 11. Once all the fields in the Comm window are properly entered, save the record and exit to the MCU main menu by pressing <Esc>.

Note: If a remote connection (modem) to the paging terminal will be used, it is recommended that a temporary local connection (usually with a laptop computer) be made for installation diagnostics. Refer to “Local Serial Connection” on page 34 for details.

❑ 12. Power up the Model 640 and let it complete its boot sequence (all lights have extinguished except the READY light is on solid).

❑ 13. Select Comm, Zlink from the main menu. MCU attempts to make a connection with the Model 640.

- ❑ 14. Once a communications link has been established, the introductory screen shown in Figure 15 appears.
- ❑ 15. The plus prompt (+) is displayed and a ZLINK connection has been successfully established. The Model 640 computer is now logged on.

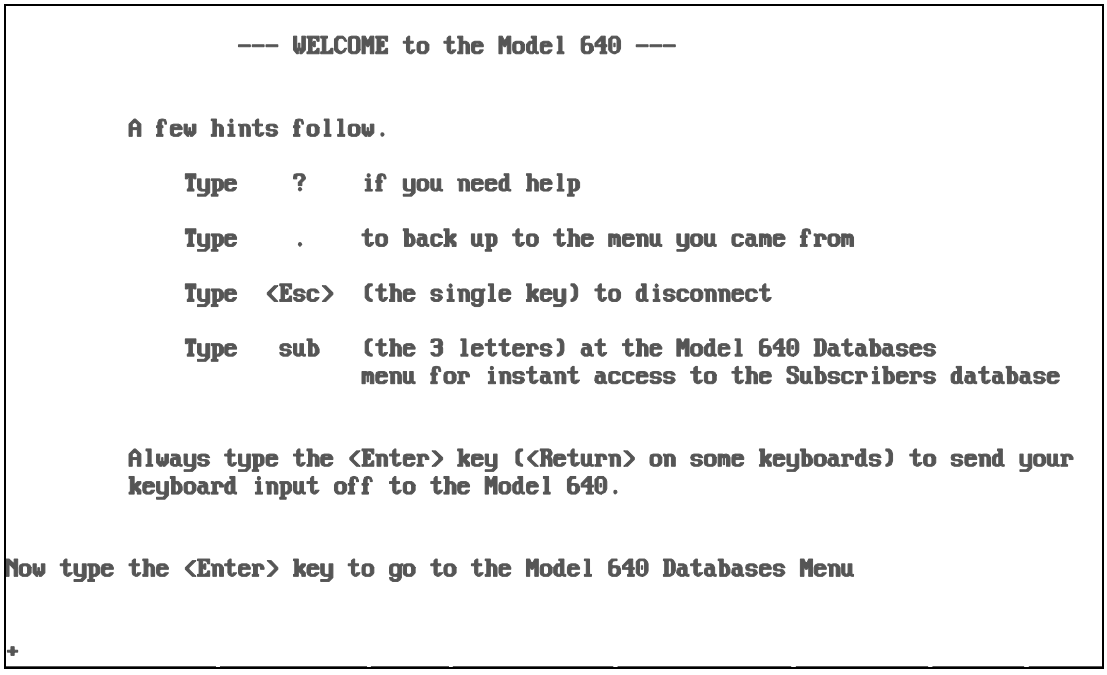


Figure 15. Introductory ZLINK Screen

Adjusting the Modem Initialization String

If the site connection is made through the office PC's modem, it may be necessary to alter the modem initialization string to ensure proper handshaking. If you encounter connection problems and a 14.4 Kbps, or faster, modem is being used, it may be necessary to disable some of the modem's capabilities that the M640 does not require. The most features most commonly disabled are the following:

Data Compression
Error Correction
Flow Control

For example, on US Robotics modems the initialization string is as follows:

AT&M0&K0&I0&H0&N2& (All entered in caps)

The commands in this string equate to the following:

AT	Get modem's attention
&M0	Error Control disabled
&K0	Data Compression disabled
&I0	RX Flow Control disable
&H0	TX Flow Control disable
&N2	Force modem to 1200 baud

Note: The initialization string for other modem brands may vary. Always consult the documentation for your modem to confirm the correct commands.

The following steps will allow you to change the modem initialization string:

- ❑ 1. Exit MCU to DOS. (Hit <Esc> repeatedly or select Other, Exit.)
- ❑ 2. Change to the \MCU directory (if not already there), by typing at the DOS prompt:
  CD C:\MCU\<my site name>
- ❑ 3. At the DOS prompt type "EDIT modem.ini".
- ❑ 4. Enter the new initialization string to disable the features previously mentioned. Do not insert spaces between commands; the string should be continuou.
- ❑ 5. Save the file and then exit to DOS.

The next time the location is ZLINKed, the computer will look at the "modem.ini" file for the appropriate modem commands.

Note: If you are unsure about modem initialization commands, contact Zetron Mobile and Paging Systems technical support for assistance. Be sure to have your modem manual handy for easy reference before calling.

Troubleshooting the MCU Interface

If the ZLINK interface is not successfully established with the paging terminal, recheck each of the following:

- ☑ all communication parameters defined in MCU, especially the Password and Phone Number fields
- ☑ all hardware connections between the office computer and the paging terminal
- ☑ all telco connections to the ZLINK trunk (if using a modem interface)

ZLINK Connection Through Another Terminal Emulator

This procedure describes how to establish communication with the Model 640 using an alternate terminal emulator program. (In the examples below, ProComm® is used.)

Note: Zetron recommends the use of MCU for communication between the office computer and the Model 640. This procedure is included for completeness, but is not the best means of linking to the paging terminal.

Use the following steps to configure the communications software for ZLINK interface:

- ❑ 1. Boot up the office computer.
- ❑ 2. Power up the Model 640 and let it complete its boot sequence (all lights have extinguished except the READY light is on solid).

- ❑ 3. Run the communications software. For example, type:

  PROCOMM

  from the \ProComm® directory.

- ❑ 4. Change the communications parameters to:

Local Connection	Modem Connection
• 4800 baud serial connection	• 1200 baud
• no parity	• no parity
• 8 bits per word	• 8 bits per word
• 1 stop bit	• 1 stop bit

  In ProComm®, this is accomplished by hitting <Alt> + <P> to enter the line settings window. Then select #11 (or #9) and press <Enter> to choose the parameters above.

- ❑ 5. Change the COM port selection to identify the computer's RS-232 or modem port.

  In ProComm® this is accomplished by selecting #22 (COM1), 23 (COM2), 24 (COM3), or 25 (COM4) from the line settings window.

- ❑ 6. Press <Esc> to save the parameter settings and return to the communication screen.

- ❑ 7. For a modem connection, enter the phone number into the dialing directory and initiate dialing.

  In ProComm®, this is accomplished by hitting <Alt> + <D> to enter the autodialing window. Then enter a new line number (1 - 10 are available). Enter the appropriate dialing string (phone number including all access codes, prefixes and area codes) to connect to the paging terminal.

- ❑ 8. Some strange control characters are printed to the screen. These characters are normal and indicate that the Model 640 is looking for a ZLINK connection. Wait a few seconds and then press <Enter> three times. Once a communications link has been established, the password entry screen shown in Figure 16 appears.

Note: *If a remote connection (modem) to the paging terminal will be used, it is recommended that a temporary local connection (usually with a laptop PC) be made for installation diagnostics. Refer to "Local Serial Connection" on page 34 for details.*

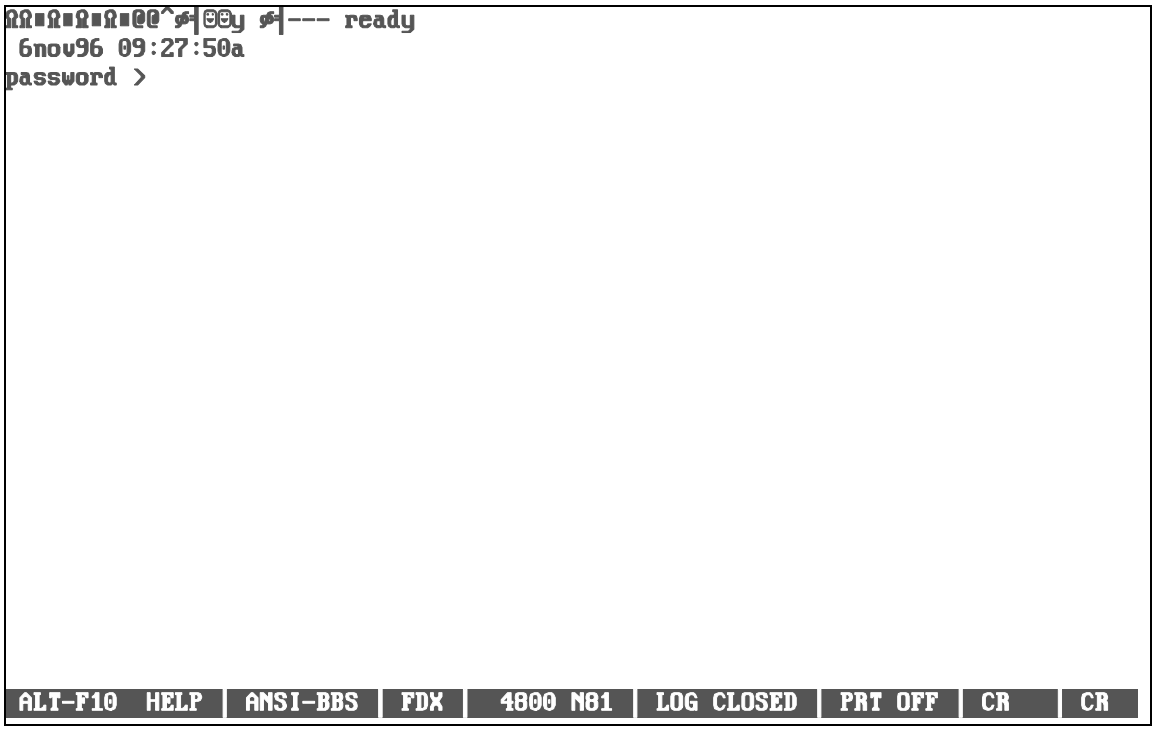


Figure 16. ZLINK Password Request Screen from ProComm®

- ❑ 9. The paging terminal is shipped from the factory with no password initially programmed. Press <Enter> and the introductory screen shown previously in Figure 15 appears.
- ❑ 10. The plus prompt (+) is displayed and a ZLINK connection has been successfully established. The Model 640 console is now logged on.

Troubleshooting the Emulator Interface

If the ZLINK interface is not successfully established with the paging terminal, recheck each of the following:

- ☑ all communication parameters defined in the terminal emulator program, especially the phone number and baud rate
- ☑ all hardware connections between the office computer and the paging terminal
- ☑ all telco connections to the maintenance trunk (if using a modem interface)

Troubleshooting the ZLINK Connection

The rest of this section troubleshoots faulty connections between the office computer and the paging terminal. If you have successfully linked up to your terminal, you need not read it. Otherwise, please read through it before calling for assistance.

Control Characters

Some unusual and special control characters are often written to the screen during the initial ZLINK interface. These symbols are normal and indicate that the terminal is attempting to handshake with the Model 640 to establish a communications link. However, if the screen displays strange characters and a ZLINK connection cannot be established, the "ansi.sys" driver may not be properly installed on the office computer. The characters may include, but are not limited to arrows, brackets, numbers, and other rather strange characters. To remedy the situation, add the following line to the "config.sys" file on the computer's boot disk:

DEVICE=ANSI.SYS

Jumper Settings

The Model 640 does not immediately recognize switch or jumper setting changes. After any changes are made, turn the equipment off, then back on to reinitialize the hardware.

Active ZLINK Connections

The office computer (PC) can talk to the paging terminal through the phone lines by way of modem, or through a local serial connection. Only one access method should be active at any given time. Zetron recommends consistently using only one interface method to avoid accidental communications conflicts.

CAUTION

Always turn off the computer or paging terminal before inserting or removing boards!

Zetron Communications Software

The ZLINK software is more sensitive to hardware configuration than dumb terminal emulator programs such as Crosstalk. ZLINK may not work correctly, even when another communications program runs okay on the same machine without changing anything. The steps below should resolve any problems. Please note that once configured properly for ZLINK, other communication programs should still run without any problem.

Note: When ZLINK starts up, both the serial port and modem are reset to communicate properly with the Model 640. There is no need to manually configure stop bits, parity, etc. - ZLINK does it automatically.

Serial Ports

If the office computer is locally connected to the paging terminal and a link cannot be established, this subsection provides some possible solutions.

A serial port is required for external modem and local connections to the paging terminal. If the office computer does not already have a built-in serial port available, one may need to be purchased and installed. Contact a computer repair and sales company for details and options.

ZLINK supports two serial ports directly (more can be addressed):

- COM1 is at I/O address 03F8h and uses IRQ4
- COM2 is at I/O address 02F8h and uses IRQ3
- COM3 is at I/O address 03E8h and uses IRQ4
- COM4 is at I/O address 02E8h and uses IRQ3

Troubleshooting Checklist

To avoid potential serial port problems, check the following:

- ❑ Ensure that a serial port is present and addressed to COM1, COM2, COM3, or COM4. Usually the COM port number is set by way of DIP switches on the serial board or computer BIOS. Check your PC manuals for details.
- ❑ Ensure that the serial port is active. Some computers allow disabling/enabling of the ports, usually by way of DIP switches. Check the PC and modem manuals for details.
- ❑ Ensure that the interrupts are set correctly and are active on the serial port. Some serial boards or ports can be setup for use with any interrupt signal. Check for the correct IRQ settings as listed above.
- ❑ Ensure that there are no serial port conflicts. If the computer has two serial ports, one must be COM1, the other COM2. If two ports are assigned the same COM port number, neither will function reliably.
- ❑ Recheck the pin configuration of the ZLINK cable, per Figure 11.

Note: Many PC cards perform several functions. For instance, a memory expansion card may also have a serial port. It is important to note that the computer may have an extra, unused serial port.

Modem Connections

Most modems on the market today function based on software commands instead of hardware switches or jumpers. An “initialization string” of commands can be sent to the modem to configure which features are enabled or disabled.

If the modem in the Model 640 responds to an incoming call, but a serial connection cannot be established, then a revised modem initialization string may be required to disable some of the default settings common in the newer, high-speed modems (14.4 Kbps and faster). The features in the modem installed in the PC that typically need to be disabled are:

Data Compression
Error Correction
Flow Control

For example, the following set of commands would be appropriate to initialize a US Robotics modem:

AT&M0&K0&I0&H0&N2

The commands in this string equate to the following:

AT	Get modem's attention
&M0	Error Control disabled
&K0	Data Compression disabled
&I0	RX Flow Control disable
&H0	TX Flow Control disable
&N2	Force modem to 1200 baud

Note: Do not assume that the computer's modem responds to the above commands exactly as described. Always check the modem manual for custom initialization commands and their use.

The following steps will allow you to change the modem initialization string:

- ❑ 1. Exit MCU to DOS. (Hit <Esc> repeatedly or select Other, Exit.)
- ❑ 2. Change to the \MCU directory (if not already there), by typing at the DOS prompt:
  CD C:\MCU\<my site name>
- ❑ 3. At the DOS prompt type "EDIT modem.ini".
- ❑ 4. Enter the new initialization string to disable the features previously mentioned. Do not insert spaces between commands; the string should be continuous.
- ❑ 5. Save the file and then exit to DOS.

The next time the location is ZLINKed, the computer will look at the "modem.ini" file for the appropriate modem commands.

Note: If you are unsure about modem initialization commands, contact Zetron Mobile and Paging Systems technical support for assistance. Be sure to have your modem manual handy for easy reference before calling.

Troubleshooting Checklist

To avoid potential serial port problems, check the following:

- ❑ Verify that the dial string to the terminal is correct.
  - If dialing over an End-to-End (POTS) line, you should hear/see the following events at the modem installed on the PC when the MCU is dialing the Model 640.
    1. Dial tone, followed by a string of Touch Tone digits
    2. One to three rings
    3. Model 640 answers with prompt "At the tone, enter your pager number.", followed by a beep prompt.
    4. The PC sends the console access number (usually 0555 or 555) by way of the modem as a string of Touch Tone digits.
    5. The Model 640 returns a solid modem tone followed shortly by the modem carrier "hiss" as it attempts to establish a connection.

6. The modem speaker is muted and the prompt “Connect 1200” appears on the screen of the PC.
7. The top menu for programming the Model 640 is displayed on the monitor.

- If dialing over a DID line, you should hear/see the following events at the modem installed on the PC when the MCU is dialing the Model 640.

1. Dial tone, followed by a string of Touch Tone digits
2. One to three rings
3. The Model 640 answers with a solid modem tone followed shortly by the modem carrier “hiss” as it attempts to establish a connection.
4. The modem speaker is muted and the prompt “Connect 1200” appears on the screen of the PC.
5. The top menu for programming the Model 640 is displayed on the monitor.

❑ If the modem in the PC and the modem in the Model 640

- ❑ Information in the EDIT LOCATIONS in MCU is correct
  EE line = (area code)nnn-nnnn,,,,,,<console access number>
  DID line = (area code)nnn-nnnn (⇐ number = console access number)
- ❑ Verify that no one is connected to the Model 640 by way of the local ZLink Comm port
- ❑ Verify that the ready light on the Model 640 is lit.
- ❑ Verify that no switch-boxes need to be switched.
- ❑ Verify that the telephone line is not shared with a FAX machine or another modem device (this applies to End-to-End lines only)
- ❑ Verify all telephone line connections.

❑ Ensure that if the phone line to the paging terminal has some kind of switch, it is in the proper position. For example, a switch to select a desk phone or the Model 640 should be set to access the paging terminal.

❑ Ensure that no FAX machines or other modems are on the telephone line.

Note: If all of the above checks and suggestions have been used and a ZLINK is still not possible, contact Zetron technical support for assistance.

INSTALLATION

INTRODUCTION

This section contains the information necessary to install the paging terminal. This includes making connections to both the telco and radio station equipment. The information is presented in the form of checklists and step-by-step procedures. Where appropriate, procedures in this section refer to detailed information contained elsewhere in the manual.

Installation Overview

Initial installation of the Model 640 is usually accomplished in six major steps:

- ❑ 1. Install the provided software modules on the office computer's hard disk.
- ❑ 2. Connect the office computer or console and establish a communications link.
- ❑ 3. Connect all trunks (2 or 4) to the telco central office (CO) or private access branch exchange (PABX).
- ❑ 4. Connect to the radio system (transmitter and receiver links).
- ❑ 5. Enter pagers into the database and perform some test paging operations. Adjust the equipment levels for the appropriate connections.
- ❑ 6. Mount and connect the working system into its permanent installation.

Steps #1 and #2 should have been completed in Section 4. Installation steps #3-5, plus several minor transition steps, are presented in this section. Each procedure lists and describes the specific steps to take during installation of the paging terminal.

Note: This section only includes the basics on setting up the Model 640 database for test purposes and using MCU for communications. Refer to the Model 640 Operating and Programming Manual (Part No. 025-9417) for details on the software operation of the paging terminal.

The installation procedures were designed with the assumption that the Model 640 was already factory configured with the correct number of trunks. It is also assumed that any other system customization (such as optional equipment) was completed prior to shipment. If optional equipment needs to be installed, refer to Section 7 before continuing with the standard installation.

To install the paging terminal, carefully follow each of the procedures in this section (in order). Some of the subsections may not be required. Simply skip the procedures that do not apply to the specific application.

Installation Warning

This equipment generates and uses radio frequency energy. If the Model 640 is not installed and used in accordance with this manual, it may cause interference to radio communications.

The Model 640 should only be installed by experienced radio and paging systems personnel. Specialized knowledge in telephone systems is also critical for interfacing the Model 640 with the telephone network.

CAUTION

Always power down the paging terminal before removing or installing cards. The Model 640 is not designed for "hot" removal/insertion of cards.

Initial Unpacking and Inspection

The following procedure prepares the technician for the actual installation of the paging terminal. It includes a general familiarization with the hardware and confirmation of the correct custom system ordered from Zetron. Some or all of this procedure may have been completed already. Skip any steps that are superfluous.

- ❑ 1. Unpack the Model 640 from its box.
- ❑ 2. Remove the six screws that hold the paging terminal top cover in place.
- ❑ 3. Remove the top cover of the Model 640 and set it and the screws aside in a safe place.
- ❑ 4. Check the unit against the order receipt to ensure that all purchased options were shipped from the factory.

  Refer to Section 3 for details on the location and operation of each card (standard and optional) in the Model 640 chassis.
- ❑ 5. Make sure all circuit cards, in each and every occupied slot, are firmly seated.

CHOOSING AN INSTALLATION METHOD

There are basically two interface options available for dividing the telco and radio connections. Each method can be modified in an endless variety of ways for a custom application.

Optional Installation Interface Assembly

This optional kit (Part No. 950-9334) includes a terminal block adapter for telco and radio station connections. The terminal block adapter plugs directly into the RJ21 connector on the rear of the Model 640 chassis. It provides two Wiedmueller connectors for the radio station interface and four RJ14 phone jacks for the telco interface.

Figure 17 illustrates the basic connections with the installation interface assembly option.

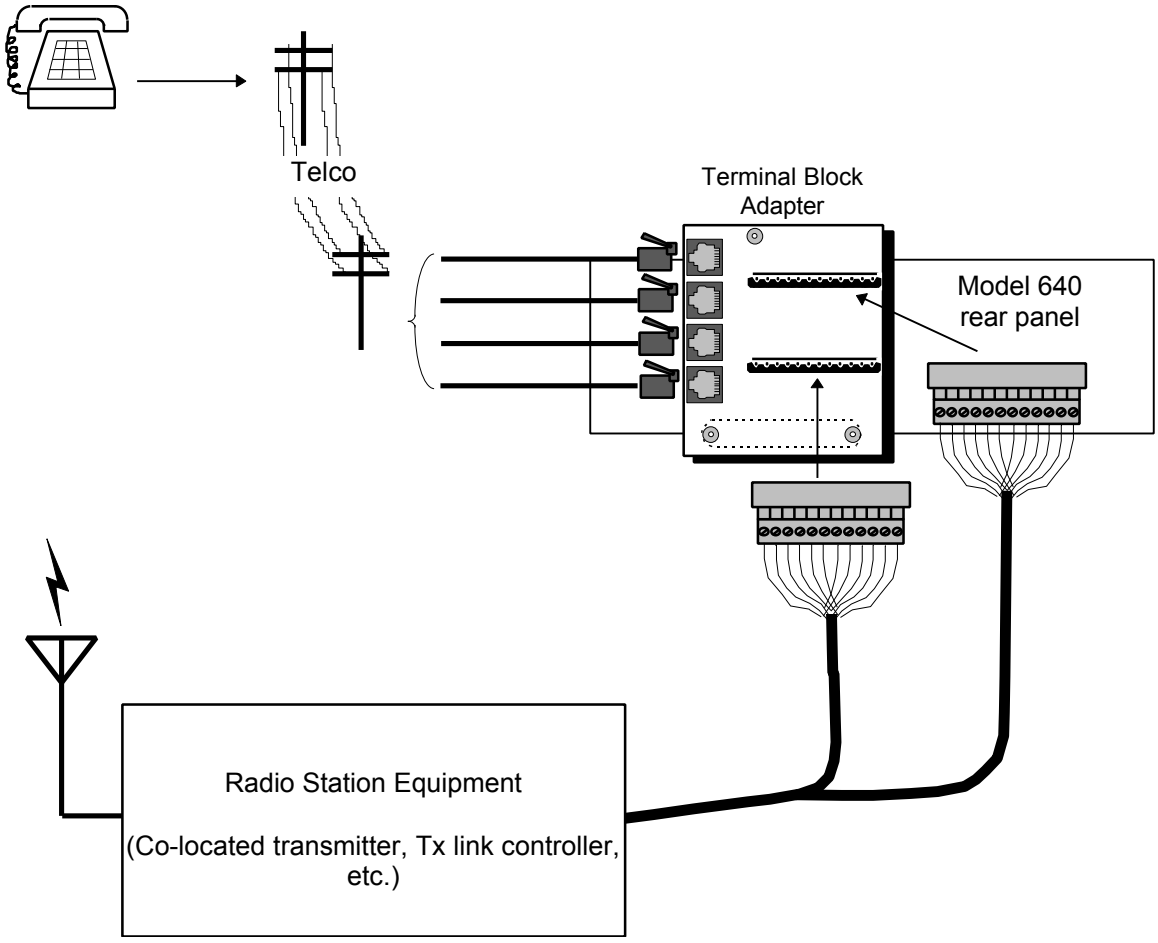


Figure 17. System Configuration with the Optional Installation Interface Assembly

66-Type Punchdown Block Installation

The other method of installation requires a 66-type punchdown block (Part No. 802-0093 or 802-0263) and a female 25-pair cable (Part No. 709-0004) to split the radio station and telco wiring out of the Model 640's RJ21 connector. This interface method is more flexible than the optional installation interface assembly, but it requires more extensive knowledge of telephone line types and signaling formats.

Figure 18 illustrates the basic connections with the 66-type punchdown block.

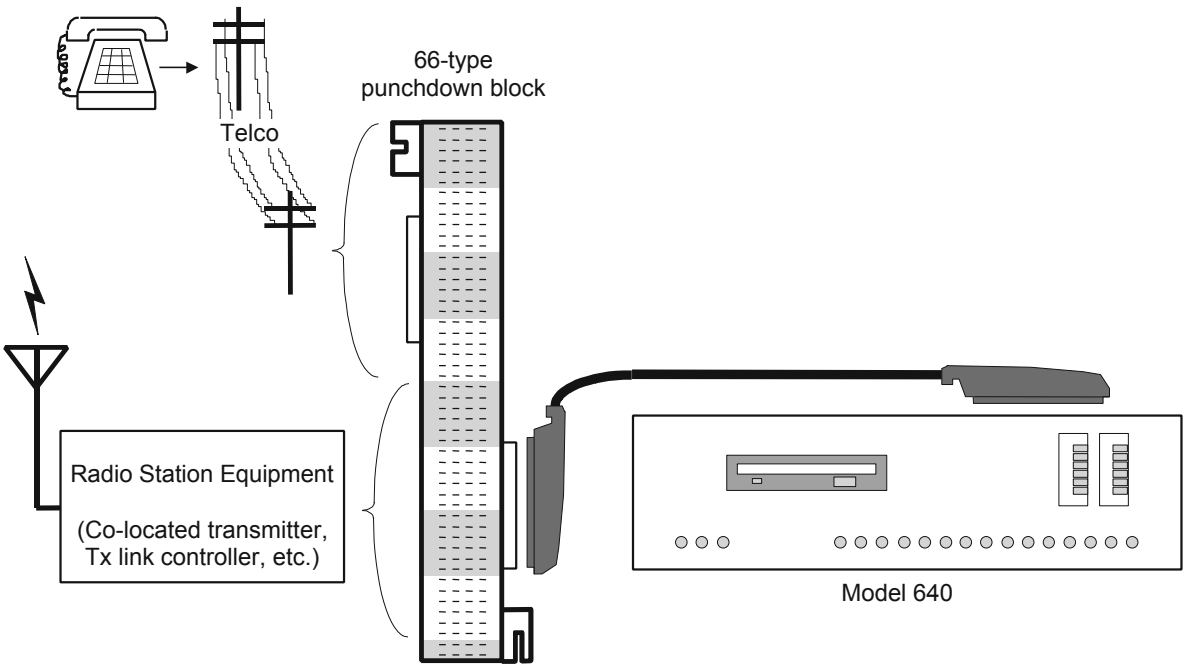


Figure 18. System Configuration with a 66-Type Punchdown Block

TELCO CONNECTIONS

The male 50-pin RJ21 connector on the rear of the Model 640 provides both trunk and radio station interfaces for the paging terminal. As a result, even though the telco and transmitter connections are accomplished separately (different installation instructions), they are not totally unrelated. The following table shows the telco pinouts for the RJ21 connector. Shading indicates the lead pairings for each of the four available trunks. This information is also printed on the rear panel of the paging terminal for convenience. Pin #1 is the first signal - top, left and pin #50 is the last signal - bottom, right.

Table 6. RJ21 Telco Pin Configuration

Pin #	Label	Description
1	RING 1-A	ring lead 1 for trunk A
2	RING 2-A	ring lead 2 for trunk A
3	M-A	M (mouth) lead for trunk A
4	RING 1-B	ring lead 1 for trunk B
5	RING 2-B	ring lead 2 for trunk B
6	M-B	M (mouth) lead for trunk B
7	RING 1-C	ring lead 1 for trunk C
8	RING 2-C	ring lead 2 for trunk C
9	M-C	M (mouth) lead for trunk C
10	RING 1-D	ring lead 1 for trunk D
11	RING 2-D	ring lead 2 for trunk D

Pin #	Label	Description
12	M-D	M (mouth) lead for trunk D
26	TIP 1-A	tip lead 1 for trunk A
27	TIP 2-A	tip lead 2 for trunk A
28	E-A	E (ear) lead for trunk A
29	TIP 1-B	tip lead 1 for trunk B
30	TIP 2-B	tip lead 2 for trunk B
31	E-B	E (ear) lead for trunk B
32	TIP 1-C	tip lead 1 for trunk C
33	TIP 2-C	tip lead 2 for trunk C
34	E-C	E (ear) lead for trunk C
35	TIP 1-D	tip lead 1 for trunk D
36	TIP 2-D	tip lead 2 for trunk D
37	E-D	E (ear) lead for trunk D

Ground Reference and Lightning Protection

TELCO or PABX interfaces to the Model 640 should always include a ground reference connection. Ground start and E&M wink start applications cannot operate reliably without this ground reference.

To ground the cabinet chassis to a common earth connection, use any of the screws holding the rear panel in place and connect to the telephone demarcation block ground point, using 16 AWG wire or larger. Tying two or three overhand knots in the wire inductively blocks lightning paths from the telephone equipment, but may also block RF grounding.

CAUTION

The Model 640 does not provide any integrated lightning defense. Use additional equipment, such as Zetron's Deadbolt, to protect your investment.

Installation Interface Assembly

The optional installation interface assembly (Part No. 950-9334) provides all of the hardware necessary for easy connection to the telco and the radio station equipment. The kit includes a terminal block adapter board (Part No. 702-9470) that plugs directly into the RJ21 connector on the rear of the Model 640. The adapter provides two male, 12-pin, Weidmuellers for connection to the radio station (separate analog and digital) and four standard, 6-wire, phone jacks for telco connections.

Terminal Block Adapter Installation

Follow the steps below to install the terminal block adapter on the rear panel of the Model 640.

- ❑ 1. Power-down the paging terminal.

❑ 2. Loosely attach two 440 × 5/16-in spacers to the bottom of the terminal block adapter with two 440 ? 1-in screws as shown in Figure 19.

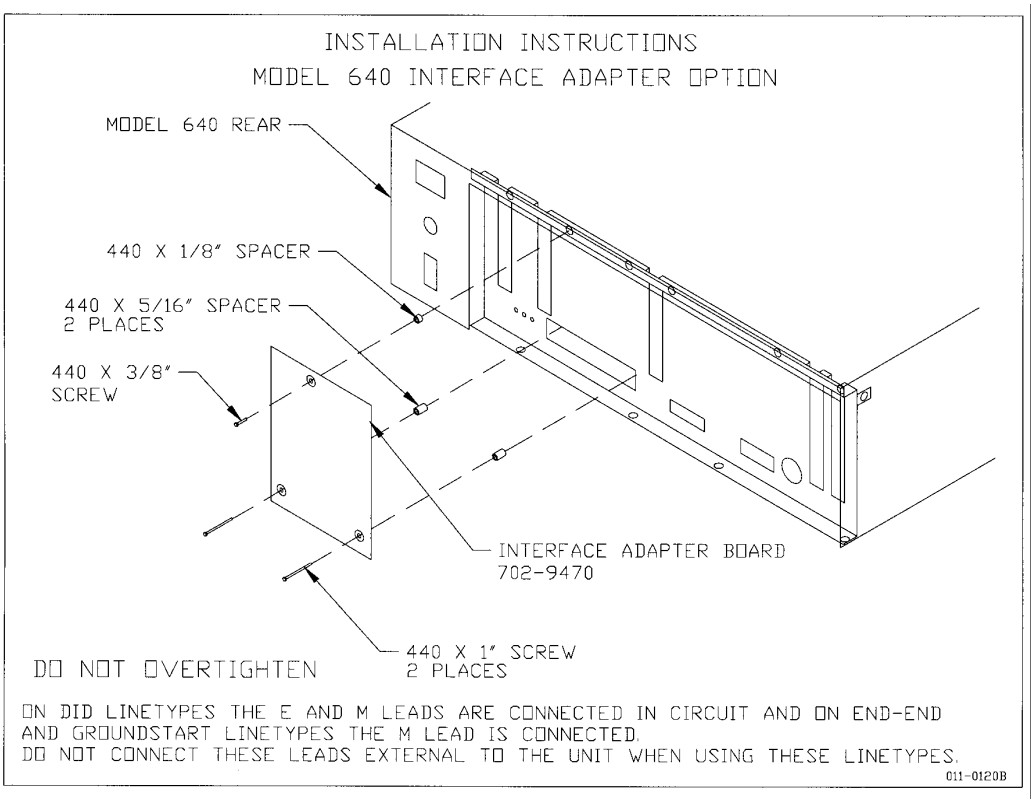


Figure 19. Terminal Block Adapter Installation

❑ 3. Loosely attach the 440 × 1/8-in spacer to the top of the terminal block adapter with the 440 × 3/8-in screw.

❑ 4. Secure the board to the RJ21 interface on the rear of the Model 640 chassis.

❑ 5. Tighten the three screws into the standoffs and the paging terminal.

Figure 20 shows the rear of the Model 640 chassis with the terminal block adapter installed.

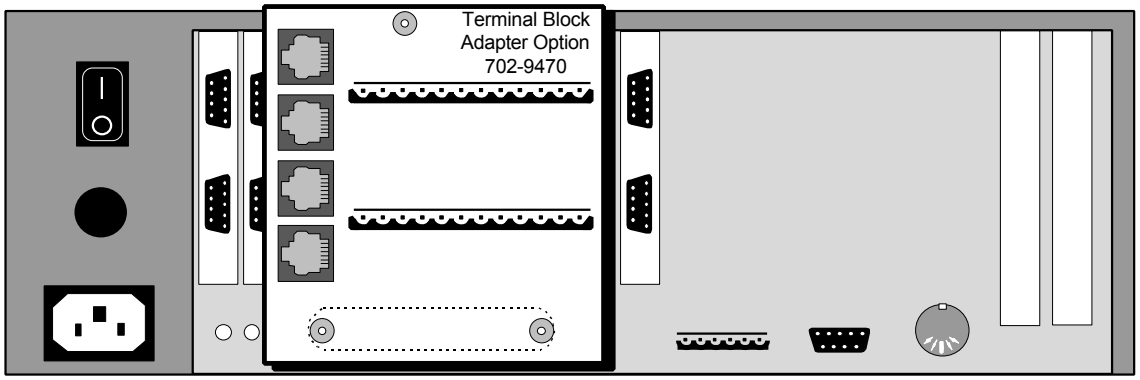


Figure 20. Installed Terminal Block Adapter Option

Note: Once the terminal block adapter is installed, the serial ports for trunks C and D (if a second dual trunk card is installed) are partially blocked. This should not create a problem as long as all alphanumeric serial input is directed to trunks A and/or B. Be aware of this minor inconvenience when configuring the trunks in the database to avoid extra work.

Telco Interface to the Terminal Block Adapter

Once the terminal block adapter is properly connected to the Model 640, the trunk lines can be interfaced to the telco phone lines. Generally, each of the four phone jacks on the adapter are connected to standard wall jacks with RJ14 cabling. However, some applications may require different telco wiring.

Follow the steps below to connect the terminal block adapter to the telephone lines:

- ❑ 1. Power-down the paging terminal.
- ❑ Use the supplied telephone cords (Part No. 709-7000) or make an appropriate cable for each of the active trunk interfaces (two or four, depending on the number of trunk cards installed). One end of each cable should have an RJ14, 6-pin plug for the connection to the terminal block adapter jacks. The other end should have whatever type of connector is required for the specific application.

2. Table 7 shows the pinouts for the jacks on the terminal block adapter (J1 - J4).

Table 7. Telco Interface (J1 - J4) Pin Configuration for Terminal Block Adapter

Pin #	Wiring Connection
1 (top)	E (ear) lead
2	Tip lead 2
3	Ring lead 1
4	Tip lead 1
5	Ring lead 2
6 (bottom)	M (mouth) lead

- ❑ 3. Connect a clamp-on ferrite (Part No. 305-2025) to the Model 640 end of each telephone cord as shown in Figure 21. Four ferrites are supplied with the installation interface assembly option for suppressing RF noise interference.

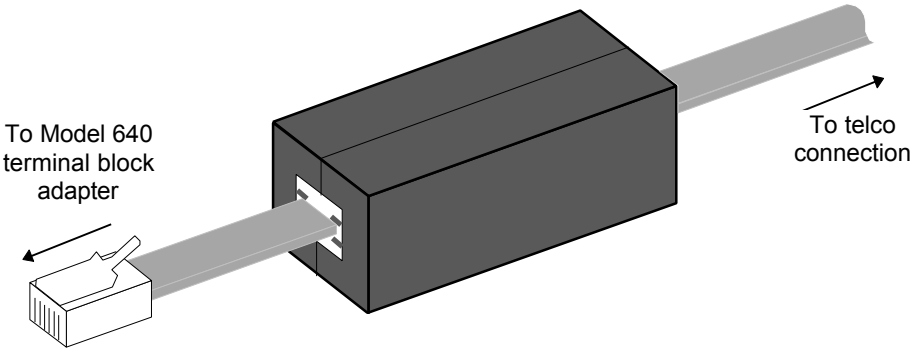


Figure 21. Clamp-On Ferrite (Part No. 305-2025) Installation

CAUTION

Four clamp-on ferrites (Part No. 305-2025) are supplied with the optional terminal block adapter kit. The ferrites must be installed on each phone cord, immediately adjacent to the Model 640 chassis.

Failure to properly install the ferrites may result in radio interference!

- ❑ 4. Plug a cord into each of the telco jacks on the terminal block adapter.
- ❑ 5. Connect the other end of each cord to the telephone line.

Telco connections for the optional installation interface assembly are complete. Proceed to "RADIO STATION CONNECTIONS" on page 61.

66-Type Punchdown Block Installation

Zetron offers two versions of the 66-type punchdown block for installation of the Model 640. The most flexible punchdown block (Part No. 802-0093) provides 50 terminals and a female RJ21 25-pair connector jack on either side of the block. The other punchdown block (Part No. 802-0263) provides only one RJ21 jack and has an easy-to-spot orange cover. Both blocks can be used for any type of connections, but each has advantages for specific applications.

Both punchdown blocks are configured with 50 rows (each corresponding to a pin) and four columns (terminals per row). The two left terminals in each row are electrically identical, as are the two right terminals. Paired bridging clips and fused bridging clips are available from other vendors to connect the two sides of the punchdown block.

Punchdown Block Installation

Zetron recommends using a female-to-male 25-pair cable (Part No. 709-0004) and a 66-type punchdown block (Part No. 802-0093) to interface the Model 640 to both the telco and the radio station.

Figure 22 illustrates the hardware connections between the Model 640 and the punchdown block.

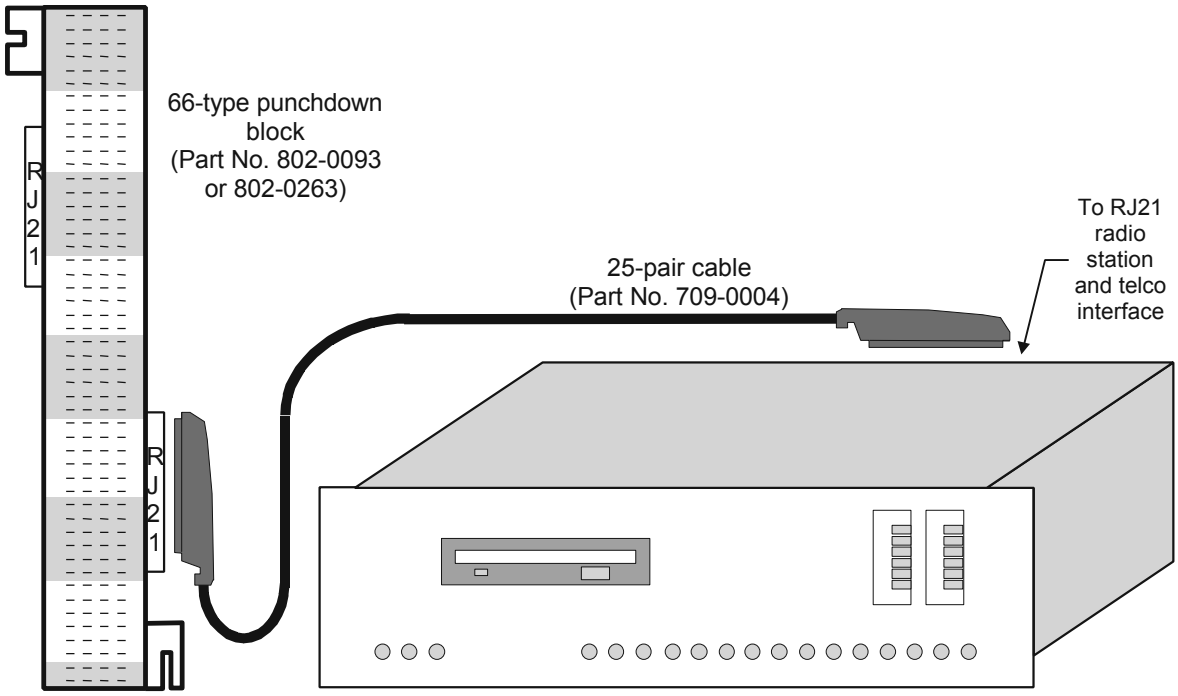


Figure 22. Punchdown Block Installation

Follow the steps below to connect the punchdown block to the paging terminal:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Obtain or make a cable with a female 50-pin connector (to Model 640) on one end and either flying leads or a male 50-pin connector (to punchdown block) on the other end. Refer to Table 6 for the telco pin configuration of the RJ21 connector on the rear panel of the paging terminal.
- ❑ 3. Plug the female connector into the RJ21 interface on the rear of the Model 640.
- ❑ 4. Plug the male connector into one of the RJ21 interfaces on the punchdown block. Be sure to make the Model 640 connections on one side and the radio station and telco connections on the opposite side.

  If using flying leads instead of a male RJ21 connector, punchdown the telco leads in the appropriate places.
- ❑ 5. Attach the punchdown block to a wall or fixture where it is easily accessible.

Telco Interface to the Zetron Punchdown Block

The interface to a central office (CO) or private access branch exchange (PABX) is typically provided by way of one of two hardware configurations:

- a 25-pair 66-type punchdown block
- standard RJ-type phone jacks

Telco Punchdown Block Interface

The block typically has telco wiring on one side and open terminals on the other side. To interface the phone company's punchdown block to the Model 640, a second punchdown block is usually required to split the radio station and trunk wiring out of the RJ21 connector (already installed above).

Figure 23 illustrates the hardware connections between a common telco 66-type punchdown block and the Zetron punchdown block. The block provides eight trunks, although the Model 640 only uses a maximum of four trunks. Notice that the telco line type in the figure is 4-wire E&M.

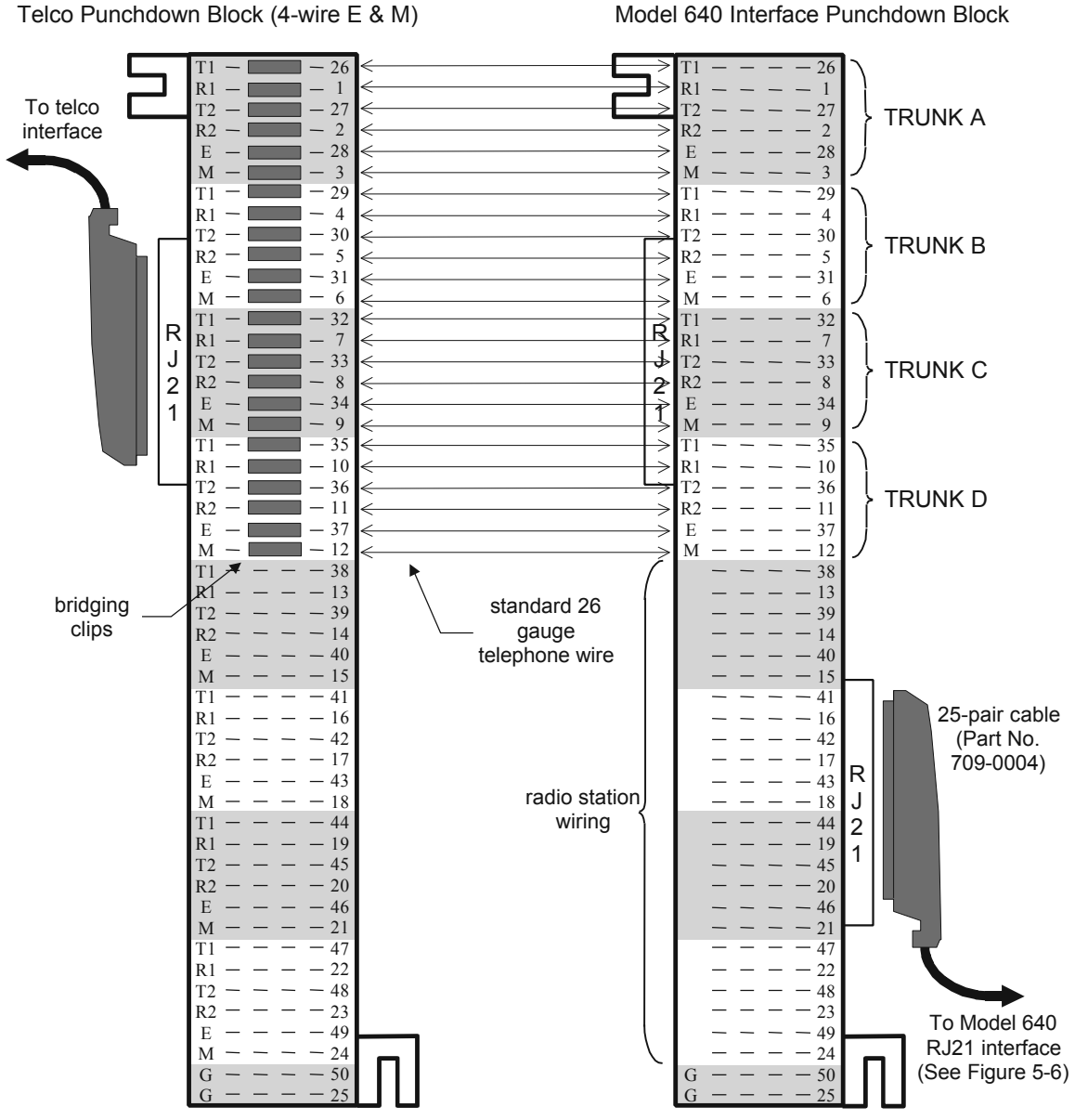


Figure 23. E&M 4-Wire Telco Interface

Follow the steps below to interface to the telco punchdown block:

- ❑ 1. Power-down the paging terminal.

❑ 2. Connect the leads for each Model 640 trunk as shown in Figure 23, using standard 26 AWG wire-wrap wire. Wiring configuration varies by telephone line type. The figure above shows the wiring configuration for an E&M 4-wire telco punchdown block.

Notes: *Many applications do not require all six of the available phone line pins. For example, a typical 2-wire telco interface only requires the TIP and RING leads for each trunk. Contact the telephone service provider to determine the line types and punchdown configuration.*

It may be wise to wire up all six leads and then use bridging clips to connect only the necessary leads. That way, any future changes in the telco line type will not require complete rewiring of the paging terminal interface.

Table 8. E&M 4-Wire Type I TELCO / PABX Interface

RJ21X pinout	Trunk #	Signal Name	Wire Color (Body/Stripe)	RJ21X pinout	Trunk #	Signal Name	Wire Color (Body/Stripe)
1	1	RING	BLU / WHI	26	1	TIP	WHI / BLU
2	1	RING1	ORG / WHI	27	1	TIP1	WHI / ORG
3	1	M	GRN / WHI	28	1	E	WHI / GRN
4	2	RING	BRN / WHI	29	2	TIP	WHI / BRN
5	2	RING1	SLA / WHI	30	2	TIP1	WHI / SLA
6	2	M	BLU / RED	31	2	E	RED / BLU
7	3	RING	ORG / RED	32	3	TIP	RED / ORG
8	3	RING1	GRN / RED	33	3	TIP1	RED / GRN
9	3	M	BRN / RED	34	3	E	RED / BRN
10	4	RING	SLA / RED	35	4	TIP	RED / SLA
11	4	RING1	BLU / BLK	36	4	TIP1	BLK / BLU
12	4	M	ORG / BLK	37	4	E	BLK / ORG
13	5	RING	GRN / BLK	38	5	TIP	BLK / GRN
14	5	RING1	BRN / BLK	39	5	TIP1	BLK / BRN
15	5	M	SLA / BLK	40	5	E	BLK / SLA
16	6	RING	BLU / YEL	41	6	TIP	YEL / BLU
17	6	RING1	ORG / YEL	42	6	TIP1	YEL / ORG
18	6	M	GRN / YEL	43	6	E	YEL / GRN
19	7	RING	BRN / YEL	44	7	TIP	YEL / BRN
20	7	RING1	SLA / YEL	45	7	TIP1	YEL / SLA
21	7	M	BLU / VIO	46	7	E	VIO / BLU
22	8	RING	ORG / VIO	47	8	TIP	VIO / ORG
23	8	RING1	GRN / VIO	48	8	TIP1	VIO / GRN
24	8	M	BRN / VIO	49	8	E	VIO / BRN
25	CHASSIS GROUND		SLA / VIO	50	CHASSIS GROUND		VIO / SLA

Notes on Table 8:

1. Colors are abbreviated as follows:
   BLK = black BLU = blue BRN = brown GRN = green
   ORG = orange VIO = violet SLA = slate (grey)
2. The E (ear) leads provide “to telco” supervision. The M (mouth) leads provide “from telco” supervision.

3. The RING/TIP pair provides two-way audio for DID, end-to-end, and E&M 2-wire tie trunks. The pair also provides “to telco” for E&M 4-wire to CO trunks.
4. The RING1/TIP1 pair is *not* used with DID, end-to-end, and most E&M 2-wire tie trunks. The pair only provides “from telco” for E&M 4-wire to CO trunks.

❑ 3. Use bridging clips or wire to connect the middle terminals of each row. Again, the appropriate connections depend on the telephone line types.

For end-to-end, loop or ground start and DID trunks, cross connect only the TIP/RING pair from the Zetron terminal to the phone company block.

For E&M trunks, cross connect the TIP/RING and E/M pairs or directly terminate the RJ21 jack of the Zetron terminal to the phone company block.

❑ 4. Trim any excess wire from each punchdown terminal to ensure good electrical contact.

❑ 5. Label the punchdown block to identify each of the leads. This will simplify troubleshooting and repair later.

Telco connections for the punchdown block are complete. Proceed to the “RADIO STATION CONNECTIONS” subsection on page 61.

Telco Phone Jack Interface

In some applications, the telephone interface is provided with standard wall phone jacks (RJ - type) instead of a punchdown block. This may be the case in a residence or converted office building.

If wall jacks are available, Zetron recommends using the optional installation interface assembly described on page 49 that includes the easy-to-install terminal block adapter. However, an optional RJ66M425 block (Part No. 802-0264) is also available from Zetron for this type of telco connection. The optional block provides six 8-pin RJ phone jacks for the telco interface.

Figure 24 illustrates the hardware connections between the Model 640 punchdown block and the RJ66M425 telco block. The block provides six trunks, although the Model 640 only uses a maximum of four trunks. Notice that the telco line type in the figure is 4-wire E&M. Connections for each trunk will vary slightly, depending on the signaling type.

Follow the steps below to interface to the optional RJ66M425 block:

❑ 1. Power-down the paging terminal.

❑ 2. Connect the leads for each Model 640 trunk as shown in Figure 24, using standard 26 AWG wire-wrap wire. Wiring configuration varies by telephone line type (E&M 4-wire shown in the illustration). Figure 25 compares the pin configurations of the two RJ-type phone jacks.

Note: The punchdown terminals on the optional RJ66M425 block do not function electrically like those on the other punchdown blocks described earlier. The four terminals in each row are separated into TIP and RING connections as shown in Figure 24.

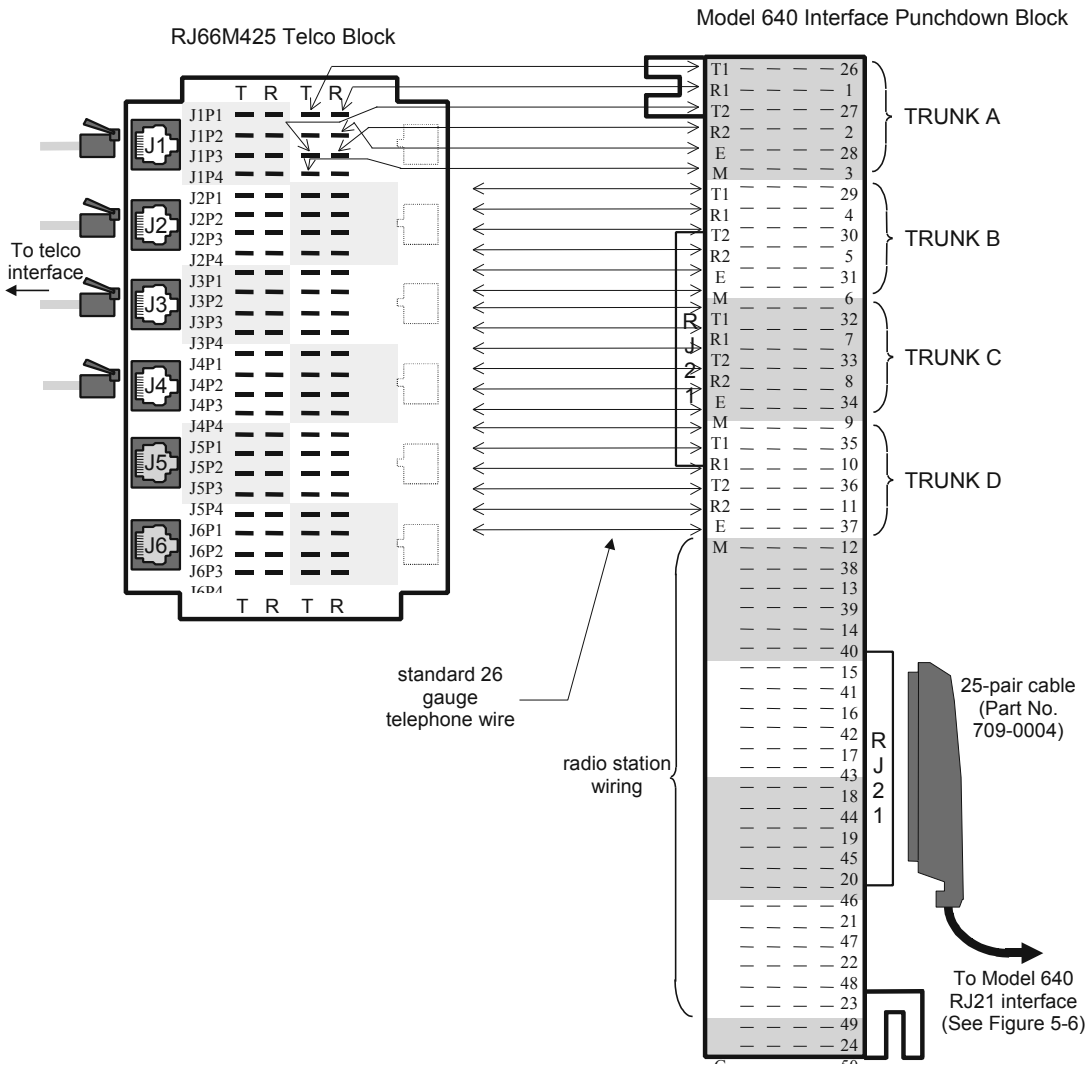
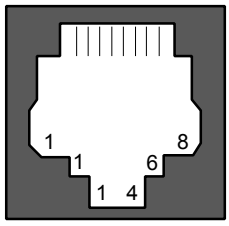


Figure 24. Telco Wiring With Optional RJ66M425 Block

Pin #	6-Wire Lead	8-Wire Lead
1	E (ear) signal	TIP 2
2	TIP 2	RING 2
3	RING 1	TIP 3
4	TIP 1	RING 1
5	RING 2	TIP 1
6	M (mouth) signal	RING 3
7		TIP 4
8		RING 4



8-wire miniature keyed jacks

Figure 25. Wiring Comparison for RJ-Type Phone Jacks

Note: It is important to remember that pin #1 for a 6-pin jack does not correspond to pin #1 for an 8-pin jack. See the wiring configurations in Figure 25.

- ❑ 3. Trim any excess wire from each punchdown terminal to ensure good electrical contact.
- ❑ 4. Label the punchdown block to identify each of the leads. This will simplify trouble-shooting and repair later.

Telco connections for the optional RJ66M425 punchdown block are complete.

RADIO STATION CONNECTIONS

As described earlier under "TELCO CONNECTIONS" on page 51, the male 50-pin RJ21 connector on the rear of the Model 640 provides both trunk and radio station interfaces for the paging terminal. This subsection details radio station installation for each type of connection available. Use only the instructions that apply to the interface method (terminal block adapter or punchdown block) already chosen for connections to the telco.

There are basically two interface options available for separating out the telco and radio connections. Each method of installation can be modified in an endless variety of ways for a custom application. The two unique hardware interfaces are:

- Zetron's optional installation interface assembly (Part No. 950-9334)
- A female to male 50-pin interface cable (Part No. 709-0004) and a 66-type punchdown block (Part No. 802-0093 or 802-0263).

Figure 26 shows the pin configuration for the radio station and telco interface connector on the rear of the Model 640.

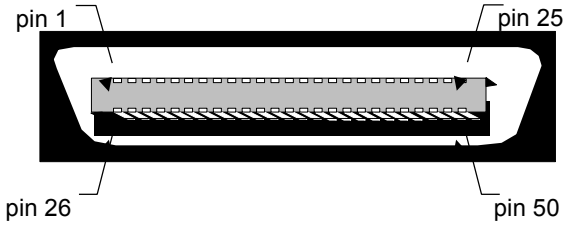


Figure 26. 50-pin Radio Station and Trunk Interface

Table 9 shows the radio station pinouts for the RJ21 connector. This information is also printed on the rear panel of the paging terminal for convenience.

Notes on Table 9:

†Relay contacts rated to 30 $V_{AC/DC}$, 1 amp or 120 V_{AC}, 0.5 amp.

* TTL, RS-232, CMOS levels: (Unless indicated otherwise, signal is compatible with all three levels)

TTL: OFF = 0 V_{DC} to 0.8 V_{DC} ON = +2.4 V_{DC} to +5.0 V_{DC}
RS-232: OFF = -3 V_{DC} to -12 V_{DC} ON = +3 V_{DC} to +12 V_{DC}
CMOS: same as TTL, except no pull-up resister load

Table 9. RJ21 Radio Station Pin Configuration

Pin #	Label	Description
13 38	REC AUDIO HI REC AUDIO LO	Receives audio (600 ohm balanced) input from radio station. Transformer-coupled audio for talkback (2-way) paging applications.
14	DIG MODE	Output (RS-232 voltage level*) keys up transmitter in digital mode.
15 40	XMIT AUDIO HI XMIT AUDIO LO	600 ohm balanced audio output to transmitter (tone, voice, modem).
16	COR / CAS	Input from radio station indicating channel busy. COR inhibits transmission until “clear.” Usually connected to radio COR or CAS output signal. Can be used as analog clear to send (CTS) input from a transmitter link controller. *
17	GROUND	Signal ground, used with signals 14, 39, 16, 41, 42, 21, 22, 46, 47. *Not the same as chassis ground (pins #49, 50).*
18 19 43	ANA PTT COM ANA PTT NC ANA PTT NO	Outputs (common, normally open, normally closed) indicate analog paging audio is being sent to the transmitter. Can be used as analog request to send (RTS) outputs to a transmitter link controller. †
20 44 45	DIG PTT COM DIG PTT NC DIG PTT NO	Outputs (common, normally open, normally closed) indicate digital paging data is being sent to the transmitter. Can be used as digital request to send (RTS) outputs to a transmitter link controller. †
21 22 46 47	ZONE ADR 8 ZONE ADR 2 ZONE ADR 4 ZONE ADR 1	Outputs indicate, along with XMIT REQUEST, whether the selected radio RF paging zone is “clear” or “busy”. The zone address is coded in binary bits 8 (2^3), 4 (2^2), 2 (2^1), 1 (2^0). (For example, 8=ON, 4=OFF, 2=OFF, 1=ON corresponds to zone #9 ($1x2^3 + 1x2^0$). Each signal requires a pull-up resistor to 5 volts, able to sink 40 mA to signal ground to drive relays or a transmitter link controller. Signal between 0 and 0.8 V is equivalent to a logic 1 (ON).
23 24 48	AUX PTT NO AUX PTT COM AUX PTT NC	Auxiliary outputs (common, normally open, normally closed) activate after XMIT REQUEST and before ANA or DIG PTT. Useful to busy out other control equipment sharing the transmitter. †
39	XMIT REQUEST	Output requesting radio transmission. RS-232 voltage level compatible. *
41	BUSY	Input from other paging equipment sharing the transmitter. Inhibits the Model 640 from keying PTT. Paging terminal stops transmitting at end of paging batch if busy asserted. Can be used as digital clear to send (CTS) input from a transmitter link controller. *
42	DIG DATA	Output carries binary digital paging data. RS-232 voltage level compatible. *
49, 50	GROUND	Connected to protective chassis ground for cable shielding and RFI protection. *Not the same as signal ground (pin #17).*

Installation Interface Assembly

The optional installation interface assembly (Part No. 950-9334) provides two male, 12-pin, Wiedmueller connectors for radio station interface (separate analog and digital). If the assembly is being used for the RJ21 interface, it should have been installed already and connected to the telco.

Follow the steps below to interface the terminal block adapter to the radio station equipment:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Obtain or make cabling for either one or both radio station connections (P1 - analog, P2 - digital). Both interfaces require male 12-pin Wiedmueller connectors on the Model 640 end.

3. Table 10 shows the pin configuration of each interface. Also, refer to Table 9 for descriptions of each signal and its application.

Table 10. Terminal Block Adapter Radio Station Wiring Configuration

Pin #	P1: Radio Analog	P2: Radio Digital
1	GND	GND
2	Tx Audio Low	Terminal Busy
3	Tx Audio High	Zone BCD Bit 1
4	COR	Zone BCD Bit 2
5	Analog PTT - NO	Zone BCD Bit 4
6	Analog PTT - COM	Zone BCD Bit 8
7	Analog PTT - NC	Digital PTT - NO
8	AUX PTT - NO	Digital PTT - COM
9	AUX PTT - COM	Digital PTT - NC
10	AUX PTT - NC	Digital Mode
11	Rx Audio Low	Request Transmit
12	Rx Audio High	Digital Data

- ❑ 3. Install a cylindrical ferrite (Part No. 305-0735) over each half of the Model 640 end of the split cabling as shown in Figure 27. Two ferrites are supplied with the installation interface assembly option for suppressing RF noise interference.

- ❑ 4. Use the included cable ties (Part No. 265-0001) to secure the individual wires together at the ends and in the middle of each half of the cabling, as shown in the illustration above.
- ❑ 5. Attach an appropriate connector to the other end of the cabling for the radio station interface. The type of connector is governed by the specific equipment used. Refer to “RF EQUIPMENT INTERFACING” on page 66 for details on many of the possible transmitter equipment interfaces.

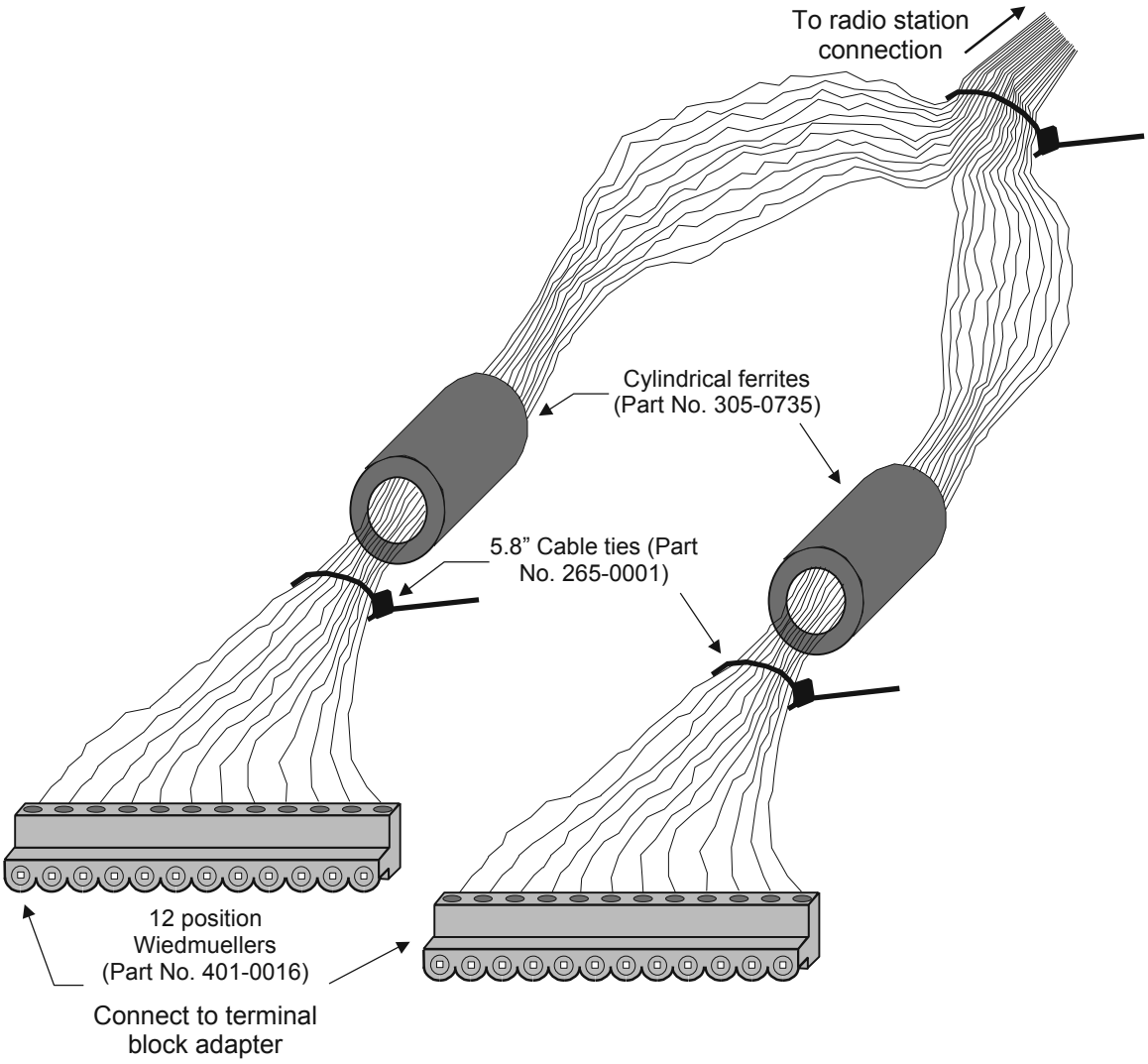


Figure 27. Radio Station Interface Cabling to Terminal Block Adapter

Note: Zetron recommends using stranded wire for the radio station interface, as it provides superior durability. The wire should be at least 14 gauge. It is also useful to have different colored wrap to easily identify each signal lead.

66-Type Punchdown Block Installation

If the telco connections were made using a 66-type punchdown block, then the lower half of the block (pins #13-25 and 38-50) provides the leads for the radio station interface. Refer to Table 9 for descriptions of each pin on the Model 640 RJ21 connector.

Follow the steps below to interface the radio station equipment to the optional punchdown block:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Connect the leads for each required radio signal to the punchdown terminal as shown in Figure 28.

- ❑ 3. Use bridging clips or wire to connect the middle terminal of each row, as needed.
- ❑ 4. Trim any excess wire from each punchdown terminal to ensure good electrical contact.
- ❑ 5. Label the punchdown block or leads to identify each of the radio signals. This will simplify troubleshooting and repair later.
- ❑ 6. Either make an appropriate cable and connector for the radio station interface or directly cross-wire the punchdown terminals to the radio equipment. The type of connection is governed by the specific equipment used. Refer to “RF EQUIPMENT INTERFACING” on page 66 for details on many of the possible transmitter equipment interfaces.

Note: Zetron recommends using stranded wire for the radio station interface, as it provides superior durability. The wire should be at least 14 gauge. It is also useful to have different colored wrap to easily identify each signal lead.

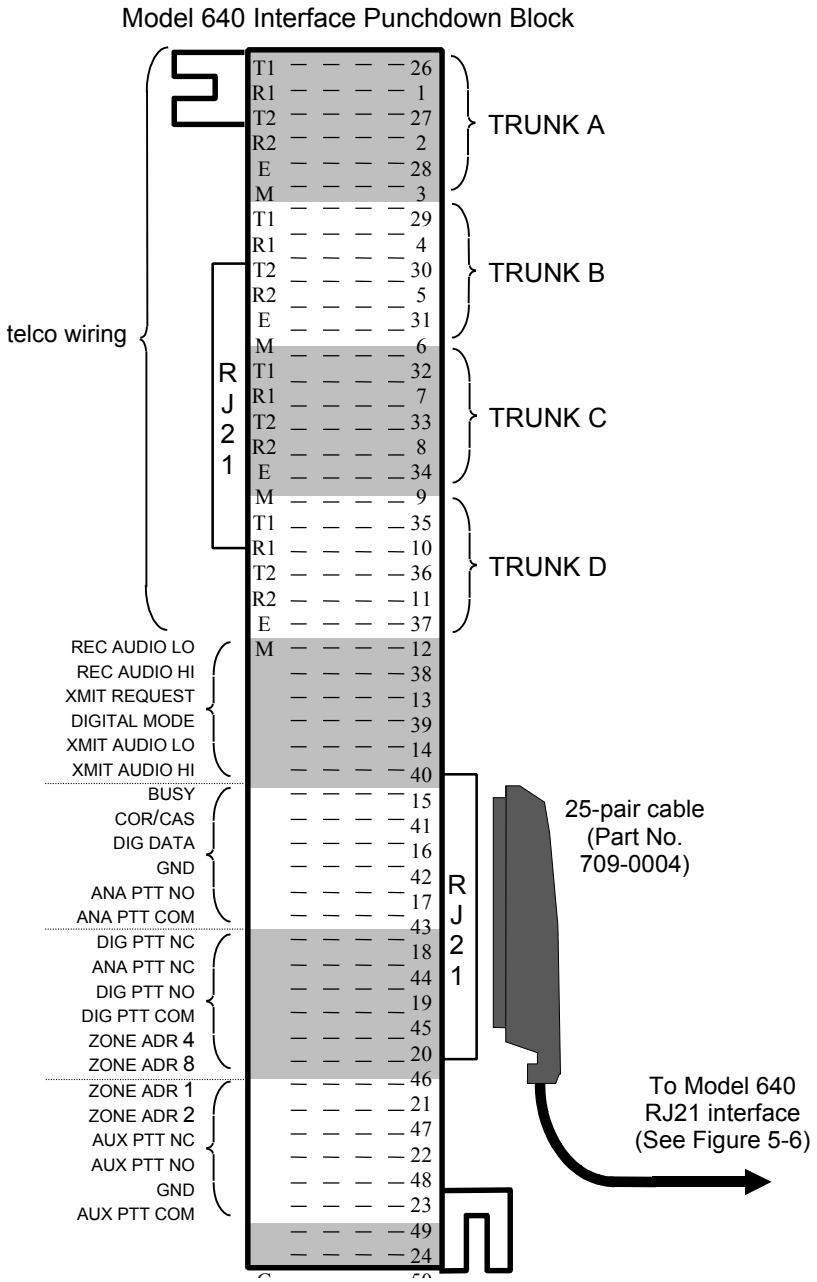


Figure 28. Punchdown Block Radio Connections

RF EQUIPMENT INTERFACING

The Model 640 provides complete radio station interface flexibility. As a result, many manufacturers and types of RF equipment can be connected to the paging terminal. The radio station output of the Model 640 allows three basic transmitter configurations:

- local transmitter
- remote transmitter(s)

- combination (local and remote transmitters)

The following subsections overview the basic connections between the Model 640 and a variety of common RF equipment — transmitters, controllers, and link equipment.

Modifications For TTL Data Outputs

In some system applications, RS-232 data output levels are not desired for the radio station connections. If either the DIG DATA (pin #42) or the DIG MODE (pin #14) signals need to be pulled down for TTL data, insert the simple circuit shown in Figure 29 between the Model 640 output and the transmitter input.

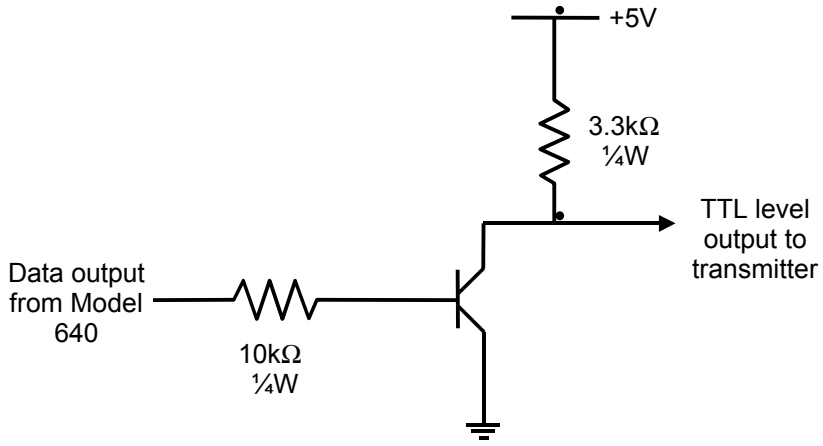


Figure 29. RS-232 to TTL Data Level Conversion

RF Station Jumper Settings

The Model 640 uses jumper settings and potentiometer adjustments to provide the needed radio station output flexibility. The jumpers on the peripheral motherboard control RF broadcast station interface parameters.

Note: Improper jumper settings can result in pager decoding errors or poor audio quality.

Figure 30 shows the locations of each jumper on the peripheral processor circuit board.

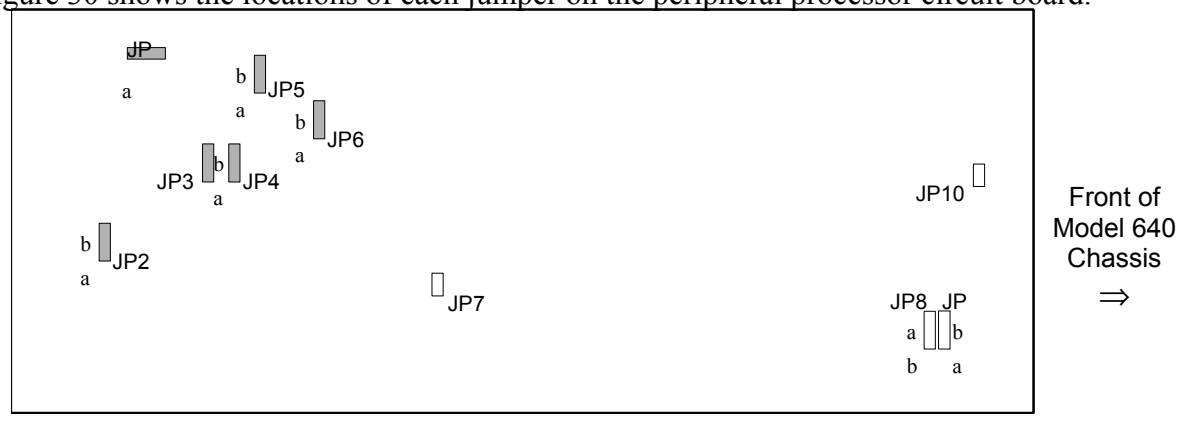


Figure 30. Peripheral Board Jumper Locations (Top View)

The highlighted jumpers on the peripheral motherboard control the station output as described in Table 11.

Table 11. Peripheral Mother Board Jumper Settings

Jumper	Function	Settings	Default
JP1	Receive voice audio from Talkback pager	A - flat B - de-emphasized	A
JP2	Transmit tone to transmitter	A - flat B - pre-emphasized	A
JP3	Enables Talkback audio path or separate tone output	A - tone output B - Talkback enabled (tx *and* rx audio)	B
JP4	COR (busy) polarity	A - active high B - active low	B
JP5	Transmit voice audio to transmitter	A - flat B - pre-emphasized	A
JP6	Terminal busy polarity	A - active high B - active low	B

Colocated Transmitters

Direct cable hookup between the Model 640 and a colocated radio transmitter is commonly used for local area paging, such as hospital and industrial plant applications. The General Electric MASTR II is an example of this type of transmitter. It is capable of digital paging using GE's modulator conversion kit.

The cable hookup depends on the specific radio station used. The Model 640 interface may be accomplished by way of an RJ21X punchdown block (see "66-Type Punchdown Block Installation" on page 55), or by way of an optional terminal block adapter (see "Installation Interface Assembly" on page 52).

Generic Transmitter Interface

Figure 31 describes the basic radio station interface configuration for the Model 640.

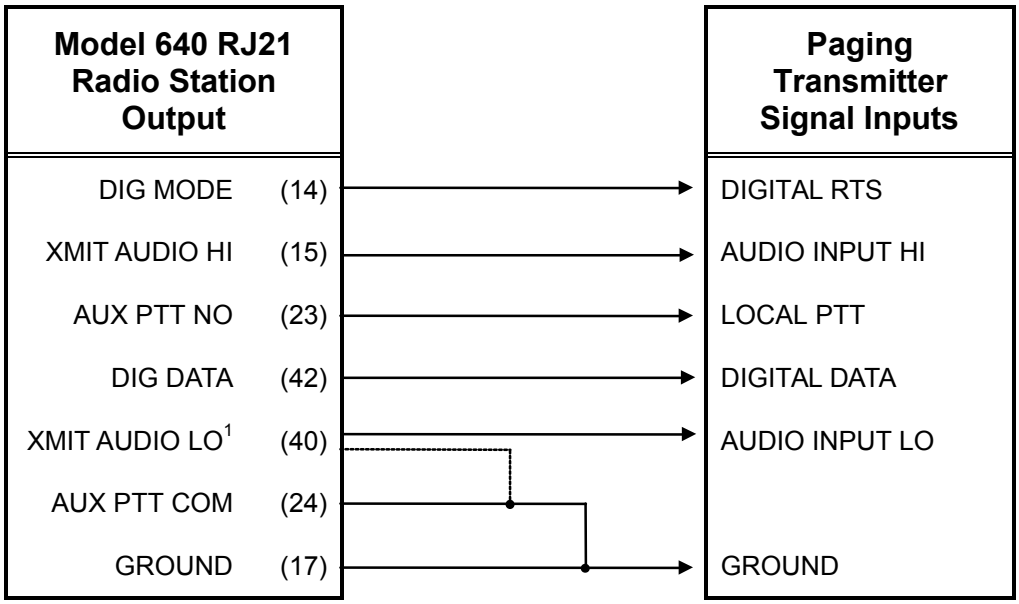


Figure 31. Wiring Configuration for Colocated Radio Station

Notes on Figure 31:

1. For single-ended systems, the XMIT AUDIO LO signal should be tied to GROUND. For balanced 600Ω systems, the XMIT AUDIO LO signal should be tied to AUDIO INPUT LO.
2. If a Motorola PURC® transmitter is used, disable the built-in UDS 202 modem.
3. In the Model 640 Transmitter Key Up Control database set:
   - the ModeSgnlPlrty parameter to “high” for digital
   - the DigDataPolarity parameter to “0” for inverted data

Motorola PURC® Transmitter Interface

Direct cable hookup between the Model 640 radio station interface and a colocated Motorola Paging Universal Remote Control (PURC®) transmitter is shown in Figure 32. The wiring configuration depends on whether the transmitter has a "unified" or "non-unified" backplane. The Motorola pin numbers refer to the backplane terminal blocks (TB).

Model 640 RJ21 Radio Station Output		Motorola PURC® Transmitter		
		Signal Name	Unified (TRN4860) Pin #	Non-Unified (TRN5349) Pin #
AUX PTT NO	(23)	LOCAL PTT	TB3 - 8	TB2 - 8
DIG DATA	(42)	RECEIVE DATA	TB3 - 13	TB2 - 2
DIG MODE	(14)	CARRIER DETECT	TB3 - 19	TB2 - 17
XMIT AUDIO HI	(15)	UNNOTCHED AUDIO	TB3 - 20	TB2 - 18
XMIT AUDIO LO	(40)			
AUX PTT COM	(24)			
GROUND	(17)	GROUND	TB3 - 1	TB2 - 1

Figure 32. Wiring Configuration for Colocated Motorola PURC® Station

Notes on Figure 32:

1. If the Motorola PURC® transmitter is equipped with a built-in UDS 202 modem, disable it.
2. The following parameter settings are typical for connection to a Motorola PURC® transmitter. In the Model 640 Key Up Control database set:
   - the ModeSgnlPlrty parameter to "high" for digital
   - the DigDataPolarity parameter to "0" for inverted data
3. Other various timing parameters, such as PTT keying and analog/digital mode change delay, are also set in the Model 640 databases.

Miscellaneous Motorola Transmitter Interfaces

Figure 33 illustrates a direct connection to a colocated Nucleus NAC transmitter. The pin numbers refer to the J17 and J15 inputs on the transmitter.

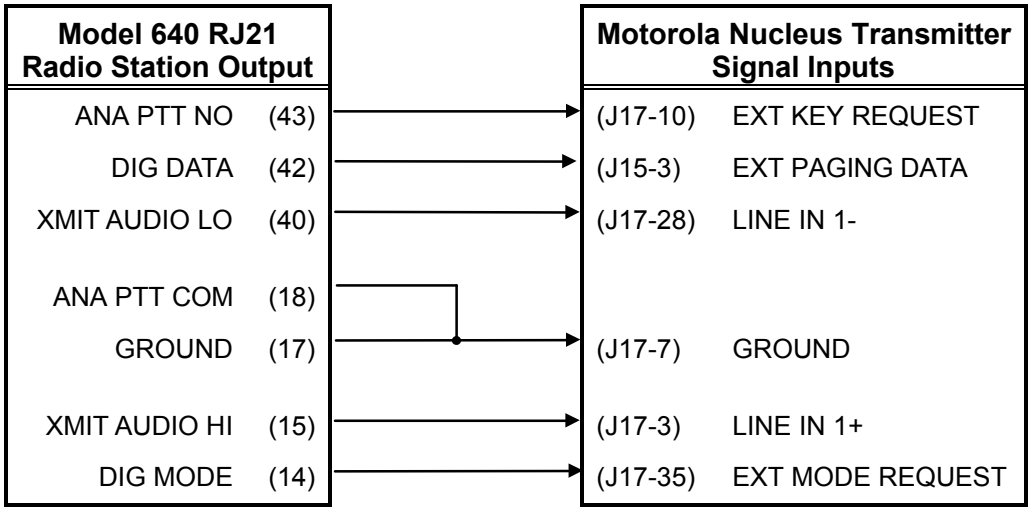


Figure 33. Wiring Configuration for Colocated Nucleus Transmitter

Figure 34 illustrates a direct connection to a colocated Motorola Radius GM300 transmitter. The pin numbers refer to the J3 accessories input on the transmitter.

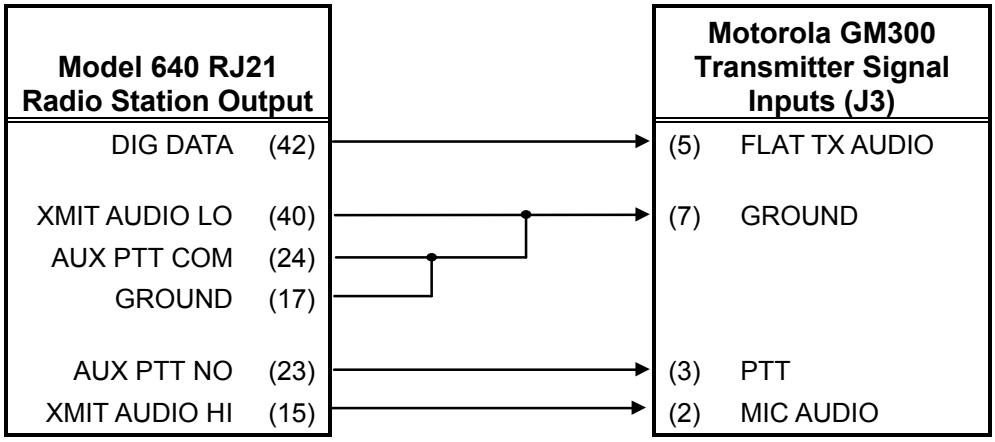


Figure 34. Wiring Configuration for Colocated GM300 Transmitter

Glenayre Transmitter Interface

Figure 35 illustrates a direct connection to a colocated Glenayre transmitter. The Glenayre pin numbers refer to the backplane terminal block connector (TB1).

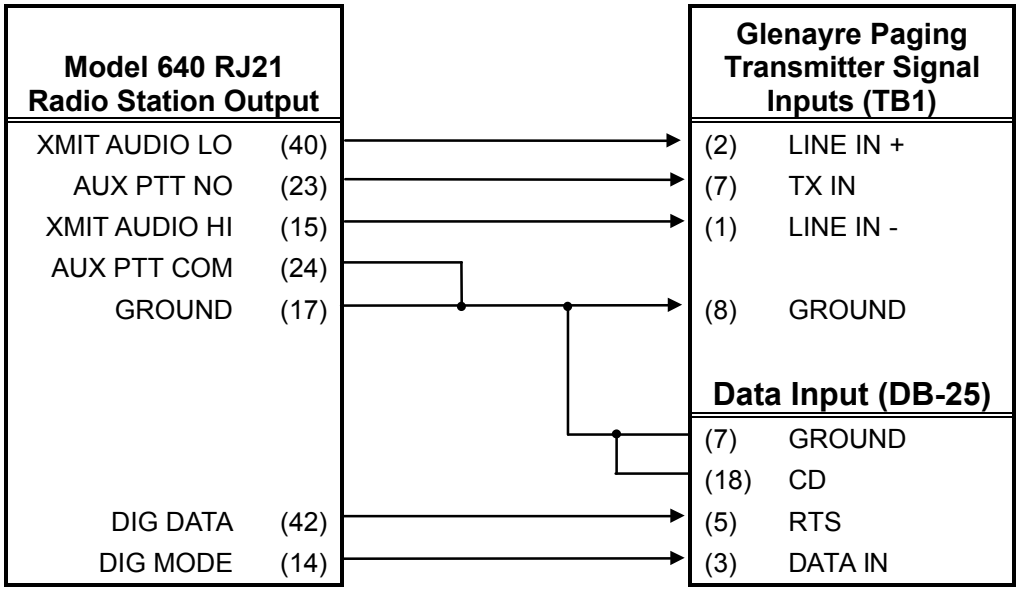


Figure 35. Wiring Configuration for Colocated Glenayre Transmitter

Notes on Figure 35:

The following parameter settings are typical for connection to a Glenayre transmitter. In the Model 640 Transmitter Key Up Control database:

- Set the ModeSgnlPlrty parameter to “high” for digital.
- If the transmitter keys, but the digital pagers *do not alert*, try setting the DigDataPolarity parameter to “0”.

Quintron 1000 Exciter Interface

Figure 36 illustrates a typical cable hookup between the Model 640 radio station interface and a Quintron 1000 Exciter.

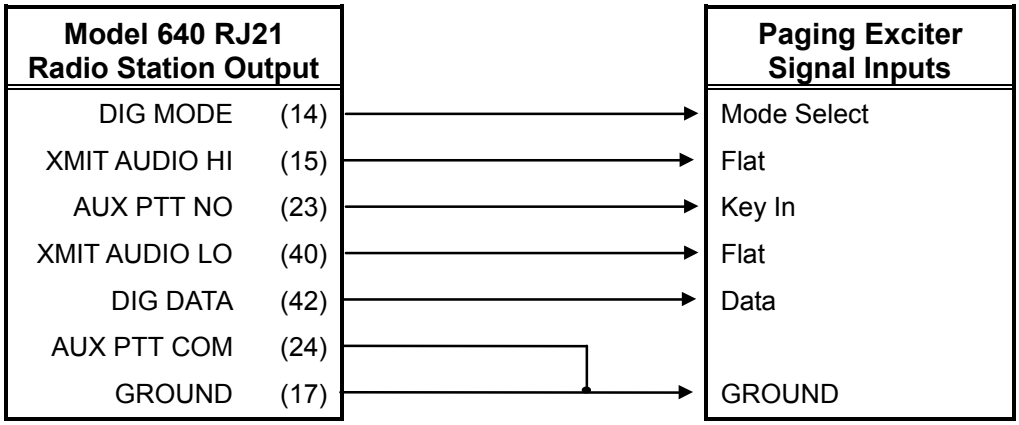


Figure 36. Wiring Configuration for Quintron 1000 Exciter

Remotely Located Transmitters

Most radio stations for wide area paging are located at a distance from the Model 640 paging terminal. To accommodate this type of application, the station card can be programmed for single- or multiple-site remote control. (Set in the Model 640 transmitter databases. See the *Model 640 Operating and Programming Manual*, Part No. 025-9417, for details.)

The remote control is compatible with Motorola PURC® transmitter control shelf equipment or a Zetron Model 66 Transmitter Control Panel. When so equipped, the Zetron station card can directly drive a dedicated line or link transmitter with just a few wires.

Figure 37 illustrates the basic connections between the Model 640 and a link transmitter. In this application, the colocated equipment sends pages out to the main paging transmitter by way of RF or microwave link.

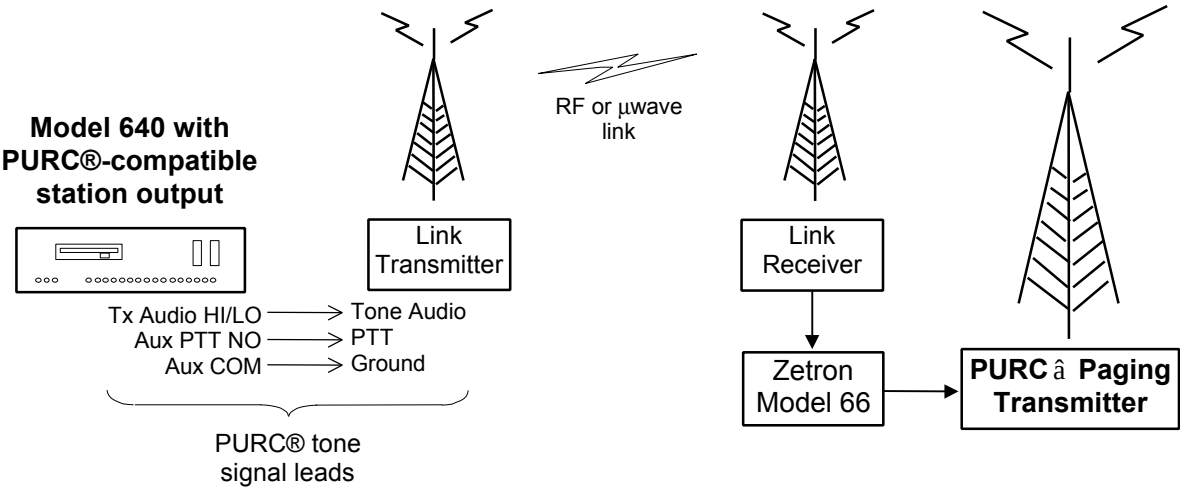


Figure 37. Remote Transmitter Connected by way of RF Link

Notes on Figure 37:

The following parameter settings are typical for connection to a Model 66 or a Motorola PURC® transmitter. In the Model 640 database set:

Transmitter Key Type database (these value correspond to default “purc” record):

StaRmtCtrl = purc
ModeTime = 100 ms
DigDataPolarity = “0” for inverted data

Transmitter Key Up Control database:

KeyUpDelay = 420 ms HLGT (set to 120 ms for HLGT plus 300 ms per RF link delay
1 link = 420, 2 links = 720, etc.)

Figure 38 illustrates the basic connections between the Model 640 and a leased telco trunk. In this application the remotely located transmitter (and controller) are directly connected to the phone line and keyed by the TIP and RING pair.

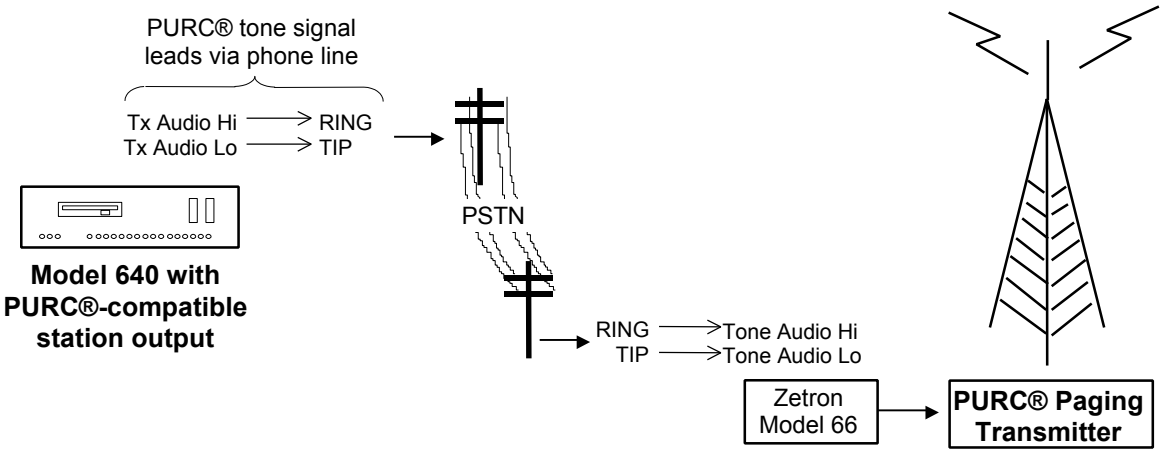


Figure 38. Remote Transmitter Connected by way of Leased Telco Line

Combined Local and Remote Transmitters

Many applications require several transmitters to cover a specified region. Often times a single transmitter is located at the main paging site with the Model 640 and one or more transmitters are located in remote areas to increase the coverage area. The remote transmitters can be linked to the paging terminal by way of either or both of the methods described earlier.

Figure 39 illustrates the basic connections between the Model 640 radio station output and both a local paging transmitter and a link transmitter. In this example, the Model 640 sends pages to three coverage zones - one local and two remote.

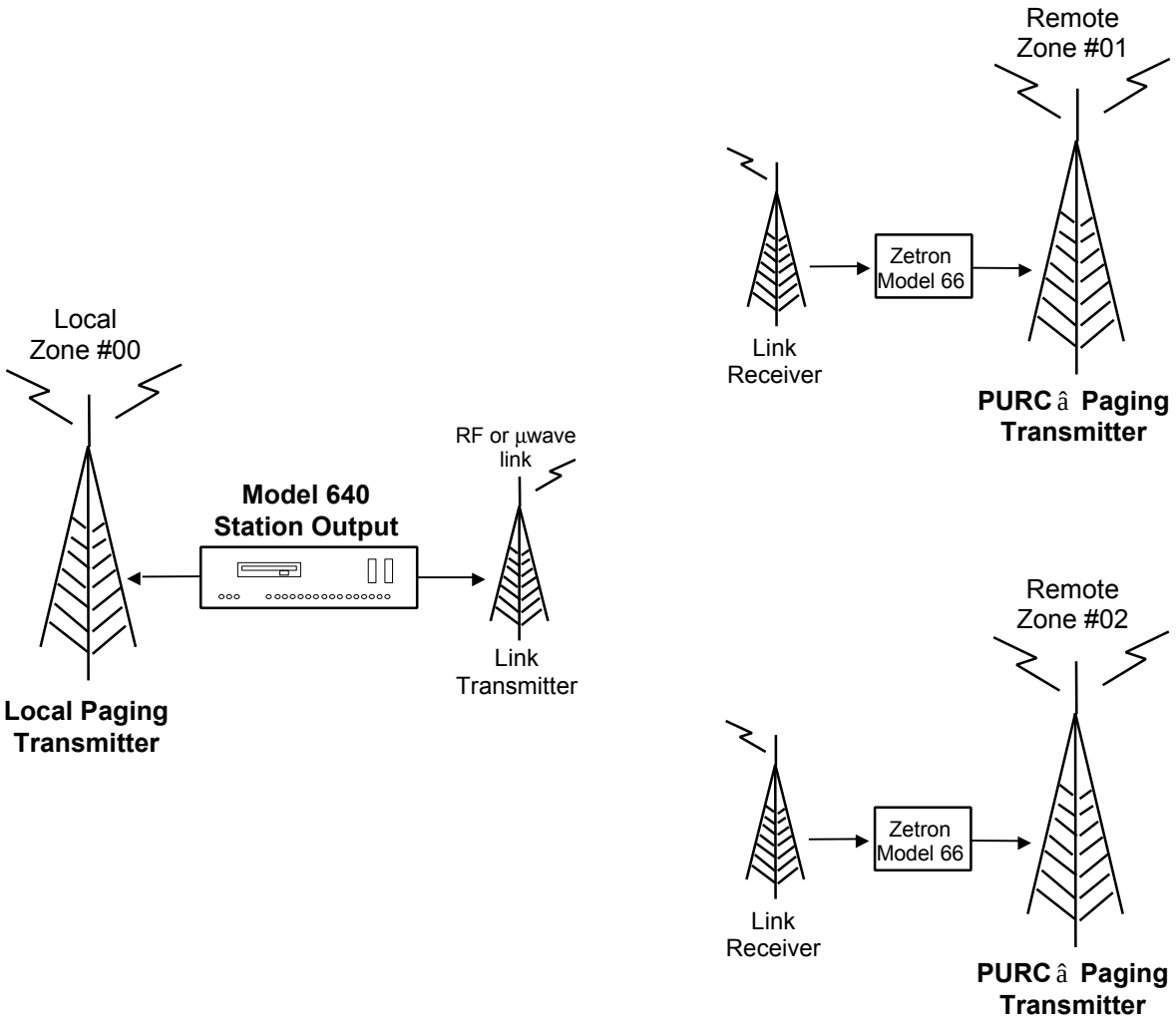


Figure 39. Combination Transmitter Connections

For this type of generic transmitter setup, use the cable hookup described in Figure 40. Be aware that different brands of transmitters may require different signal leads.

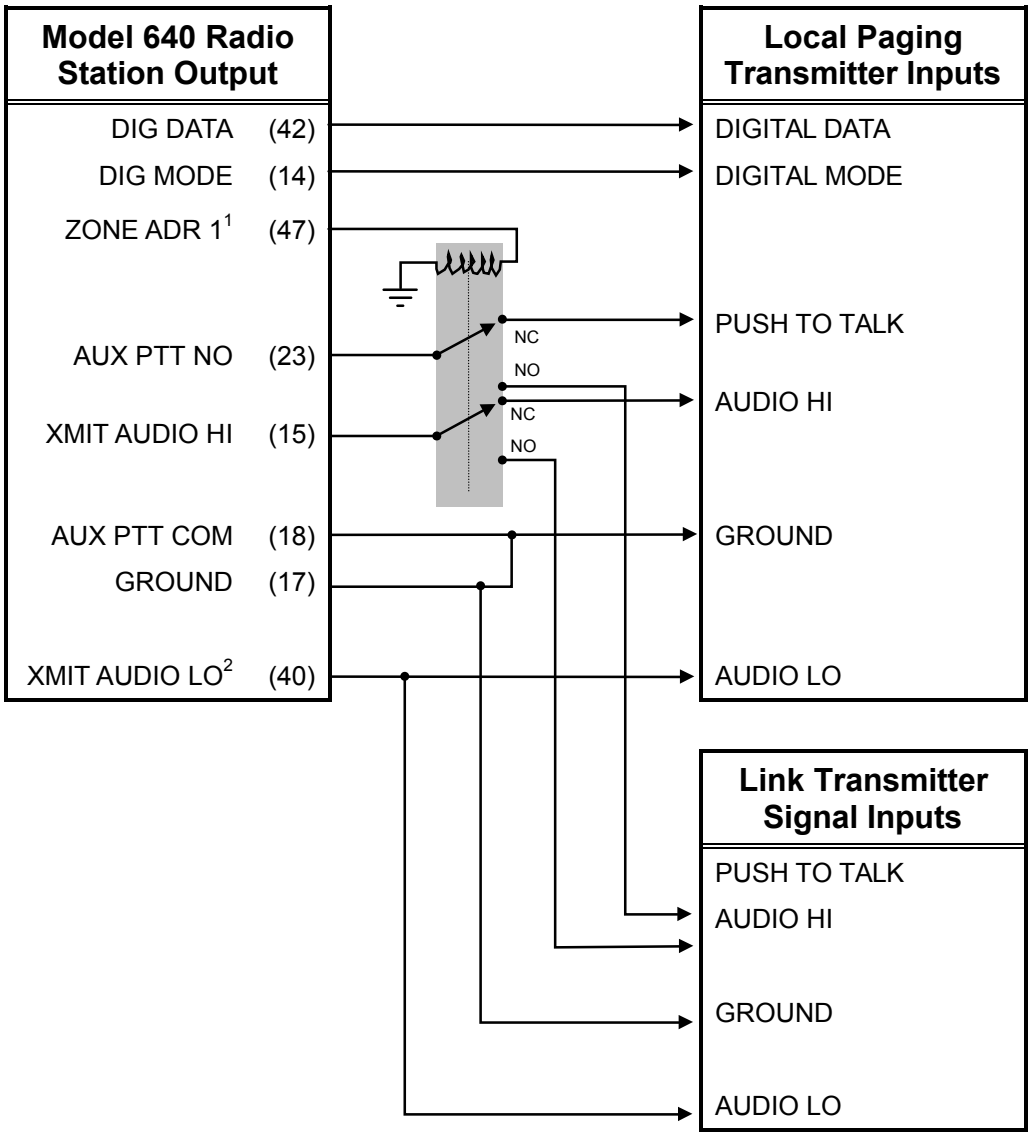


Figure 40. Wiring Configuration for Combination Transmitter Control

Notes on Figure 40:

1. The zone output drives the PTT and audio relays. The local transmitter is zone #00 and the link transmitter is zone #01. (Zone address outputs from the Model 640 are active low.)
2. The audio low signal is not hooked to a separate relay because internal coils connect it to the audio high circuit. This ensures that both high and low audio are sent together.

RF and Microwave Transmitter Link Controllers

A transmitter link controller is used when the Model 640 station interface is not sufficient to drive the link transmitter (non-PURC® applications). The transmitter link controller is installed at the paging terminal site between the Model 640 and the link transmitter. See Figure 37 for the basic system configuration.

Generic Transmitter Link Controller Interface

Figure 41 illustrates a typical cable hookup between the Model 640 radio station interface and most brands of transmitter link controllers such as a Quintron Omega, Microlink 20T, or Motorola DDC. (For connections to a Motorola PSC or SSC transmitter link controller, see the signaling description in the following subsection.)

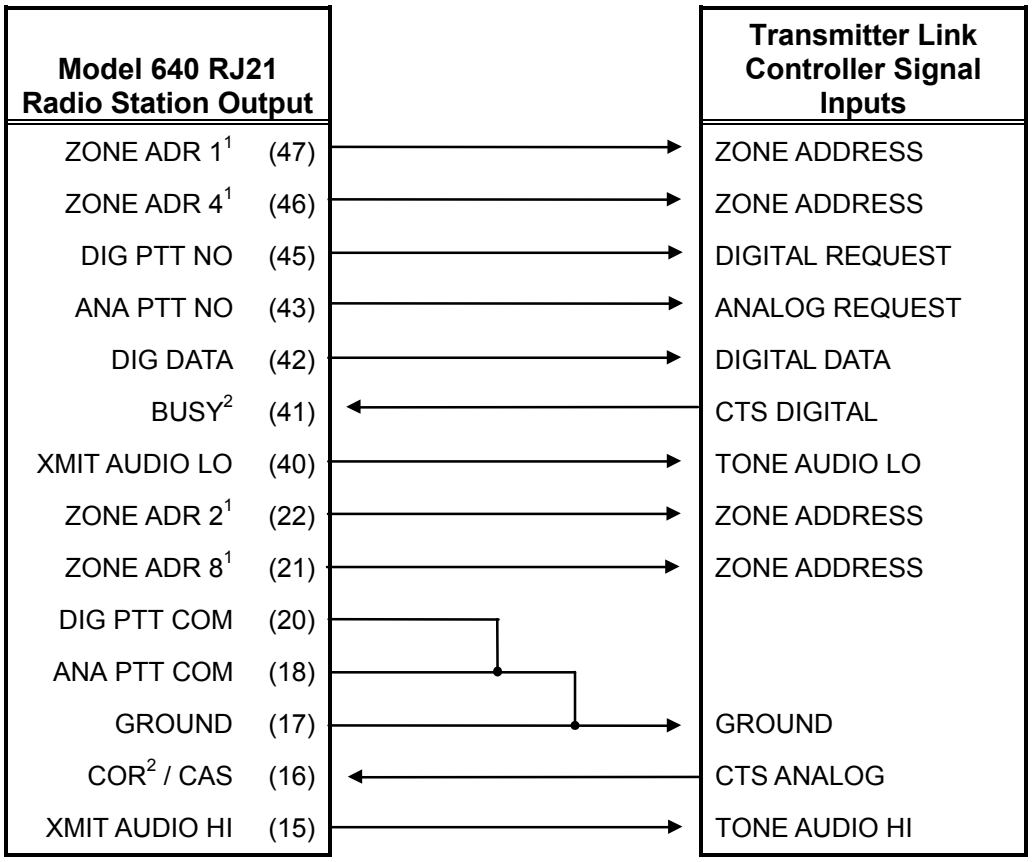


Figure 41. Wiring Configuration for Transmitter Link Controller

Notes on Figure 41:

1. Zone address outputs from the Model 640 are active low.
2. Default polarity for the COR and BUSY inputs are active low (0 volts = logic “1”). The busy LED should not be lit when idle. If reversed polarity is desired, move jumpers JP4 and JP6 on the peripheral board to position A - active high.
3. The following parameter settings are typical in the Model 640 database. In the Transmitter Key Type database set:

   ModeTime = 50 ms BusyTime = 25 ms
   StaRmtCtrl = RTS/CTS

Motorola PSC/SSC Transmitter Link Controller Interface

Figure 42 illustrates a typical cable hookup between the Model 640 radio station interface and a Motorola PURC® Station Controller (PSC) or Simulcast System Controller (SSC). Note that a Motorola PSC or SSC requires an external 202 type modem to encode the digital paging data. Zetron's multiple-site remote control feature for the Model 640 radio station provides an alternate to most Motorola PSC and SSC applications.

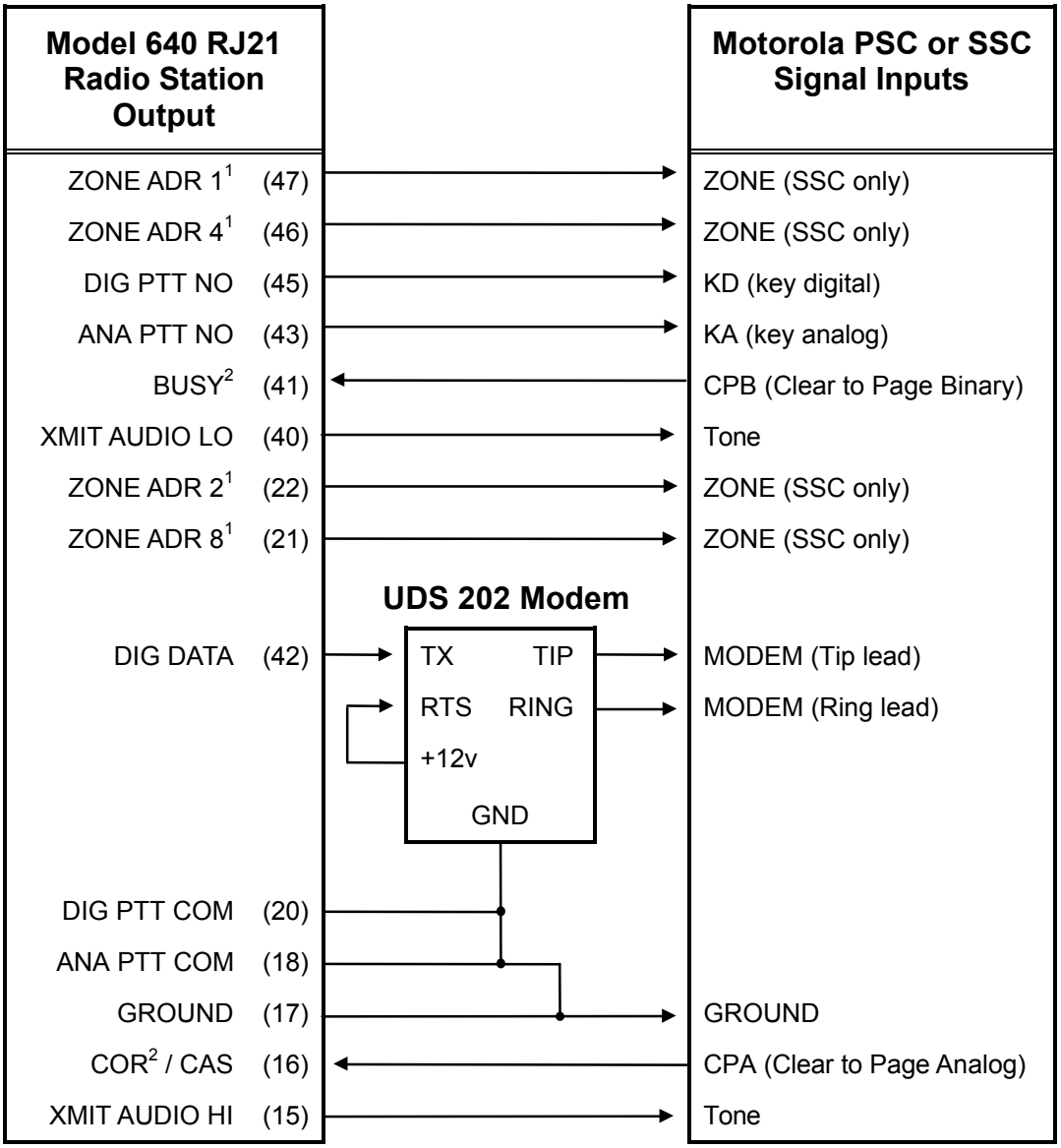


Figure 42. Wiring Configuration for Motorola PSC/SSC Link Controller

Notes on Figure 42:

1. Zone address outputs from the Model 640 are active low.
2. Default polarity for the COR and BUSY inputs are active low (0 volts = logic "1"). The busy LED should not be lit when idle. If reversed polarity is desired, move jumpers JP4 and JP6 on the peripheral board to position A - active high.
3. Line out signals from the Motorola PSC/SSC drive the link.
4. Make sure the modem is a 202, not a 212.

5. If an SSC is not working, check that the CPA line jumper is set for CPA to CPA, not CPA to CPB.
6. The following parameter settings are typical in the Model 640 database. In the Transmitter Key Type database set:

   ModeTime = 50 ms BusyTime = 25 ms
   StaRmtCtrl = RTS/CTS DigDataPolarity = “0” for inverted data

   In the Transmitter Key Up Control database set:

   ModeSgnlPlrty = “high” for digital

Transmitter Controllers

Transmitter controllers are used between the paging input (either directly from the paging terminal or on an RF/microwave downlink) and the paging transmitter. The transmitter controller governs how the transmitter sends out pages. It can determine whether the pages are analog or digital and demodulate the FSK signals from the paging terminal (in digital mode).

Model 66 Transmitter Controller Interface

At the radio site, a Zetron Model 66 Transmitter Controller provides the remote paging transmitter interface by way of telco line or μwave/RF link. The Model 66 controls analog and digital paging for transmitters from Quintron, General Electric, Glenayre, Neutec, Spectrum, and other manufacturers. The Model 66 supports both PURC® and dual-frequency tone remote operation. See Figure 37 and Figure 38 for basic system applications requiring a transmitter controller.

Figure 43 illustrates the direct cable hookup between the Model 66 and a generic paging transmitter. The link input (RF, microwave, or telco) to the Model 66 should be connected to the FROM LINK pins (J3 - 4, 5) on the rear panel of the transmitter controller. Refer to the *Model 66 Transmitter Controller Operation and Installation Manual* (Part No. 025-9078) for more details.

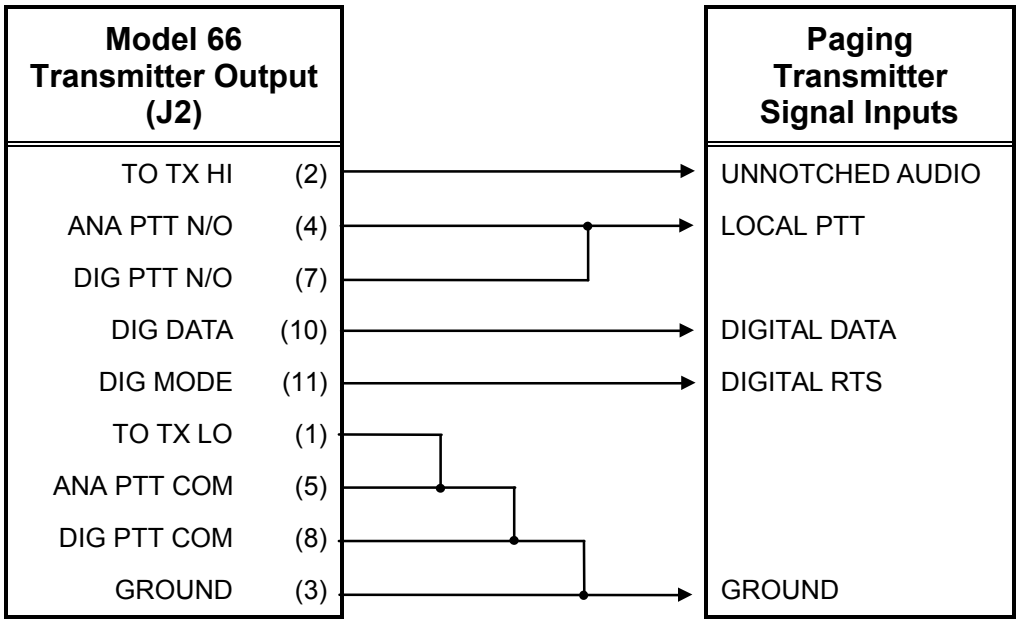


Figure 43. Wiring Configuration for Model 66 Transmitter Controller

Note: The polarity for the DIG DATA and DIG MODE outputs is selected with jumpers (JP3 and JP2) in the Model 66.

In an alternate application, the Model 66 can be colocated with the Model 640 and the transmitter for simulcast systems. The connections between the Model 66 and the paging transmitter are identical to those shown in Figure 43. Figure 44 illustrates the connections between the paging terminal and the Model 66.

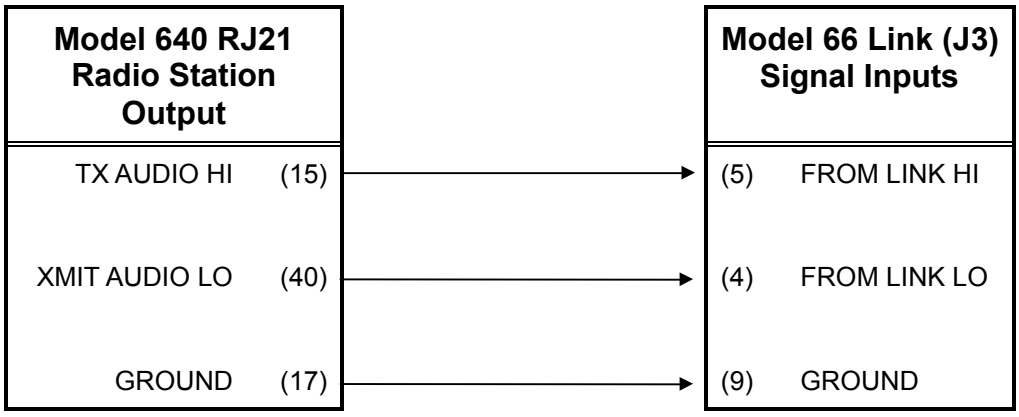


Figure 44. Model 66 Colocated with Model 640 for Simulcast Application

Model 68 Transmitter System Controller Interface

When a Zetron Model 68 Transmitter System Controller is interfaced to the Model 640, the paging output can be directed to up to 16 transmitter zones. The Model 68 steers the output from the paging terminal to any one of 2-16 local or remote paging transmitters, dependent upon installed options. For technical details related to operation and/or installation of the Model 68, refer to the *Model 68 Transmitter System Controller Operating and Installation Manual* (Part No. 025-9089). Figure 45 shows the layout of the Model 68 radio station connectors.

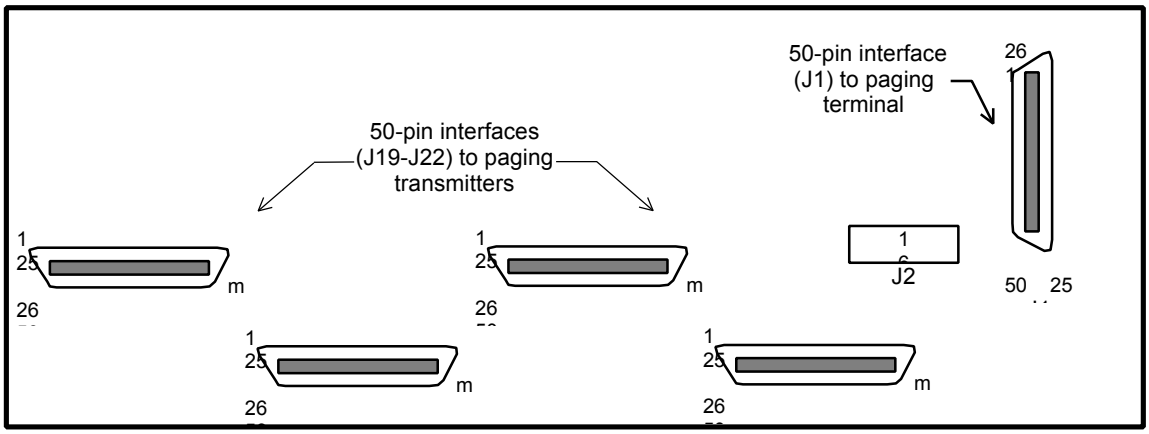


Figure 45. Model 68 Rear Panel Connectors

The specific wiring connections between the Model 68 and the Model 640 depend on the telco and radio station installation method previously chosen. Recall that the 50-pin RJ21 connector on the Model 640 provides both trunk and radio station signals for the paging terminal. The two basic installation methods are the terminal block adapter and one or more 66-type punchdown blocks.

Note: A special software update is required to interface the Model 68 to the Model 640. The programming ensures that the AUX and DIG PTT both key prior to the HLGT (high

level guard tone) to avoid missed digital data. Contact Zetron Mobile and Paging Systems Division technical support for assistance.

Installation Interface Assembly

The optional terminal block adapter (Part No. 702-9470) provides the simplest direct interface between the Model 640 and Model 68. A specially designed cable (Part No. 709-7398) can be purchased to connect the terminal block adapter to the transmitter system controller. Figure 46 illustrates the basic connections for this method of installation.

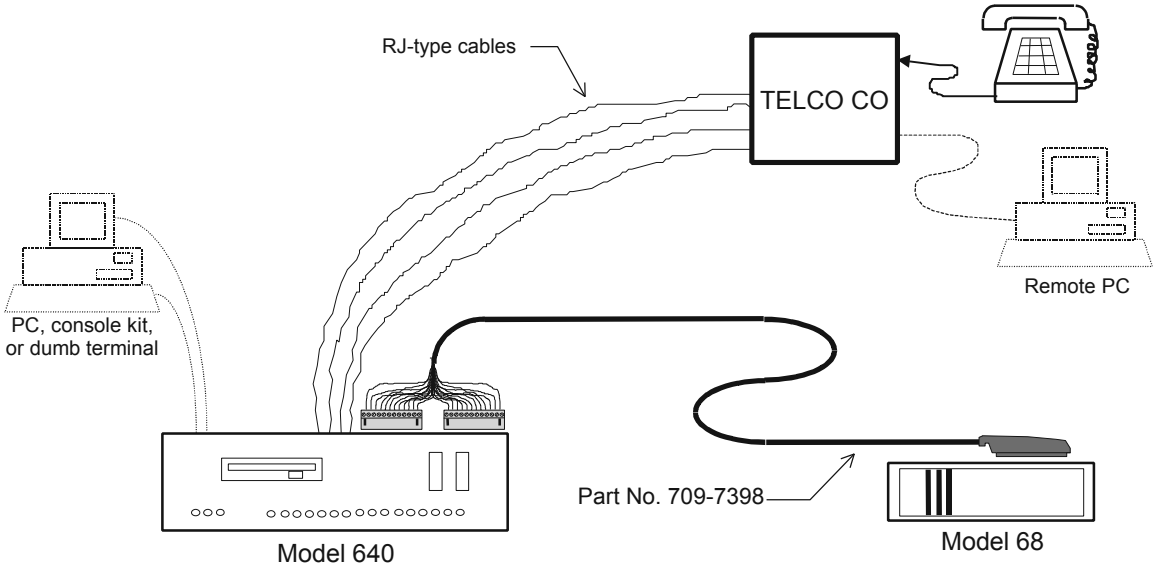


Figure 46. Model 640 to Model 68 Terminal Block Adapter Interface

The Model 640 to Model 68 direct interface cable is illustrated in Figure 47. The signal pinout is included for easy reference.

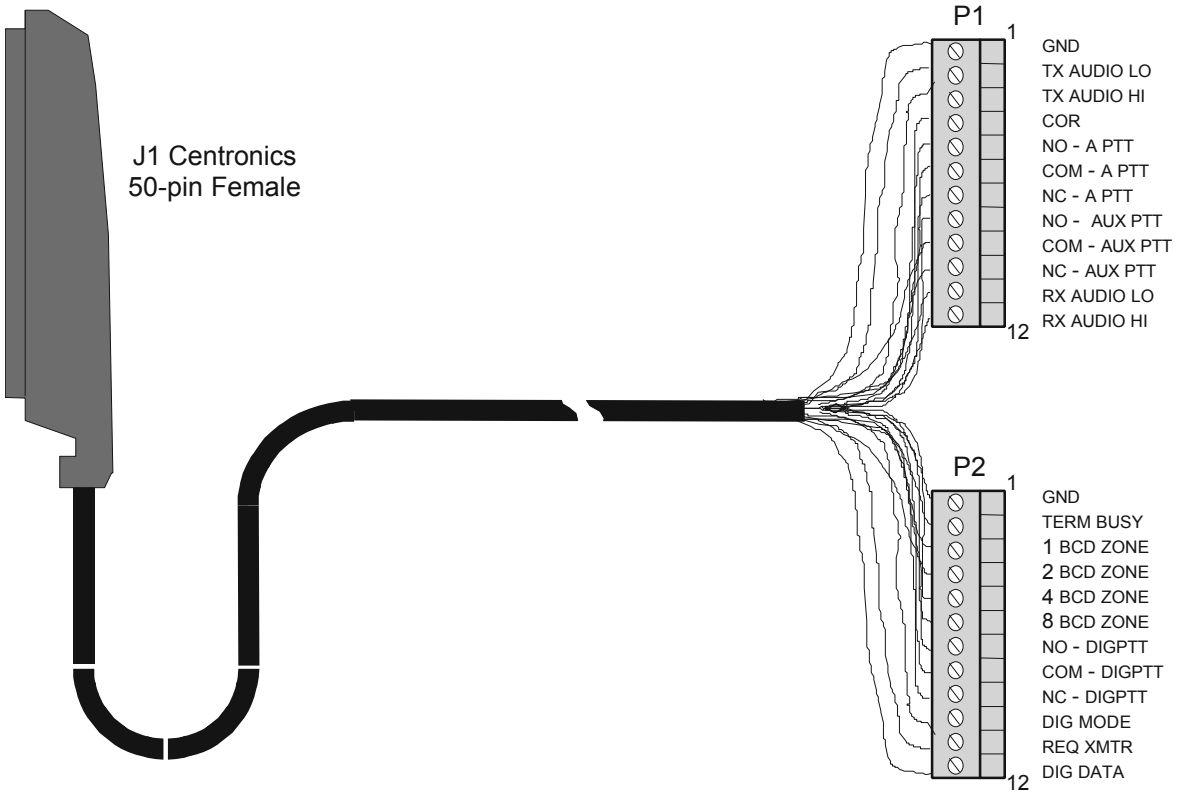


Figure 47. Model 640 to Model 68 Direct Interface Cable

66-Type Punchdown Block Installation

The punchdown block interface is more complicated, but also more flexible. Figure 48 illustrates the basic connections for this method of installation.

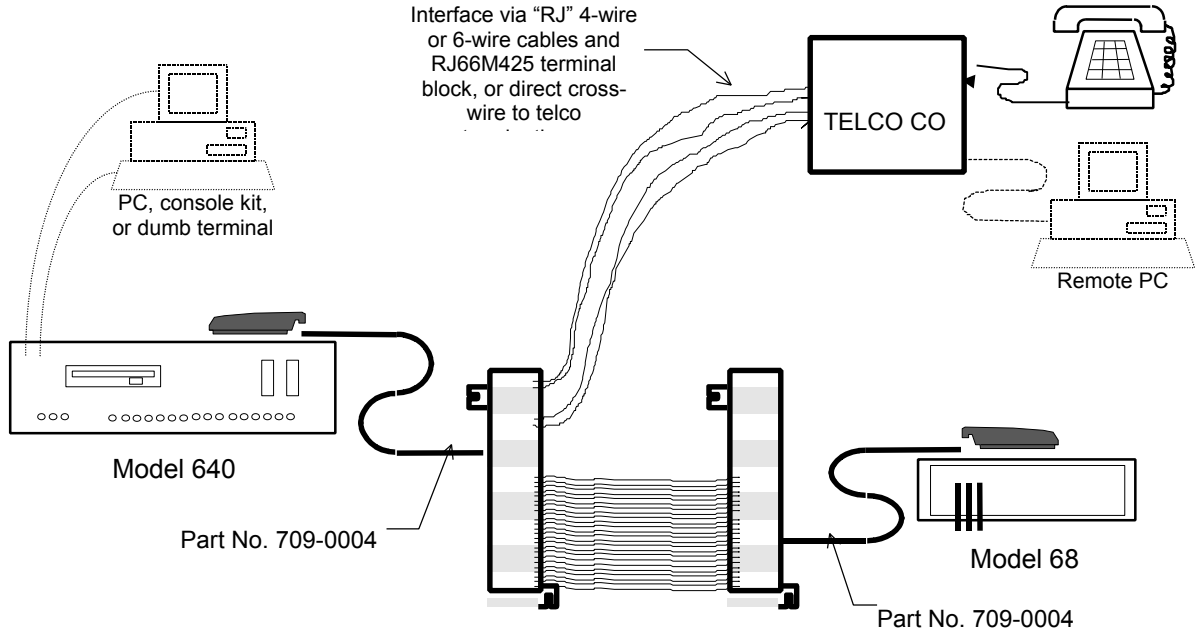


Figure 48. Model 640 to Model 68 Punchdown Block Interface

Notes on Figure 48:

1. The cross-wiring between the two punchdown blocks is not as straight-forward as Figure 48 may suggest. Wiring is dependent on the telco line types and the system application.
2. In the Transmitter Key Type database set:
   M68 = “On”
3. In the Transmitter Key Up Control database set:
   RqstSgnlPlrty = “high”

Be sure to consult Table 12 before making a cable or cross-wiring the punchdown blocks. Also refer to the *Model 68 Transmitter System Controller Operating and Installation Manual* (Part No. 025-9089) for details on connecting the unit to other radio station equipment.

Table 12. Model 640 to Model 68 Interface Wiring Configuration

	MODEL 640		MODEL 68
Signal Name	**50-pin RJ21 Output (J1)**	**Terminal Block Output**	**50-pin RJ21 Input (J1)**
REC AUDIO HI	13	P1-12	1
DIG MODE	14	P2-10	2
XMIT AUDIO LO	15	P1-2	3
COR / CAS	16	P1-4	4
GROUND (signal)	17	P1-1	5
ANA PTT COM	18	P1-6	6
ANA PTT NC	19	P1-7	7
DIG PTT COM	20	P2-8	8
ZONE ADR 8	21	P2-6	9
ZONE ADR 2	22	P2-4	10
AUX PTT NO	23	P1-8	11
AUX PTT COM	24	P1-9	12
REC AUDIO LO	38	P1-11	26
XMIT REQUEST	39	P2-11	27
XMIT AUDIO LO	40	P1-2	28
BUSY	41	P2-2	29
DIG DATA	42	P2-12	30
ANA PTT NO	43	P1-5	31
DIG PTT NC	44	P2-9	32
DIG PTT NO	45	P2-7	33
ZONE ADR 4	46	P2-5	34
ZONE ADR 1	47	P2-3	35
AUX PTT NC	48	P1-10	36
GROUND (chassis)	49, 50	P2-1	37

ADJUSTMENT PROCEDURES

OVERVIEW

The following procedures describe the level adjustments necessary to make the Model 640 operate properly. Each procedure should be performed following the initial installation process and whenever the hardware configuration changes. For example, if the telephone line signaling format changes, or if new options are purchased, the appropriate levels should be readjusted.

In addition to adjusting the paging terminal interfaces when hardware changes, some adjustments should be performed as part of regular maintenance.

Measurement Conventions

The following conventions are used in each of the adjustment procedures.

All trunk level readings are expressed in decibels (dB) and AC volts RMS (Vrms). All dB readings have been determined using a bridging (high impedance) AC voltmeter calibrated in decibels referenced to 1 milliwatt dissipated into a 600 ohm load (dBm). All voltage readings have been obtained using an AC true-RMS voltmeter measuring sinusoidal waveforms.

Note: The measurements are NOT made in dBm because the line termination may not necessarily be 600 ohm.

WARNING: Field technicians must be sure lines are connected (terminated) properly before setting adjustments.

If assistance is needed to complete any of the adjustments, contact Zetron technical support.

TRUNK CARD LEVELS

The following procedures apply to both types of trunk cards (standard and 4-wire audio dual trunk interface).

Each telephone interface line requires three separate adjustments:

- audio level from the telco (labeled FROM TEL)
- telco line balance R (labeled BAL R)
- telco line balance C (labeled BAL C)

These potentiometers have been set at the factory, but usually need to be field-adjusted to match actual phone line characteristics.

The voice audio on each telephone interface line has a gain control, which automatically compensates for differences in caller loudness and call-to-call gain changes. The AGC KILL switch is used in conjunction with the three pots to make accurate adjustments.

Test Equipment

The following equipment is required to adjust the trunk card levels:

- buttset
- digital voltmeter (DVM)
- miniature flat head screwdriver
- small Phillips head screwdriver
- touch-tone phone

Notes: *The trunk card adjustments are very important. They affect background noise immunity when recording voice prompts, speech silence compression, DTMF key decoding, VOX disconnect features (if used), and modem communications.*

Follow each procedure carefully.

FROM TEL Adjustment

In general, leave FROM TEL in the factory adjusted position. If there is too much silence deletion, then turn the pot clockwise. If there is not enough silence deletion, then turn the pot counterclockwise.

Follow the steps below to perform the factory adjustment for FROM TEL:

- ❑ 1. Remove the top cover of the Model 640 chassis (if not already done).
- ❑ 2. Remove the plate covering the trunk adjustment pots.
- ❑ 3. Create a new Class of Service in the Model 640 database as follows:
    - Select 1 - Subscriber Phone Numbers from the main menu.
    - Select 2 - Class of Service from the Subscriber Phone Numbers menu.
    - Enter N to create a New record.
    - Fill in the record as shown in Figure 49.

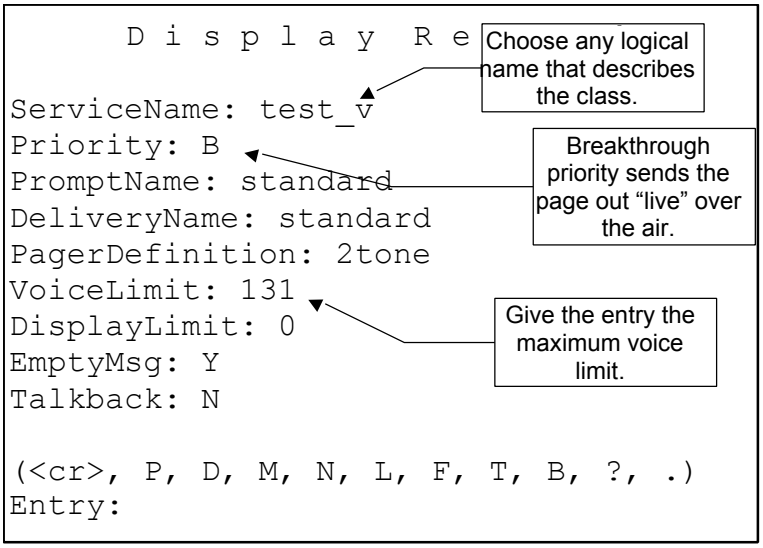


Figure 49. Model 640 Database 2-Tone Class of Service Record

- ❑ 4. Save the record by entering S.
- ❑ 5. Create a new Subscribers record as follows:
  - Enter a period (.) to back out to the Subscriber Phone Numbers menu.
  - Select 1 - Subscribers.
  - Enter N to create a New record.
  - Fill in the record as shown in Figure 50.

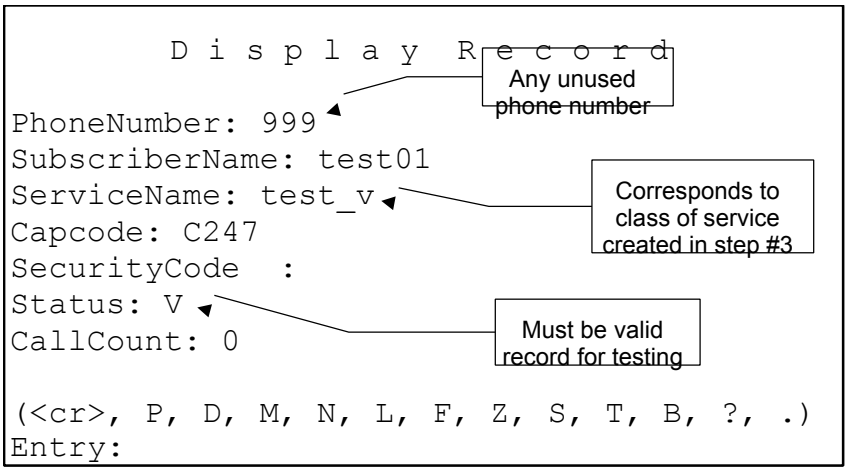


Figure 50. Model 640 Database 2-Tone Subscribers Record

- ❑ 6. Save the record by entering S.
- ❑ 7. Connect the voltmeter to the appropriate pins that extend off the sides of the potentiometers. Use the top and bottom pins to adjust trunk A/C. Use the middle and bottom pins to adjust trunk B/D. Refer to Figure 51.

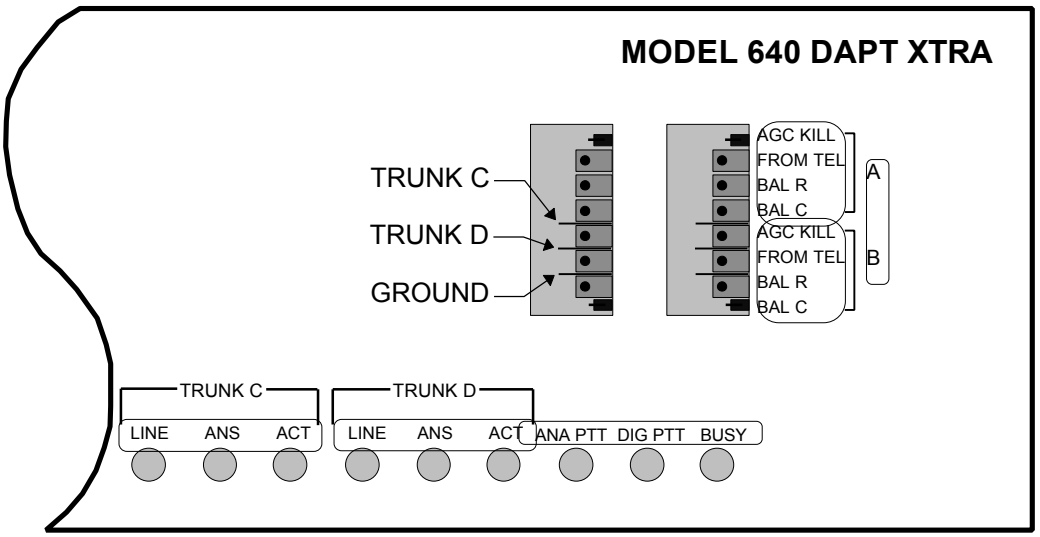


Figure 51. Trunk Card Level Adjustments

- ❑ 8. Set the meter range for 3-5 V_{AC}.
- ❑ 9. Connect a buttset or equivalent high impedance monitor to the appropriate trunk.
- ❑ 10. Dial into the trunk (using any touch-tone phone) by way of the local telco CO.
- ❑ 11. Verify that the line under test is the same line dialed by monitoring the line for voice on the buttset. (Speak into the telephone and listen on the buttset.) If no audio is heard, redial to access the correct trunk.
- ❑ 12. Press and hold down one of the telephone's touch-tone keys. ('A' transmits the highest and lowest DTMF frequencies - 697 and 1633 Hz. If the phone does not have an 'A' key, '3' is the next widest tone pair - 697 and 1477 Hz.)
- ❑ 13. Set the AGC KILL switch to the kill position (toward the rear of the chassis). The figure above shows the location of the AGC KILL switch and the potentiometers. Do NOT kill the gain control until ready to make actual adjustments, as DTMF decoding usually does not work with this setting.
- ❑ 14. Adjust the FROM TEL pot until the voltmeter reads 3.0 $V_{RMS} \pm 0.25$ V_{RMS}.
- ❑ 15. Set the AGC KILL switch back to the normal position (toward the front of the chassis).
- ❑ 16. Verify that the FROM TEL DTMF level is ≈ -8 dB (435 mV_{rms}) with the gain control active.

Note: This tunes the knee of the AGC circuit for optimum operation.

- ❑ 17. Hang up the telephone and terminate the call.

The FROM TEL adjustment is complete.

Hybrid (BAL R and BAL C) Adjustment

The BAL R and BAL C potentiometers isolate the trunk card audio output (TO TEL) from the telco line input audio (FROM TEL). The two audio paths are separated into transmit and receive. This is accomplished by adjusting the resistive and capacitive impedance of the active hybrid balance circuit. Some adjustment is usually required to compensate for the particular telephone line impedance to the telco central office. The audible result of proper hybrid adjustment is elimination of sidetone (microphone audio) heard in the earpiece of the line.

If the phone lines are swapped around or the telco changes the lines, this procedure should be performed again. The telco CO occasionally "rotates" lines, swapping a different hybrid line termination circuit for the previously existing circuit. This is common during routine maintenance of the trunk. Since the telephone company may perform such updates unannounced, it is good practice to readjust the hybrids every 2-4 months.

Note: If the system application uses voice prompts or alphanumeric modem paging, the hybrid circuit balance is particularly important to eliminate audio distortion and sidetone (echo) problems.

Follow the steps below to perform the BAL R and BAL C adjustments:

- ❑ 1. Remove the top cover of the Model 640 chassis (if not already done).
- ❑ 2. Remove the plate covering the trunk adjustment pots.
- ❑ 3. Connect the voltmeter to the appropriate pins that extend off the sides of the potentiometers. Refer to Figure 51.
- ❑ 4. Set the meter range to 2 V_{RMS} AC or less.
- ❑ 5. Dial (using any touch-tone phone) into the trunk by way of the local telco CO.
- ❑ 6. Enter the System Prompt Access PhoneNumber (0200 default in the Model 640 database). The paging terminal responds with 1 long and 4 short beeps.
- ❑ 7. After the beeps, enter the SecurityCode (0200 default in the Model 640 database). The paging terminal responds with 3 short beeps.

Note: If either of the above numbers does not work, enter the Model 640 database to verify the access numbers. From the main menu, select 1 - System Access Phone Numbers. Then select 3 - System Prompt Access to view the current settings.

- ❑ 8. After the beeps, enter 999. The paging terminal responds with a single beep, followed by a long pause (approximately 5 seconds). Then a continuous 1000 Hz tone plays.
- ❑ 9. Set the AGC KILL switch to the kill position (toward the rear of the chassis). Do NOT kill the gain control until ready to make actual adjustments, as DTMF decoding usually does not work with this setting.
- ❑ 10. While the 1000 Hz tone is playing, adjust the BAL C pot for a minimum reading on the voltmeter.
- ❑ 11. Likewise, adjust the BAL R pot for a minimum reading on the voltmeter.

- ❑ 12. Repeat steps #8 and #9 until the pot settings make little difference.
- ❑ 13. Set the AGC KILL switch back to the normal position (toward the front of the chassis).

Note: This adjustment minimizes signal bleeding from the TO TEL back into the FROM TEL.

- ❑ 14. Hang up the telephone and terminate the call.

The hybrid adjustment is complete.

STATION INTERFACE ALIGNMENT PROCEDURE

The following alignment procedures assure correct radio station interface and optimum signal levels.

The radio station alignment consists of three separate adjustments:

- paging tone (digital) output level to the transmitter (labeled TONE)
- voice audio (analog) output level to the transmitter (labeled VOICE)
- transmitter digital deviation

Test Equipment

The following test equipment is required to align the radio station interface levels:

- touch-tone (DTMF) telephone
- AC digital voltmeter (DVM)
- communications service monitor

Database Setup

Several test records must be created in the Model 640 database before the actual adjustments can be performed.

Follow the steps below to setup the Model 640 database for each of the station adjustments:

- ❑ 1. Create a new Pager Definition in the Model 640 database as follows:
    - Select 1 - Subscriber Phone Numbers from the main menu.
    - Select 5 - Pager Definitions Databases from the Subscriber Phone Numbers menu.
    - Select 1 - TwoTone from the Pager Definitions menu.
    - Enter N to create a New record.
    - Fill in the record as shown below.

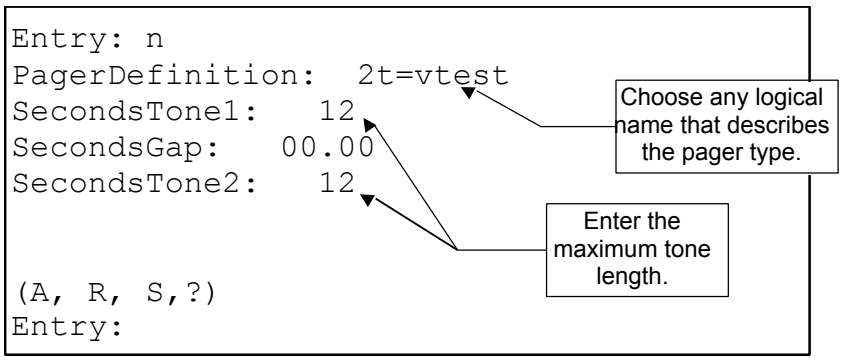


Figure 52. Model 640 Database 2-Tone Pager Definitions Record

- ❑ 2. Save the record by entering S.
- ❑ 3. Create a new Class of Service in the Model 640 database as follows:
  - Enter a period (.) to back out to the Subscriber Phone Numbers menu.
  - Select 2 - Class of Service.
  - Enter N to create a New record.
  - Fill in the record as shown in Figure 53.

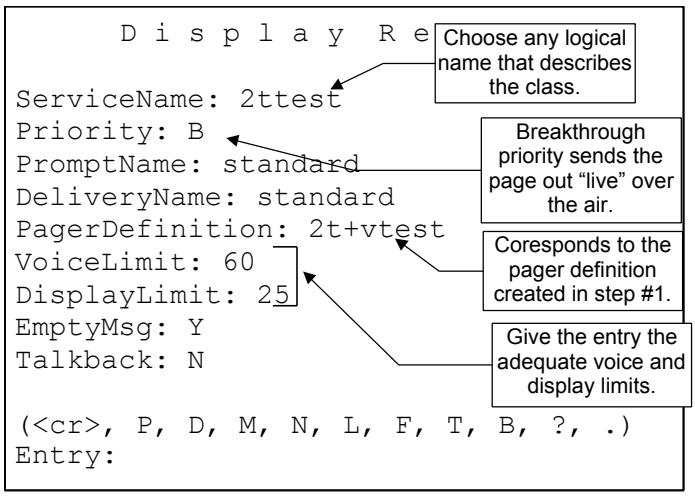


Figure 53. Model 640 Database 2-Tone Class of Service Record

- ❑ 4. Save the record by entering S.
- ❑ 5. Create a new Subscriber in the Model 640 database as follows:
  - Enter a period (.) to back out to the Subscriber Phone Numbers menu.
  - Select 1 - Subscribers.
  - Enter N to create a New record.
  - Fill in the record as shown in Figure 54.

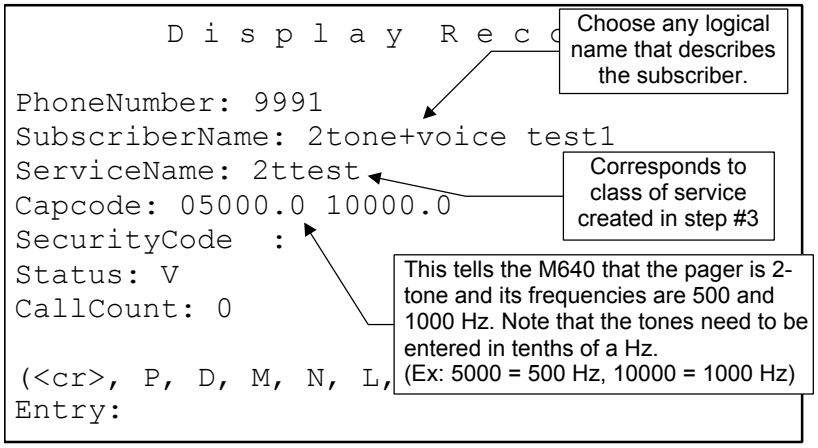


Figure 54. Model 640 Database 2-Tone Subscriber Record

- ❑ 6. Save the record by entering S.
- ❑ 7. Enter N to create another Subscriber record.
- ❑ 8. Fill in the record identical to Figure 54, modifying the fields as follows:
  - enter 9992 for the PhoneNumber (or an appropriate #)
  - enter 2tone+voice test2 for the SubscriberName (or suitable alternative)
  - enter 10000 and 20000 for the Capcode (1000 Hz and 2000 Hz)
- ❑ 9. Save the record by entering S.
- ❑ 10. If the application requires digital paging, create a new Subscriber in the Model 640 database as follows:
  - Enter a period (.) to back out to the Subscriber Phone Numbers menu.
  - Select 1 - Subscribers.
  - Enter N to create a New record.
  - Fill in the record similarly to the subscriber shown in Figure 55.

```
          D i s p l a y   R e c o r d

PhoneNumber: 9993
SubscriberName: pocsag test
ServiceName: pocdsply
Capcode: 1234567
SecurityCode:
Status: V
CallCount: 0

(<cr>, P, D, M, N, L, F, Z, S, T, B, ?, .)
Entry:
```

Figure 55. Model 640 Database POCSAG Subscriber Record

Note: The example shows a POCSAG pager, but another type of digital pager record will also work. Program a record that corresponds to the equipment you intend to use.

The Model 640 database programming for the radio station adjustments is complete. Continue with the alignment procedures below.

VOICE Audio Adjustment

Follow the steps below to perform the VOICE audio adjustment:

- ❑ 1. Call the first 2-tone test pager defined in Figure 54. The Model 640 responds with 3 short beeps to indicate the start of voice message recording.
- ❑ 2. Hold down a key on the touch-tone phone, so that a long tone is recorded.
- ❑ 3. Hang up or press pound (#) to terminate recording.
- ❑ 4. Use the radio service monitor to measure the RF deviation of the transmission. While the long DTMF tone is playing, adjust the VOICE potentiometer on the rear panel of the paging terminal for about 3.0 - 4.0 kHz deviation. Figure 56 shows the location of the radio station pots.

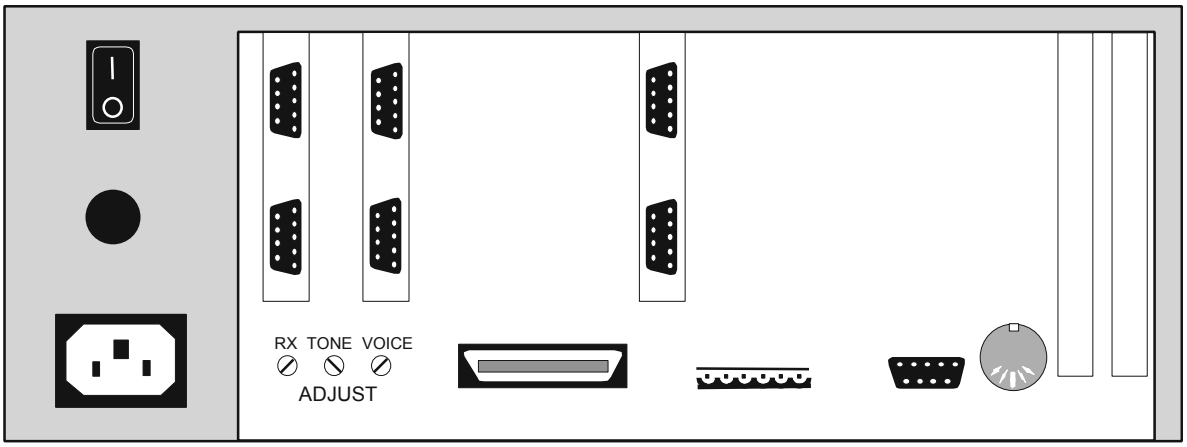


Figure 56. Rear View of Model 640 Chassis

- ❑ 4. Call the pager again.
- ❑ 5. During the recording time, speak a test voice message.
- ❑ 6. Use the radio service monitor to measure the RF deviation of the voice transmission. While the page is being sent, check the deviation again to ensure that it is about 4.5 kHz during the peak voice levels.
- ❑ 7. Hang up or press pound (#) to terminate recording.

The VOICE audio adjustment is complete.

TONE Audio Adjustment

Follow the steps below to perform the TONE audio adjustment:

- ❑ 1. Call the first 2-tone test pager defined in Figure 54. The Model 640 responds with 3 short beeps to indicate the start of voice message recording.
- ❑ 2. Immediately hang up to terminate recording.

Note: The EmptyMsg field in the Class of Service must be set to Y for this adjustment to work. Otherwise a hang-up cannot initiate a page.

- ❑ 3. Use the radio service monitor to measure the RF deviation of the transmission. While the tones are playing, adjust the TONE pot on the rear panel of the paging terminal for about 3.0 - 4.0 kHz deviation.
- ❑ 4. Make sure that the deviation level does not vary when the paging tones change from 500 Hz to 1000 Hz.
- ❑ 5. Repeat steps #1 - #3 using the second 2-tone test pager (1000 Hz and 2000 Hz).
- ❑ 6. Ensure that the deviation level is consistent for each of the paging tones.

Note: Deviation levels that vary with frequency may indicate improper bandpass (pre-emphasis) characteristics in the audio processing circuitry fed to the modulator. Verify correct jumper settings

The TONE audio adjustment is complete.

Transmitter Digital Deviation Adjustment

RF deviation levels on binary digital transmissions are determined by your transmitter, not by the station interface. Typically, digital paging involves modulating the RF carrier with a serial data stream followed by audio messages. A digital "high" shifts the carrier frequency higher (f_c + f_{dev}), while a digital "low" shifts the carrier lower in frequency (f_c - f_{dev}).

Follow the steps below to perform the DIGITAL deviation adjustment:

- ❑ 1. Call the digital pager defined in Figure 55.
- ❑ 2. Enter a long numeric display message (any numbers) after the Model 640 prompts. The more digits entered, the easier this adjustment will be. We recommend entering at least 20 DTMF digits.
- ❑ 3. Use the radio service monitor to measure the digital deviation of the transmission. While the message is playing, adjust the transmitter for 4.5 - 5.0 kHz deviation.

The digital deviation adjustment is complete.

DIAL CLICK CARD LEVEL ADJUSTMENT

This procedure sets up the optional dial click decoder for the specific phone line. Refer to Section 7 for details on field-installation of the dial click board. It is a good idea to readjust the dial click card once in a while to ensure optimum digit decoding. Zetron recommends readjusting the decoder 2 or 3 times a year.

Test Equipment

The following test equipment is required for the adjustment:

- Touch-tone telephone
- Rotary dial telephone
- Phone cord "Y" connector for 2 telephones
- Extender Card (Part No. 705-9431)

Note: The audio levels recognized by the dial click card depend only on the adjustment pots (R6, R30). The FROM TEL pot on the trunk card has no effect on dial click decoding.

Follow the steps below to adjust the dial click levels:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Remove the top cover.

- ❑ 3. Unscrew the card guide from the back of the chassis for the dual trunk on which the dial click decoder is to be adjusted. Pull the dual trunk from its connectors.
- ❑ 4. Plug the extender card into the connectors on the paging terminal peripheral board where the dual trunk was installed. Then plug the dual trunk into the extender card. This enables easy access to the dial click pots for adjustment.

Note: If an extender card is not available and trunk A or B needs adjustment, remove the other dual trunk card (C/D) to perform the procedure.

- ❑ 5. Power-up the paging terminal and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).
- ❑ 6. Connect the two telephones together with the Y connector into the same trunk of the Model 640.
- ❑ 7. Call into the paging terminal with the touch-tone phone and access a tone+voice pager previously programmed with lots of voice time (for example, 60 seconds).
- ❑ 8. During the voice recording time, pick up the rotary telephone and hang up the touch-tone telephone. Be sure to hang up, otherwise unwanted noise and phone line loading may change the sounds of the "clicks."
- ❑ 9. Start dialing digits while adjusting the appropriate pot on the dial click card. R6 is located at the top of the card and defines trunk A/C. R30 is located at the bottom of the card and defines trunk B/D.

  Begin the adjustment from the fully counter-clockwise position and rotate the pot clockwise until the light on the card blinks consistently with each dial click (two blinks for each click).

  Optimum adjustments vary, and software settings should be re-checked. (Typical pot setting ≈ midrange.)
- ❑ 10. Once the card is adjusted, power-down the Model 640.
- ❑ 11. If an extender card was used, remove it and reinstall the trunk card. If a second trunk card was removed for the adjustment procedure, reinstall it.
- ❑ 12. Replace the top cover of the paging terminal and secure it with screws.

Note: If the dial click card is newly installed, some modifications to the Model 640 database are required. Refer to the Model 640 Operating and Programming Manual (Part No. 025-9417) for details on trunk configuration.

OPTIONAL EQUIPMENT INSTALLATION

This section provides installation instructions for several hardware options that may need to be field-installed (upgrades after initial installation). These procedures can also be used to identify where the optional cards are installed in the factory-configured system and how they are connected to the rest of the Model 640 processor boards.

DUAL TRUNK CARD

A standard Model 640 comes equipped with one dual trunk interface (Part No. 702-9361) card. The unit can be upgraded to support a second dual trunk card, bringing the total number of trunks up to four (two per card).

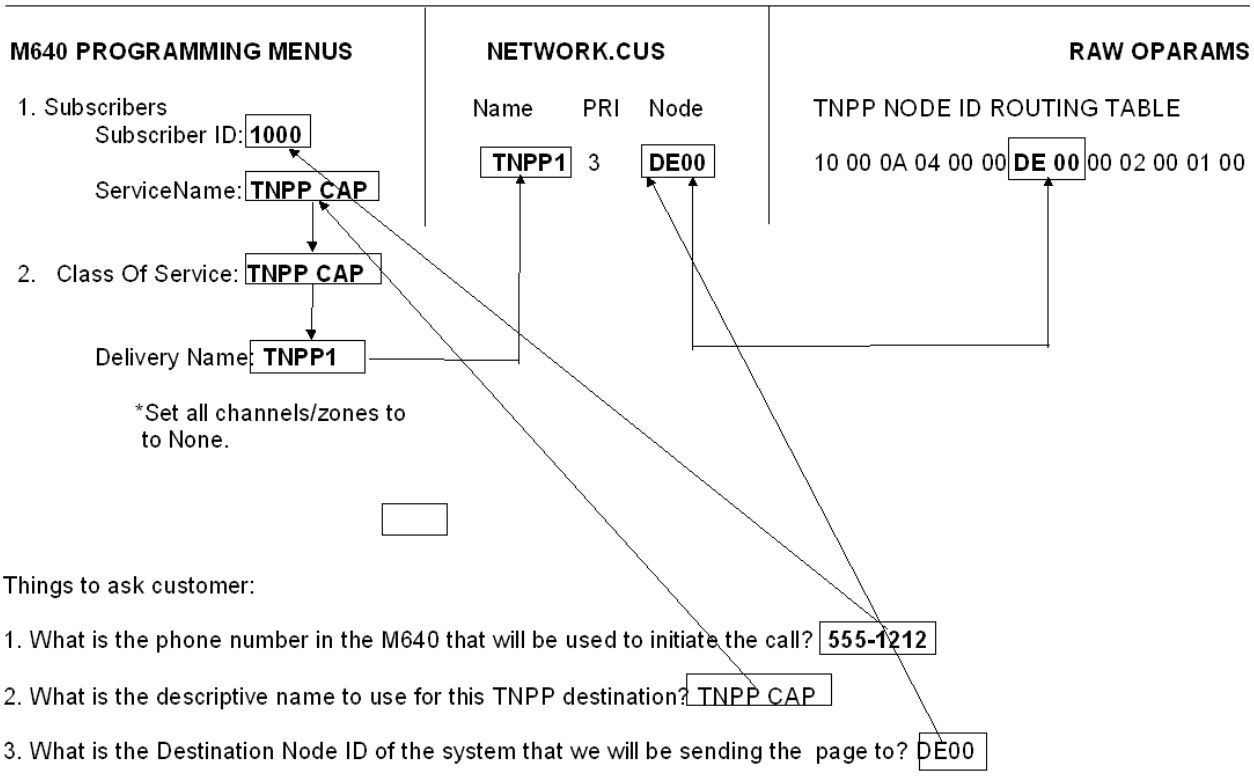
Either one or both of the trunk cards may be optional, dual-trunk, 4-wire, audio cards (Part No. 702-9488) for 4-wire audio circuits (for example, E&M, 4-wire RF/μwave links, T1 trunks, etc.)

Follow the steps below to install either type of dual trunk card:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Remove the top cover.
- ❑ 3. Verify that the matrix cards are configured for the appropriate line types. The matrix plug in J3 defines trunk C and J4 defines trunk D. See “Line Type Matrix Card” in Section 3 for details on the matrix card settings.
- ❑ 4. Plug the dual trunk into the left connectors (J2 and J4) on the peripheral board. Again, refer to Section 3 for illustrations of the dual trunk and its placement in the Model 640 chassis.
- ❑ 5. Secure the card guide to the top of the back panel with the provided screw.
- ❑ 6. Power-up the unit and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).
- ❑ 7. Access the Model 640 database and edit the Trunks database to configure trunks C and D. Refer to the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details on how to edit these databases.
- ❑ 8. After the databases have been setup, reboot the Model 640 to initialize the changes.
- ❑ 9. Refer to Section 6 for detailed adjustment procedures and level settings.

TNPP INTERFACE

Several networking options include the TNPP interface (Part No. 702-9362) card. The following figure gives an overview of M640 TNPP capcode paging flow:



Installation Procedure

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Remove the top cover.
- ❑ 3. Plug the TNPP card into connector J8, located in the middle, rear of the chassis. Refer to Section 3 for illustrations of the Model 640 and the correct location of each interface card.
- ❑ 4. Secure the card guide to the top of the back panel with the provided screw.
- ❑ 5. Power-up the unit and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).
- ❑ 6. The Model 640 software requires several changes to implement the TNPP card. Refer to the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details on how to edit the databases and system files.
- ❑ 7. After the paging terminal has been configured, reboot the Model 640 to initialize the TNPP option.

RS-232 Interface Ports

The Model 640 TNPP interface card has two DB-9 ports that provide two-way communications with the network link equipment. Zetron offers a cable (Part No. 702-7211) specially designed to connect the RS-232 port to a standard 25-pin interface. If a 9-pin connector is preferred, use a common 9-to-25-pin adapter cable. These should be readily available at any computer store. Otherwise, use the pinouts shown in Figure 57 to create an appropriate cable. Leads 5-9 do not require a connection on either end.

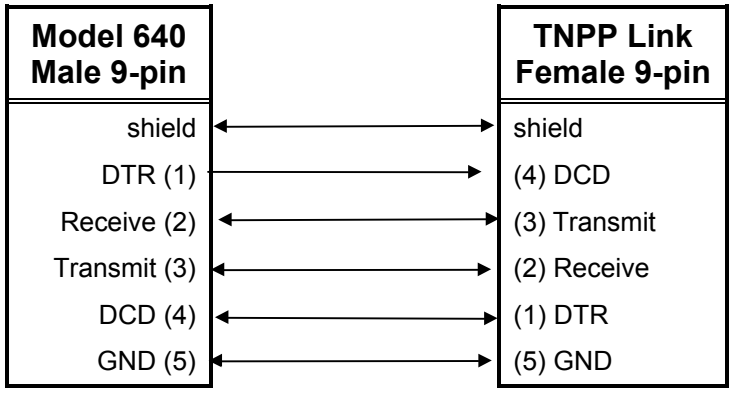


Figure 57. Pin Configuration for TNPP Link Cable

TAP OUTDIAL OPTION

The TAP Outdial is part number 950-9613. Parts included in this option are:

- M640 2-Port Serial Card (part number 702-9362)
- M640 Modem Interface Cable (part number 709-7329)
- External Modem

The figure below gives an overview of M640 TAP Outdial operation:

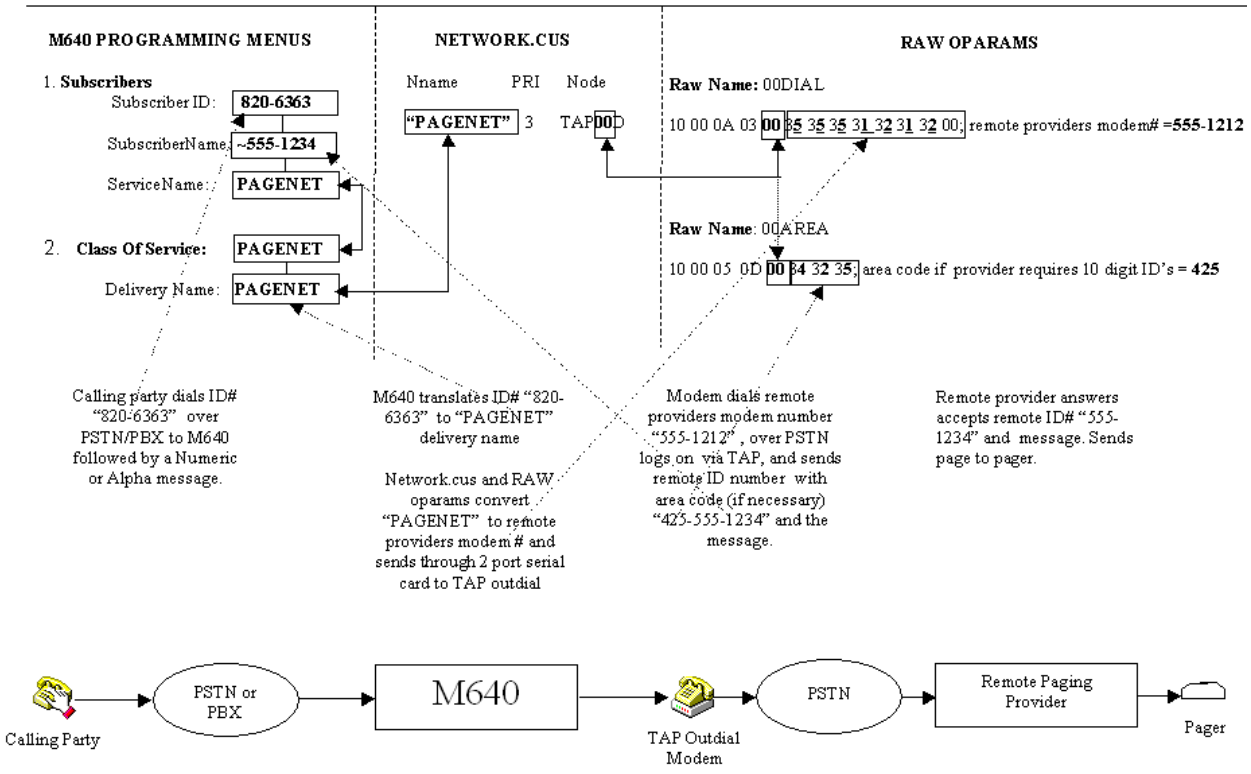
Installation Procedures

Note: *If a 2-Port Serial Card (part number 702-9362) is already installed in J8 (center slot) of your M640, do not proceed with this installation. Call Zetron M640 Technical Engineering at 425-820-6363.*

Tools required for installation are:

- IBM-compatible PC running M640 Communications Utility, with ability to connect to M640 by either modem or RS0-232 serial port
- #10 Phillips screwdriver

Note: *If you need assistance with any of these procedures, please complete Table 1 and fax it, along with your Z-number, to Zetron at 425-820-7031, ATTN: M640 Technical Engineering. Then call M640 Technical Engineering at 425-820-6363.*



External Paging Provider Destination Parameter RAW Oparam Programming

The term *oparam* is short for *operating parameter*. Oparams define the requirements for connecting with an external paging provider from your M640 by way of the TAP protocol.

1. Gather the following information:
   - Modem numbers of all remote paging providers that pages will be sent to
   - TAP data transfer baud rate for each provider (we support up to 9600 baud)
   - Data bits, data parity, and stop bits for each provider (usually 7 data bits, even parity, and 1 stop bit for TAP)
   - Whether provider requires 10-digit subscriber IDs
   - If 10-digit subscriber IDs required, the area code for each remote paging provider
   - Arbitrary 8-character destination names for all paging providers to be dialed (for example, `PAGENET` to dial "Paging Network Inc.")

   Please use Table 1 to record the required information for each provider.

Table 1:

Internal dest number (fixed internally)	8-character Name (aribitrary)	Modem Ph# to provider	Baud Rate(300,1200, 2400,4800,9600)	Data Bits, Parity, Stop Bits (usually e,7,1)	Req's 10 digit ID's (Y/N)	Area Code if requires 10 digit ID's
TAP00						
TAP01						
TAP02						
TAP03						
TAP04						
TAP05						
TAP06						
TAP07						
TAP08						
TAP09						

2. Back up all M640 database.
3. From the main menu in MCU, select **COMM** then **ZLINK**. This should connect with the M640 and display a + prompt.
4. Access the RAW oparam programming menu.
   a. At the + prompt press Enter. The **Model 640 Databases** menu should display, and you should have a flashing cursor at the **Entry** prompt.
   b. At the **Entry** prompt type the word `RAW` and press Enter. The following prompt appears.

      ```
      (N, ?, .) Entry:
      ```
5. Create RAW oparams.
   a. At the **Entry** prompt enter the letter `N` (for New Entry). The following prompt appears.

      ```
      RawName:  (8 chars) ?
      ```
   b. At the **RawName** prompt enter `00baud`. The following prompt appears.

      ```
      OparamData:  (70 chars) ?
      ```
   c. At the **OparamData** prompt enter the following line of code and, using the information from table 1, substitute the variables *0x* and *0y* as necessary per Tables 2 and 3.

      `10  00  05  02  00  0x  0y  20`

Table 2:

0x	Sets baud rate to
00	300 baud
01	1200 baud
05	2400 baud
06	4800 baud
02	9600 baud

Table 3:

0y	Sets data, parity, and stop bits to
00	7 data bits, EVEN parity, 1 stop bit
01	7 data bits, ODD parity, 1 stop bit
02	8 data bits, NO parity, 1 stop bit

The RawName and line of code should be displayed back to you as follows. This example assumes 9600,e,7,1.

```
RawName:  00baud
OparamData:  10 00 05 02 00 02 00 20
(A, R, S, ?) Entry:
```

d. Verify the RawName and line of code are correct. If so, proceed. If not, press R (for Redo), then reenter the parameters as per above.

e. At the **Entry** prompt enter S (for Save) to save the settings. The RawName and line of code should be displayed back to you.

f. Repeat steps b-e for each of the RawNames in Table 4. Enter the OparamData as shown in the table, following the notes as applicable for the **bold** parameters.

Table 4:

RawName	OparamData
00batch	10 00 0B 01 00 01 00 3C 00 F0 03 84 00 02
00session	10 00 0A 04 00 00 00 02 06 10 01 03 00
00page	10 00 06 05 00 07 05 01 07
00retry	10 00 0E 06 00 07 03 03 07 00 08 00 20 00 20 00 10
00area	10 00 05 0D 00 **aa aa aa** *(See Note 4)*
00dial	10 00 **0X** 03 00 **OL 2C nn nn nn nn nn nn nn nn nn nn 00** *(See Notes 1-3)*

Note 1: If you do not need to dial a digit to get an outside line, omit **OL** and **2C**. If you need to dial a digit to get an outside line, replace **OL** with the ASCII value for the digit to be dialed, per Table 5, and include **2C**.

Note 2: Replace all **nn**'s with the ASCII values for the DTMF digits to be dialed to connect with the remote paging provider's modem, per Table 5.

Table 5:

DTMF Digit Decimal Value	ASCII Value
0	30
1	31
2	32
3	33
4	34
5	35

DTMF Digit Decimal Value	ASCII Value
6	36
7	37
8	38
9	39

Note 3: Replace **0X** with the hexadecimal value for the total number of bytes following it, including the `00` at the end of the string, per Table 6. For example, for the entry shown in Table 4 it would be 15 decimal, which converts to `0F` hex.

Table 6:

Decimal	Hex	Decimal	Hex
0	00	16	10
1	01	17	11
2	02	18	12
3	03	19	13
4	04	20	14
5	05	21	15
6	06	22	16
7	07	23	17
8	08	24	18
9	09	25	19
10	0A	26	1A
11	0B	27	1B
12	0C	28	1C
13	0D	29	1D
14	0E	30	1E
15	0F	31	1F

Note 4: If remote provider requires 10-digit Ids, replace **aa aa aa** with the ASCII values for the area code to be prefixed to the ID number sent to the remote provider, per Table 5.

g. At the **Entry** prompt enter L (for List all raw oparams).

h. When prompted to send the information to the printer, type `N` for No.

i. Verify all RawNames and OparamData. If you need to change any of them, press Enter to get to the RawName that you want to change, then enter `M` (for Modify), then repeat the steps as necessary.

6. Go back to step 5 and repeat the data entry process for the rest of the internal destinations from Table 1, but make the following changes:

   - Increment the RawNames for each successive TAP destination. That is, instead of entering `00baud`, `00session`, etc., as you did for `TAP00`, enter `01baud`, `01session`, etc., for `TAP01`; `02baud`, `02session`, etc., for `TAP02`; and so on.

- In Table 4 the 5th byte of each line of OparamData is `00`. That corresponds to the TAP number, so increment it also.

7. Enter the RawNames and OparamData listed in Table 7 to initialize the external modem.

Table 7:

MDM-1	10 00 14 F8 41 54 26 46 26 4D 30 26 4B 30 26 48 30 26 42 31 58 33 0D
MDM-2	10 00 06 F6 41 54 42 31 0D

M640 System Programming

This section requires you to connect with the system, upload the new software, retrieve current configuration files, edit them with a text editor, and return the edited files to the system.

Note: If you need assistance with this please call M640 technical engineering at 1-425-820-6363 and an M640 technical engineer will assist you. Please have your Z-number and Table 1 completed and ready to fax before you call.

1. Save the new image file (that was sent to you on a floppy disk or e-mailed to you) to the C:\MCU folder.
2. From the main menu in MCU, select **COMM** then **ZLINK**. This should connect with the M640 and display a + prompt.
3. At the + prompt enter:

   `dos copy c:\mcu\`*`filename.img`*

   where *`filename.img`* is the name of the image file. The message "`1 file copied`" should appear when the copy is completed.
4. At the + prompt enter:

   `put` *`filename.img`*

   The message "`Put complete`" should appear when the transfer is completed. This may take a few minutes if connected by way of modem.
5. Modify configuration file `Config.cds`.

   CAUTION: Incorrect configuration of this file could disable your system.

   a. At the + prompt enter:

      `get config.cds`

      The message "`Get complete`" should appear when the transfer is completed.

   b. At the + prompt enter:

      `dos edit config.cds`

   c. Find the line that reads:

      `16 8 a:\zdir\`*`oldfilename.img`*

      where *`oldfilename.img`* is the name of your old image file.

   d. If there is a semi-colon at the beginning of this line, delete it.

   e. Edit the line so that it reads as follows:

```
16 8 c:\zdir\newfilename.img
```

where *newfilename.img* is the name of your new image file.

f. Save the file by pressing Alt+F, then S.

g. Exit the file by pressing Alt+F, then X.

h. At the + prompt enter:

```
put config.cds
```

6. Modify configuration file `Network.cus`.

a. At the + prompt enter:

```
ls network.cus
```

If the file is not found, enter:

```
get network.cus
```

b. At the + prompt enter:

```
dos edit network.cus
```

c. Add a line of the following form for each internal destination entry in Table 1. Place doublequotes around the 8-character name.

```
outbound "8-char name from Table 1"  3  TAP00D  x|yS
```

Include the *x|y*S part only if also sending pages to the local RF paging transmitter. For *x* put the RF Channel (for example, 1). For *y* put the RF Zone (for example, 0).

d. Save the file by pressing Alt+F, then S.

e. Exit the file by pressing Alt+F, then X.

f. At the + prompt enter:

```
put network.cus
```

M640 Subscriber Database Programming

This section defines how the actual ID# on your system will be routed externally to an ID# on the remote paging provider's system.

Note: You can enter ? at any prompt for a list of options and/or descriptions of the parameter.

1. Set up the Class of Delivery Service database.

a. From the Model 640 Databases menu select 1 - Subscriber Phone Numbers.

b. From the **Subscriber Phone Numbers** menu select **4 - Class of Delivery Service Database**.

c. At the **Entry** prompt enter `N` (for New).

d. Enter the following information.

Delivery:	*8-character name from Table 1*
Firstzone:	*(none — just press spacebar)*
FirstRepeat:	0
FirstDelay:	0

SecondZone:	*(none — just press spacebar)*
SecondRepeat:	0
SecondDelay:	0
ThirdZone:	*(none — just press spacebar)*
ThirdRepeat:	0
ThirdDelay:	0
ForthZone:	*(none — just press spacebar)*
ForthRepeat:	0
ForthDelay:	0

e. Enter S (for Save).

f. Repeat steps c-e for all 8-character names from Table 1.

2. Set up the Class of Service database.

a. From the **Model 640 Databases** menu select **1 - Subscriber Phone Numbers**.

b. From the **Subscriber Phone Numbers** menu select **2 – Class of Service**.

c. At the **Entry** prompt enter N (for New).

d. Enter the following information.

ServiceName	*(arbitrary)*
Priority	L
PromptName	Standard
DeliveryName	*8-character name from Table 1*
PagerDefinition	(Pocsag, Golay, or New Flex)
VoiceLimit	00
DiplayLimit	*(any limit up to 500 characters)*
EmptyMsg	N
TalkBack	N

e. Enter S (for Save).

f. Repeat steps c-e for all 8-character names from Table 1.

3. Program subscribers.

a. From the Model 640 Databases menu select 1 - Subscriber Phone Numbers.

b. From the **Subscriber Phone Numbers** menu select **1 – Subscriber**.

c. At the **Entry** prompt enter N (for New).

d. Enter the following information.

PhoneNumber	*(7-digit ID number)*
SubscriberName	*(last 7 digits of ID # on remote system)*
ServiceName	*(ServiceName from step 2)*
Capcode	*(Pager-specific; enter a dummy capcode if no local page needed)*
SecurityCode	*(only if needed)*

Status	V
CallCount	0

2-port Serial Card Hardware Installation

1. Power down M640.
2. Remove top cover.
3. Locate and remove the card slot cover for J8.
4. Install M640 2-port serial card into slot J8. Secure with screw removed in step 3.
5. Power up M640.

Modem Setup and Interfacing

1. Connect 9-pin end of cable 709-7329 to port 1 of M640 2-port serial card.
2. Connect 25-pin end of cable 709-7329 to external modem.
3. Connect power supply to modem and plug into AC power.
4. Connect phone line to RJ11 "Telco" jack of the modem.

Testing and Debugging

1. From the main menu in MCU, select **COMM** then **ZLINK**. This should connect with the M640 and display a + prompt.
2. At the + prompt enter:

   `Traffic -ar`
3. Send a page to one of the subscribers set up in step 3 under *M640 Subscriber Database Programming*.
4. Verify that you hear the following sequence from the modem.
   a. Modem comes "Off Hook" and you hear dial tone.
   b. Modem dials paging provider's modem #.
   c. Paging provider's modem answers and modems negotiate connection.
5. Verify you see a posting similar to the following in the **Traffic** screen for the subscriber under test.

   `820-6363 page sent 07:59:25a 1 8BO TAP00D ID [7-digit ID#] D 4 <message>`
6. If test was successful, build and test all other subscribers. If test was not successful, and/or you see the error message "`Page No Xmit`" in the **Traffic** screen, review all of your programming, then retest.

DIAL CLICK DECODER

The dual dial click decoder option (Part No. 702-9119) enables the terminal to process numbers dialed by rotary telephones. Dial *clicks* are distinctly different from dial *pulses*. The Model 640 decodes dial pulses without the optional dual dial click decoder board.

Installation

To install this option onto a dual trunk card (Part No. 702-9361 or 702-9488) of the Model 640, proceed as follows:

CAUTION

Please exercise electro-static discharge (ESD) precautions when handling all parts.

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Remove the top cover.
- ❑ 3. Unscrew the card guide from the back of the chassis for the dual trunk that the dial click decoder is to be installed onto. Pull the dual trunk from its connectors.
- ❑ 4. Mount the supplied standoff near the center of the board as shown in Figure 58.

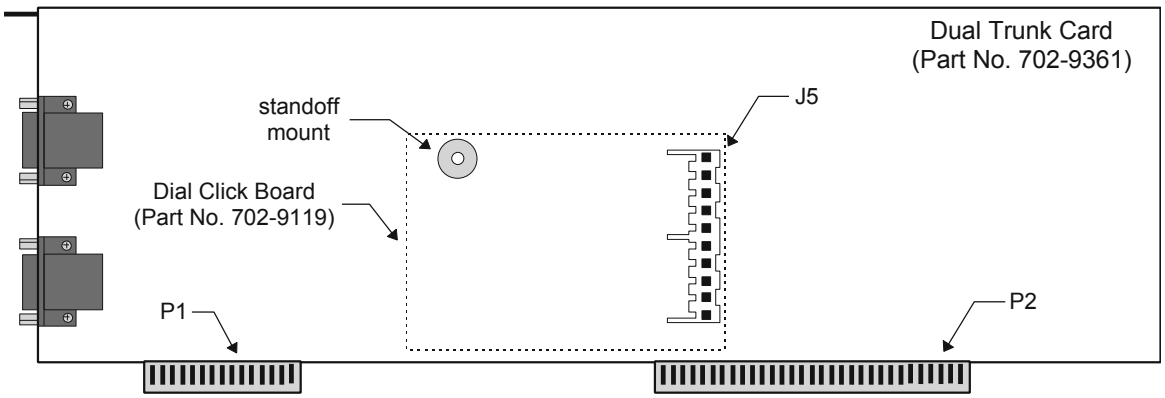


Figure 58. Dial Click Board Installation

- ❑ 5. Install the dual dial click board into the 10-pin female connector (J5) on the dual trunk. The card should extend toward the rear of the dual trunk board. Bolt the board to the standoff installed in Step 4.
- ❑ 6. Plug the supplied extender card into the connectors on the paging terminal peripheral board where the dual trunk was installed. Then plug the dual trunk into the extender card. This enables easy access to the dial click pots for adjustment.

Note: If an extender card is not available and trunk A or B needs adjustment, remove the other dual trunk card (C/D) to perform the procedure.

- ❑ 7. Power-up the unit and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).
- ❑ 8. Access the Model 640 database and edit the Dial Click database to enable the option. Then edit the Trunks database to enable the option on the desired trunk. Refer to the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details on how to edit these databases.
- ❑ 9. After the databases have been setup, reboot the Model 640 to initialize the dial click option.
- ❑ 10. Follow the procedure below to adjust the dial click pots.

Level Adjustment

This procedure sets up the dial click decoder for the specific phone line. The following test equipment is required for the adjustment:

- Touch-tone telephone
- Rotary dial telephone
- Phone cord "Y" connector for 2 telephones
- Extender Card (Part No. 705-9431)

Note: The audio levels recognized by the dial click card depend only on the adjustment pots (R6, R30). The FROM TEL pot on the trunk card has no effect on dial click decoding.

Follow the steps below to adjust the dial click levels:

- ❑ 1. Connect the two telephones together with the Y connector into the same trunk of the Model 640.
- ❑ 2. Call into the paging terminal with the touch-tone phone and access a tone+voice pager previously programmed with lots of voice time (for example, 60 seconds).
- ❑ 3. During the voice recording time, pick up the rotary telephone and hang-up the touch-tone telephone. Be sure to hang-up, otherwise unwanted noise and phone line loading may change the sounds of the "clicks."
- ❑ 4. Start dialing digits while adjusting the appropriate pot on the dial click card. R6 is located at the top of the card and defines trunk A/C. R30 is located at the bottom of the card and defines trunk B/D.

  Begin the adjustment from the fully counter-clockwise position and rotate the pot clock-wise until the light on the card blinks consistently with each dial click (two blinks for each click).

  Optimum adjustments vary, and software settings should be re-checked. (Typical pot setting ≈ midrange.)
- ❑ 5. Once the card is adjusted, power-down the Model 640.

- ❑ 6. If an extender card was used, remove it and reinstall the trunk card.

  If a second trunk card was removed for the adjustment procedure, reinstall it.

- ❑ 7. Replace the top cover of the paging terminal and secure it with screws.

DUAL MULTI-FREQUENCY (MF) DECODER

The multi frequency decoder option (Part No. 702-9197) allows the terminal to accept MF digit feed from direct inward dial (DID) trunks or E&M 2- or 4-wire trunks emulating DID.

Note: MF is not the same as DTMF (touch-toneÒ) signaling. The multifrequency option will not decode DTMF feed digits.

MF is a dual-tone signaling method similar to the common touch-tone DTMF (dual tone multi frequency) protocol. Both formats use two combined tones. MF tones, however, are different frequencies from DTMF tones. Also, the MF protocol involves rigid timing constraints and framing characters, so that *a DID line with four feed digits actually sends six characters which can NOT decode properly as DTMF*.

MF service can be indirectly tested with most RF service monitors, using their DTMF decoders AC coupled to the telco pair. If MF feed digit service decodes properly as DTMF characters with no framing digits, then contact the telco service provider to correct the situation. If feed digits plus two extra characters are observed and do not properly decode as DTMF and if the tone bursts are not clipped, the MF digits are probably acceptable. The telco technician should have an MF decoder to verify feed digits if necessary.

The MF option board (Part No. 702-9297) installs onto the dual trunk board to decode these tones. Essentially, it provides a specialized tone decoder chip for each half of the dual trunk.

JP1 is used only for production testing of MF tone generation. Table 13 shows tone pairs for MF and DTMF protocols to illustrate the differences.

Table 13. MF and DTMF Tone Pair Comparison

Coded Digit	MF Format Name	Tone Pair Frequencies	
		MF Format Tones	DTMF Format Tones
1	1	700, 900	697, 1209
2	2	700, 1100	697, 1336
3	3	900, 1100	697, 1477
4	4	700, 1300	770, 1209
5	5	900, 1300	770, 1336
6	6	1100, 1300	770, 1477
7	7	700, 1500	852, 1209
8	8	900, 1500	852, 1336
9	9	1100, 1500	852, 1477

Coded Digit	MF Format Name	Tone Pair Frequencies	
		MF Format Tones	DTMF Format Tones
*	---	NO TONE	941, 1209
0	---	NO TONE	941, 1336
#	---	NO TONE	941, 1477
A	0	1300, 1500	697, 1633
B	KP	1100, 1700	770, 1633
C	ST	1500, 1700	852, 1633
D	ST1	900, 1700	941, 1633
E	ST2	1300, 1700	NO TONE
F	ST3	700, 1700	NO TONE

Installation

Follow the steps below to install this option onto a dual trunk card (either 702-9361 or 702-9488) of the Model 640:

- ❑ 1. Power-down the paging terminal.
- ❑ 2. Remove the top cover.
- ❑ 3. Unscrew the card guide from the back of the chassis for the dual trunk that the MF decoder is to be installed onto. Pull the dual trunk from its connectors.
- ❑ 4. Mount the supplied standoff as shown in Figure 59.

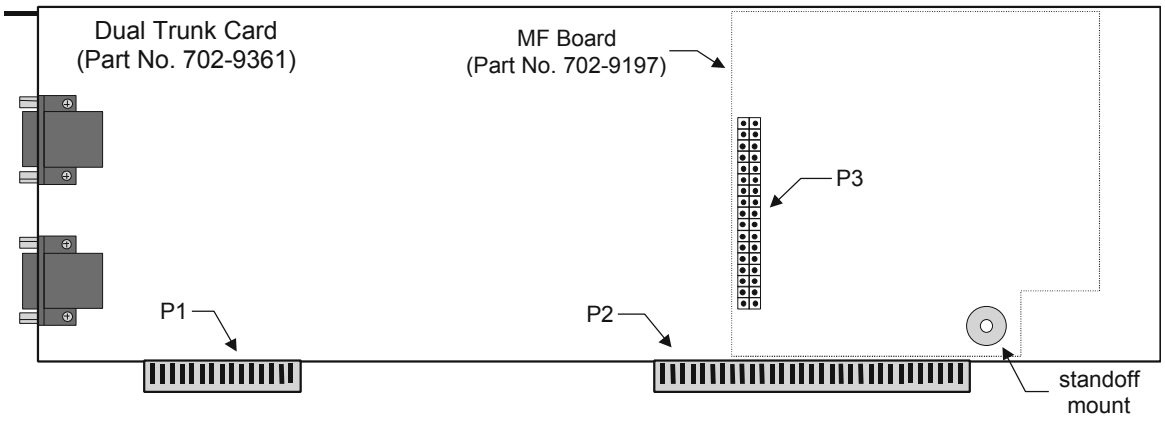


Figure 59. Multifrequency Board Installation

- ❑ 5. Install the multifrequency board onto the 34-pin male connector (J5) on the dual trunk. The board should extend toward the front of the dual trunk board. Bolt the MF board to the standoff installed in Step 4.
- ❑ 6. Reinstall the dual trunk card in the Model 640 chassis and secure the card guide to the chassis.

- ❑ 7. Replace the top cover of the paging terminal and secure with screws.
- ❑ 8. Power-up the unit and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).
- ❑ 9. Access the Model 640 database and edit the Trunk Line Type database to setup a line with multifrequency signaling. Then edit the Trunks database to enable the option on the desired trunk. Refer to the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details on how to edit these databases.
- ❑ 10. After the databases have been setup, reboot the Model 640 to initialize the MF option.

No hardware adjustments are required for the MF decoder option.

PARALLEL PRINTER CARD

The printer option (Part No. 950-9758) enables a parallel printer to be connected to the Model 640. The printer provides a real-time hard copy of the system events (log file data). This is useful for monitoring traffic and analysis of the system functions, throughput, and efficiency. The printer records paging input and output, network link status, and ZLINK session activity.

Once the printer option is installed, all system activity is sent to the printer. Be sure to keep the printer powered-up and loaded with paper to ensure that no events are missed.

Installation

Follow the steps below to install the optional printer card (Part No. 702-9359) into the Model 640 chassis.

CAUTION

Please exercise electro-static discharge (ESD) precautions when handling all parts.

- ❑ 1. Verify that all of the printer card jumpers are set appropriately. Figure 60 shows the configuration and locations of the critical jumpers. (The jumpers should have been set at the factory, but it is a good idea to double check.)

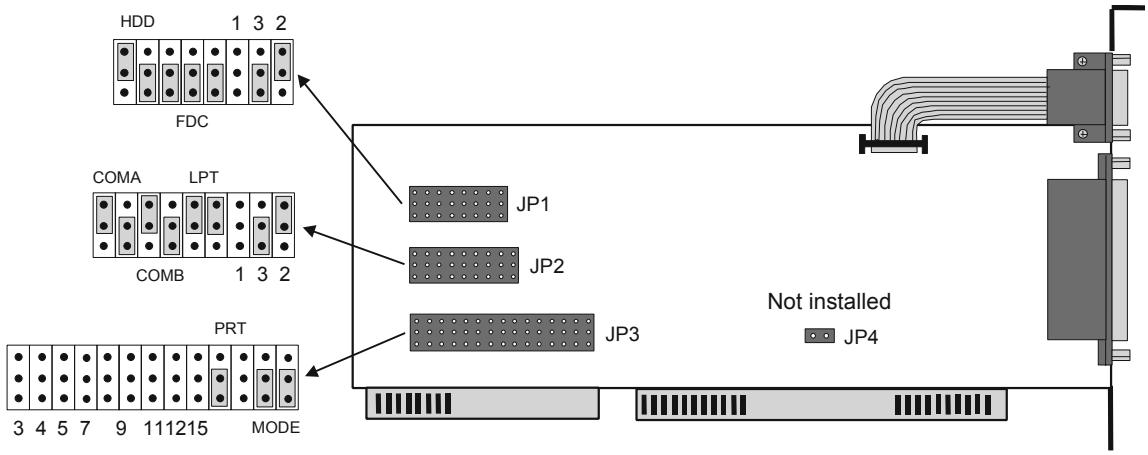


Figure 60. Parallel Printer Card

- ❑ 2. Power-down the paging terminal.
- ❑ 3. Remove the top cover.
- ❑ 4. Plug the printer card into connector J5, located at the left rear of the Model 640 chassis. If a video controller card is already installed into the J5 connector, use J4 instead.
- ❑ 5. Secure the card guide to the top of the back panel with the provided screw.
- ❑ 6. Connect a standard parallel printer cable between the female DB-25 on the rear of the newly installed card and the printer.
- ❑ 7. Power-up the unit and let it complete its boot sequence (all lights have extinguished, except the READY LED is on solid).

Note: If the printer card is installed as a field-upgrade, contact Zetron technical support to complete the required software update.

CONNECTION TO AN EXTERNAL ALARM

The Model 640 has a 6-pin FAULT connector for interface to an external alarm system. The male Weidmüller connector provides 3 usable signals from an onboard relay. The fault interface signals terminal failure conditions to the connected equipment. This is useful in applications where the correct paging operation is critical, such as emergency response and nuclear plants. Use the pinouts shown in Table 14 to create an appropriate cable for the FAULT connector.

Table 14. FAULT Connector Pin Configuration

Pin #	FAULT Output Signal
1	Relay normally closed (NC)
2	Relay common (COM)
3	Relay normally open (NO)

VOICE PROMPTS

OVERVIEW

The Model 640 DAPT XTRA is equipped to play high quality verbal prompting messages (that is, *voice* prompts) in addition to *tone* prompts. Voice prompts guide callers through the process of placing a page to a subscriber on the system. When used efficiently, voice prompts personalize the paging system and make it more user-friendly. Knowledgeable callers can always override voice prompts by pressing the "*" key on their telephone to speed up call processing.

Note: The "" cancel function can only operate reliably if the telephone hybrid circuits are correctly balanced. See Section 6 for details on telco adjustment procedures.*

The voice prompts are high fidelity voice recordings, not synthesized audio. They are stored as files on the non-volatile RAM disk, and copied into pooled voice storage when the Model 640 is turned on.

Custom Voice Prompts

The Model 640 is shipped with system voice prompt files recorded at the Zetron factory. These prompts are recorded in English by an American woman. You may wish to replace these prompts with a language or dialect more appropriate to your region or country. Personalized prompts can be recorded to replace the default voice at any time by telephone. When a custom prompt is recorded, the new version is automatically copied to the RAM disk. However, custom prompts should be backed up (preferably using MCU) in case of accidental erasure.

The original factory-recorded voice prompts are stored on the office computer hard drive for backup purposes when MCU is installed.

Database Configuration

The prompts are configured on a per trunk and per subscriber class of service basis in the Model 640 database. The database defines which prompts are played when and to whom.

VOICE PROMPT CATEGORIES

The user-definable system voice prompts are divided into four categories in the Model 640 database. The Class of Prompt Service has fields that determine whether each of the four categories of voice prompts are played to the subscribers. In addition, some of the prompts are played to *all* callers, as defined by the paging terminal software. Figure 61 shows the default Class of Prompt Service record "standard."

```
        D i s p l a y   R e c o r d

PromptName: standard
WelcomePrompt: Y
MessagePrompt: Y
SecurityPrompt: N
ThankYouPrompt: Y

(<cr>, P, D, M, N, L, F, T, B, ?, .)
Entry:
```

Figure 61. Default Class of Prompt Service Record

Table 15 describes which voice prompt(s) each field controls and their purposes. Note that the "Category" column corresponds to the Class of Prompt Service fields.

Table 15. Voice Prompt Categories

Category	Prompt Name	Purpose
Welcome	System Welcome	Plays when the caller accesses the system. No response from the caller is required.
Message	Voice Message	Prompts caller to speak a voice message for recording and later transmission to a voice pager.
	Display Message	Prompts caller to key in a numeric display message for storage and later transmission to a display pager.
Security	Security Code	Prompts caller to enter a security code to page the selected subscriber.
	Function Code	Prompts caller to enter the function for paging the subscriber's pager. The pager has been programmed with function code "Cf" where f is the default function code if the caller does not enter one, or with "CN" which means the call will not go through unless the caller enters an appropriate function code.
Thank You	Thank You	Plays when paging software has successfully accepted and stored the paging message from the caller. Many system operators use this prompt for advertising.

VOICE PROMPT ACCESS NUMBER

A System Prompt Access Number must be programmed in the Model 640 database before any voice prompts can be recorded or deleted. The access number allows an authorized system operator or technician to enter voice prompt recording mode.

Follow the steps below to setup an access number in the database:

- ❑ 1. Select 2 - System Access Phone Numbers from the database main menu.
- ❑ 2. Select 3 - System Prompt Access from the **System Access Phone Numbers** menu. The default record shown in Figure 62 appears.

```
PhoneNumber: 200
VoiceLimit: 10
SecurityCode: 0200

(D, M, N, ?, .)
Entry:
```

Figure 62. Default System Prompt Access Record

- ❑ 3. Modify the record as needed. The fields are used as follows:
  - PhoneNumber is the number to call to access voice prompt recording.
  - VoiceLimit is the maximum length of each voice prompt. The prompts do not have to be this long. In fact, it is a good idea to keep the prompts concise. Long prompts make the system inefficient by increasing call times and taxing disk space. The paging terminal is designed to store approximately 60 seconds of voice prompts.
  - SecurityCode is the four-digit number that must be overdialed to access voice prompt recording. If this field is left blank, the security feature is disabled.

Note: It is not a good idea to allow voice prompts to have "security-free" access. Anyone that accidentally dials the Voice Prompt Access PhoneNumber will be dumped into programming mode. Prompts could easily be destroyed.

- ❑ 4. Once the appropriate modifications are made (if any), save the record by entering S.
- ❑ 5. Exit the database to the plus (+) prompt by entering consecutive periods (.).
- ❑ 6. Type "reboot" to reset the paging terminal and make the database changes take effect.

CUSTOMIZING THE VOICE PROMPTS

A touch-tone phone is required to actually record, delete, and play the voice prompts. The telephone should generate DTMF dialing tones. While it is possible to access the prompts with a rotary dial telephone and the dial click decoder option, this is not recommended, as dial clicks cannot be decoded as reliably as DTMF.

Backing Up Voice Prompts

Zetron recommends backing up any custom voice prompts in case they are ever needed. Follow the steps below to make a backup of the current voice prompts:

Note: This only applies if custom prompts have been previously recorded. Otherwise, the original system prompts are available in the C:\MCU\PROMPTS subdirectory.

- ❑ 1. Enter the Model 640 Communications Utility (MCU) program.
- ❑ 2. Move the cursor to the Backup menu using the arrow keys (← and →).

- ❑ 3. Press <Enter> to view the menu choices.
- ❑ 4. Highlight vOice Prompts and press <Enter>.
- ❑ 5. MCU links to the paging terminal and obtains copies of each voice prompt file automatically. The screen shows status information about each file and the success of the backup.

The voice prompt files are stored to the subdirectory that corresponds to the paging terminal site (C:\MCU\<sitename>). See the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for more details on the backup and restoration procedures.

Accessing Voice Prompt Programming Mode

The Model 640 voice prompts are accessed by a telco call into one of the available trunks. It is also possible to record new prompts by plugging a touch-tone phone directly into the paging terminal.

Note: Before attempting to record voice prompts, be sure the line type configuration in the Model 640 database and the matrix plugs are set appropriately. To access the prompts by way of a directly connected phone (not through the telco connection), set the line type to DID Loop Start in the database, and put the matrix plug in the DID position.

Follow the steps below to access programming mode:

- ❑ 1. Use a touch-tone phone to access one of the Model 640 the trunks by way of the telco or a direct connection into the paging terminal. If calling by way of the telco, dial the PhoneNumber programmed previously in "VOICE PROMPT ACCESS NUMBER" on page 116. If using a directly connected telephone, overdial the PhoneNumber. The default entry is '0200' in the Model 640 database.
- ❑ 2. When the paging terminal responds with 1 long and 4 short beeps, enter the SecurityCode. The default entry is '0200' in the Model 640 database. The Model 640 should respond with 3 short beeps to indicate that voice prompt programming mode is active.
- ❑ 3. Enter a digit sequence that corresponds to the type of action desired. Table 16 shows the programming codes for playing, recording, and deleting each of the 16 available voice prompts. These codes are interpreted as follows:
  - 001 - 072: 0 = *record* new prompts
  - 300 - 372, 999: 3 = *play* existing prompts
  - 601 - 672: 6 = *delete* existing prompts

Note: The portion of the voice prompts in parenthesis are provided as suggestions for modification of the default messages.

Table 16. Voice Command Chart

Command #			Zetron Preferred Wording	Voice File Name
Rec	Play	Del		
---	300	---	Plays all voice prompts in order.	
001	301	601	System welcome - "You have reached our paging terminal (XYZ Communications)."	sys_welc.ome
002	302	602	Voice message - "At the tone, please speak your message."	sys_vmsg
003	303	603	Display message - "At the tone, please key in your message."	sys_dmsg
004	304	604	Thank you - "Thank you for calling (XYZ Communications)."	sys_than.kyo
005	305	605	Pager function code - "At the tone, key in the pager function code."	fcode_in.put
006	306	606	End-to-End overdial - "At the tone, enter the pager number."	sys_end_.end
007	307	607	Security code (for accessing client) - "At the tone, enter the security code."	security._co
010	310	610	Bad number prompt - "The number you have dialed is not in service."	bad_numb.er
030	330	630	Talkback processing - "Your call is being processed."	sys_proc.ess
031	331	631	Talkback queue entered message - "Another call is in progress, please wait."	sys_busy
032	332	632	Talkback message queued - "The system is busy, please call back later." (Also used for a generic "System Busy" prompt.)	try_late.r
033	333	633	Talkback, no answer to ring-out - "The pager did not answer, please try again later."	no_answe.r
034	334	634	Talkback, mobile activity or call limit, timer expiration - "Your time limit has expired."	sys_time.out
035	335	635	Test page prompt, used in conjunction with the ZLINK "page" command for issuing test pages (refer to Section 6). "This is a test page from a Zetron paging terminal."	voice_te.st
071	371	671	System load management - "Your call cannot be processed at this time. Please try again later."	load_mgm.t
072	372	672	System error - "Your call cannot be processed. (Please call _____ to report the problem.)"	sys_erro.r
---	999	---	Plays Test Tone to set the telephone balance and levels for inbound and outbound trunks.	

Recording Tips:

To ensure the highest quality recordings possible, follow these tips:

- Make sure that there is no background noise in the room from which you are calling into the paging terminal.

- Make sure that Silence Compression is turned on (set by way of raw oparams). See the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details.
- Programming is simplified if VoxDisconnect is enabled. (Set in the Telephone Line Databases.) This ensures that the recording will time out after a specified interval of silence.
- Five short beeps indicate successful completion of a command.
- Three short beeps indicate the paging terminal is waiting to accept another command.
- A slow busy signal indicates an incorrect command code.
- After speaking the new prompt, wait quietly until a confirmation tone is played.

RESTORING VOICE PROMPTS

The original factory prompts are stored on the PC hard drive when MCU is installed. These prompts should be kept in the event that the custom prompts are deleted or corrupted.

Customized Prompts

Follow the steps below to restore custom voice prompts to the paging terminal:

Note: Custom prompts can only be restored if backup copies of the files were previously made. Do backups every time the prompts are modified! Refer to "Backing Up Voice Prompts" on page 117.

- ❑ 1. Enter the Model 640 Communications Utility (MCU) program.
- ❑ 2. Move the cursor to the Restore menu using the arrow keys (← and →).
- ❑ 3. Press <Enter> to view the menu choices.
- ❑ 4. Highlight vOice Prompts and press <Enter>.
- ❑ 5. MCU links to the paging terminal and transfers copies of each voice prompt file automatically. The screen shows status information about each file and the success of the restoration.

Factory-Recorded Prompts

Follow the steps below to restore the original system voice prompts to the paging terminal:

- ❑ 1. If custom prompts currently reside in the paging terminal, you may want to make backup copies now. Refer to "Backing Up Voice Prompts" on page 117.
- ❑ 2. Check the current contents of the site subdirectory (C:\MCU\<sitename>) for voice files. This can be accomplished by way of the DOS "dir" and "ls" commands or using the Windows "File Manager" utility. There are 16 voice files identified by an underscore character (_) within the file name. For example, 'bad_numb.er' and 'sys_busy'. Refer to Table 16 for the description and name of each voice file. If the site subdirectory already contains voice files, delete them now or move them to another directory for safekeeping (not C:\MCU\PROMPTS).

- ❑ 3. Copy the original prompt files and ‘ld1.bat’ from the C:\MCU\PROMPTS directory to the C:\MCU\<sitename> directory. This can be accomplished by way of the DOS “copy” command or using the Windows “File Manager” utility.

Note: Be sure to perform a copy, rather than a move. This will ensure that the original voice prompts will remain in their backup location for future use.

- ❑ 4. Enter the Model 640 Communications Utility (MCU) program.
- ❑ 5. Move the cursor to the Restore menu using the arrow keys (← and →).
- ❑ 6. Press <Enter> to view the menu choices.
- ❑ 7. Highlight vOice Prompts and press <Enter>.
- ❑ 8. MCU links to the paging terminal and transfers each voice prompt file automatically. The screen shows status information about each file and the success of the restoration.

See the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for more details on the backup and restoration procedures.

TROUBLESHOOTING AND REPAIR

TROUBLESHOOTING THE PAGING PROCESS

This section provides troubleshooting charts to help solve some of the problems that can occur with the paging terminal or any of the peripheral equipment connected to it. Many times the paging terminal is operating properly, but as a result of some programming or configuration error, it appears to malfunction. The troubleshooting charts include descriptions of symptoms, causes, and remedies.

The paging process is broken down into three basic parts for troubleshooting simplicity:

- paging input
- page processing within the Model 640
- paging transmission output

The second step of the page processing — the things that are controlled by the Model 640's hardware and software — are transparent to the system operator and the paging subscribers. The result is that troubleshooting falls into only two categories - pages that are not successfully input to the paging terminal and pages that are not successfully transmitted. In many situations, the common problems that arise are a result of faulty communications between the paging terminal and the input and output equipment it is interfaced to.

Paging Input

The first step in the paging process is the input to the paging terminal. This can consist of telephone calls into the paging terminal, local alphanumeric paging input, or any network link input. Problems in getting a page into the paging terminal can involve the telco connections and settings, the serial input connections or the Line Type Database parameters.

Use Table 17 to help isolate and correct problems that may appear with the paging terminal.

The *italicized* words in the table are used to guide the system operator to the specific sight or sound that defines the problem. They allow a quick scan of the table for the appropriate entry.

Table 17. Troubleshooting Paging Input to the Model 640

Symptom	Possible Problems	Solutions
Trunk won't answer an end-to-end line type and:		
LINE LED *doesn't light*	Matrix plug incorrectly set	Verify matrix position.
	Telco problems	Verify phone lines wired at punchdown block.

Symptom	Possible Problems	Solutions
LINE LED *lights*	Incorrect Model 640 database parameters	Verify Telephone Line database settings.
DID line doesn't receive feed digits from the CO and:		
LINE LED *lights*, silence on phone	Matrix plug incorrectly set	Verify matrix position.
	Incorrect database parameters	Verify Telephone Line database settings are DID wink start.
	CO sending MF, not DTMF	Change CO service to DTMF or pulse. *(or)* Order MF decoder option
LINE LED *blinks*, busy on phone	TIP and RING leads reversed	Reverse the TIP and RING connections.
Caller hears a *whooping* sound when calling a DID line.	Receiving invalid feed digits from the CO	Verify the Telephone Line databases for the correct ValidNumber settings.
The Model 640 does not detect star (*) override function during voice prompts.	Telephone transmits timed DTMF	Verify that the telephone sends DTMF tones for the duration keys are held.
	Hybrids (BAL R and BAL C) not balanced	Readjust the trunk hybrids (BAL R and BAL C).
Feed digit decoding is intermittent or inconsistent.	The trunk card levels are out of balance.	Readjust the trunk hybrids (BAL R and BAL C). The levels should be reset regularly (every 2-4 months).
Caller hears *busy* tones before the end of paging.	FROM TEL level is too low	Readjust the FROM TEL levels per Section 6.
Model 640 accepts the pager # or a call from a DID line. Caller hears a *busy* signal during or following a display message entry.	Terminal was expecting a Function Code Overdial digits not being passed by the CO from a pulse phone	Listen to phone line to verify DTMF or dial clicks. Order dial click decoder option. *(or)* Readjust the dial click card per Section 6.

Paging Output

The final step in the paging process is the output from the paging terminal. This may include communication with RF link transmitters, colocated transmitters, TNPP output links, etc. Problems in getting a page sent can involve the radio station connections, settings, and level adjustments, the serial output connections, or the Transmitter Database parameters.

The paging output troubleshooting is split into three categories - general problems, display paging problems, and voice paging problems. Use Table 18 to help isolate and correct general problems that may appear with output from the paging terminal.

Table 18. Troubleshooting General Paging Output From the Model 640

Symptom	Possible Problems	Solution
Page is transmitted, but pager does not alert.	Incorrect capcode	Edit subscriber Capcode. Verify 2-tone frequencies.
	Incorrect function code	Edit Pager Definition FunctionCode field.
	Insufficient RF deviation	Readjust the station TONE pot for 3.5 kHz deviation per Section 6.
	RF frequency is off	Adjust the transmitter center frequency to match pagers.
	Digital polarity reversed	Edit DigDataPolarity field in Transmitter Key Type database.
Page is transmitted, but pager only alerts sometimes.	Insufficient RF deviation	Readjust the station TONE pot for 3.5 kHz deviation per Section 6.
	RF frequency is off	Readjust the transmitter digital for 4.5 kHz deviation per Section 6.
	Insufficient tone duration	Edit the 2-tone pager definition fields SecondsTone1/2 appropriately
Zone outputs do not change.	No pull-up resistors	Install pull-up resistors to +5 volts at the zone outputs (pins 21, 22, 46, and 47).

Use Table 19 to help isolate and correct problems that may appear with display paging (numeric or alphanumeric) output from the Model 640.

Table 19. Troubleshooting Display Paging Output from the Model 640

Symptom	Possible Problems	Solution
Terminal accepts display page, but does not transmit.	Subscriber record programmed with an illegal function code	Edit appropriate Pager Definition FunctionCode field.
	Voice and display limits both programmed as nonzero	Only HSC pagers allow both display and voice paging. Modify one limit to equal zero.
	COR / terminal busy on	Fix radio station connection.
Pager alerts, but display is unintelligible.	Alpha data to numeric pager or vice versa	Edit Pager Definition Alpha field.
	Incorrect function code	Edit Pager Definition FunctionCode field.
	Insufficient RF deviation	Readjust the station TONE pot for 3.5 kHz deviation per Section 6.
	RF frequency off	Readjust the transmitter digital for 4.5 kHz deviation per Section 6.

Symptom	Possible Problems	Solution
Pager alerts, but display characters are missing.	Insufficient DTMF level	Readjust the FROM TEL levels per Section 6.

Use Table 20 to help isolate and correct problems that may appear with voice paging output from the Model 640.

The *italicized* words in the table are used to guide the system operator to the specific sight or sound that defines the problem. They allow a quick scan of the table for the appropriate entry.

Table 20. Troubleshooting Voice Paging Output from the Model 640

Symptom	Possible Problems	Solution
Hum or *buzz* present during voice page.	Over deviation	Reduce the station VOICE pot setting.
	Telco line imbalance	Call the telco CO.
Too much *background noise* present during voice page.	Overdriving transmitter	Reduce the station VOICE pot setting.
	Trunk AGC too hot	Readjust the FROM TEL levels per Section 6.
Voice *quiet* at first, then *increases* during voice page.	Hybrid not balanced	Readjust the BAL R and BAL C levels per Section 6.

FRONT PANEL LEDS

The front panel lights indicate the status of hardware and software signals in the system. They can provide valuable information when troubleshooting paging operations. Table 21 outlines the meaning of the lights labeled LINE, ANS, or ACT which relate to communication between the CPU and the microprocessor on the peripheral board. As parts of the paging software become active, the LEDs illuminate in different ways as described below. Also, refer to Section 3 for a description of each LED.

Table 21. Troubleshooting Front Panel LED Operation

Software Step	LEDs	Light Activity
Power on	all ACT	all solid on
Boot-up sequence	READY	comes on solid at end of cycle - ready for paging
	all ACT	all solid on, then rapidly blinking until end of cycle
	MODEM, COM	intermittent flickering throughout cycle
New telco call	active trunk (A-D): LINE	blinks for end-to-end and pulse on for trunk answer

Software Step	LEDs	Light Activity
	ACT	on for pulse and during DTMF digit decoding
	ANS	on for trunk answer blinks for DID DTMF
Active telco call	active trunk (A-D): LINE, ANS	solid on
	ACT	on when receiving FROM TEL audio
Active paging	ANA PTT	on when transmitting paging tones or voice
	DIG PTT	on when transmitting binary digital paging data
	BUSY	on if radio station is already active (in cross-busy applications)
Modem ZLINK active	MODEM	solid on or rapid flickering during modem data transfer between PC and Model 640 short flashes every 3 seconds when link is active, but data is not transferring
Local ZLINK active	COM	solid on or rapid flickering during serial data transfer between PC and Model 640 short flashes every 3 seconds when link is active, but data is not transferring

PROGRESS TONES

The progress tones output by the Model 640 provide valuable clues about the paging process. If the system operator is familiar with the tones, troubleshooting the paging terminal is vastly simplified. Table 22 describes each progress tone issued by the paging terminal and when it plays.

Table 22. Troubleshooting Progress Tones

Audible Tones	Frequencies	Cadence	Indicated Activity
beep	1000 Hz	700 msec	Prompt to enter pager # for end-to-end or voice message
ring	440 + 480 Hz	on - 2 secs off - 2 secs	Connecting to terminal, please wait
di di dit	1000 Hz	di - 50 msec off - 50 msec	Prompt to enter a numeric display message or FunctionCode
dah di di di dit	1000 Hz	dah - 250 msec off - 35 msec di - 35 msec	Prompt for subscriber's SecurityCode

Audible Tones	Frequencies	Cadence	Indicated Activity
di di di di dit	1000 Hz	di - 50 msec off - 50 msec	Page has been accepted
busy	480 + 620 Hz	on - 500 msec off - 500 msec	Invalid subscriber ID, page rejected, or other error
fast busy	480 + 620 Hz	on - 250 msec off - 250 msec	End of telco call

TROUBLESHOOTING TNPP PAGING

Most problems that occur with TNPP paging involve a network link that is down. In effect, the paging terminal cannot connect to the receiving link and send pages. A down link may be the result of modem communication errors, a faulty RF link, transmitter deviation, or any other problems with the network link equipment. In addition, the test light on the TNPP interface card may flash to indicate the link is down.

Many times the TNPP problem occurs on a per-page basis. That is, some TNPP pages are correctly received and/or sent, but others fail. These types of errors are indicated by descriptive response messages in the log files. Sometimes the destination node is invalid or undefined. Usually if the Model 640 is unable to pass pages on to another paging terminal (TNPP node), the logs show a “page no dest” response.

Note: Zetron recommends enlisting the assistance of a Mobile and Paging Systems Division applications engineer to troubleshoot TNPP problems. This subsection is only provided as a general overview of the errors that can occur with a TNPP-equipped paging terminal.

TNPP Interface LEDs

The TNPP interface card has six red LEDs that identify operation of the card. Although these LEDs are not visible if the top panel of the Model 640 chassis is installed, it is important to describe them for troubleshooting purposes. If a malfunction of the TNPP interface is suspected, remove the top panel of the paging terminal and observe the operation of the LEDs at the middle rear of the chassis. Figure 63 shows a side view of the TNPP interface board (Part No. 702-9362).

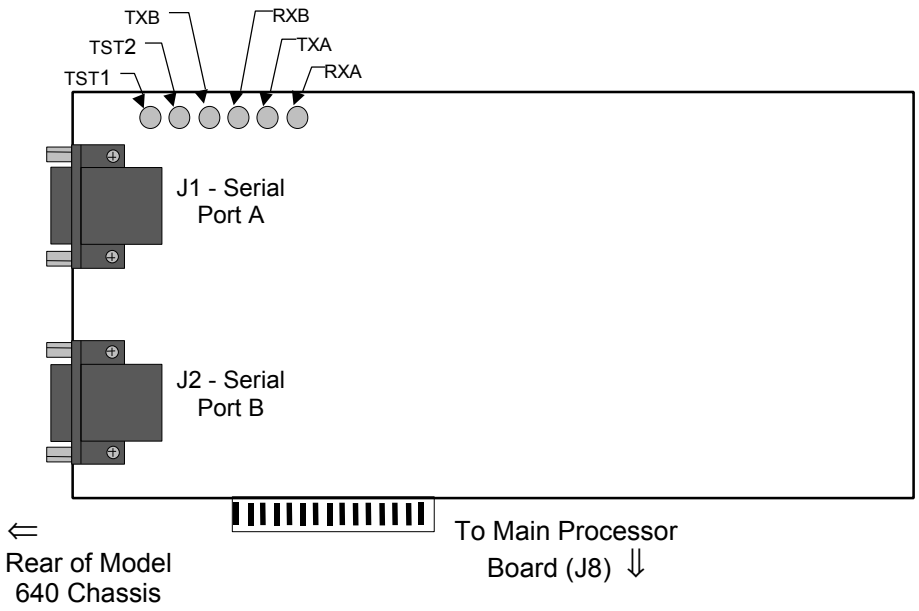


Figure 63. TNPP Interface Board LEDs

Table 23 describes each of the LEDs on the TNPP interface card.

Table 23. Function of TNPP Interface Card LEDs

Label	Identifies	Operation
TST1	Test 1	Lights to indicate a self-test of the DB-9 serial port J1.
TST2	Test 2	Lights to indicate a self-test of the DB-9 serial port J2.
TXB	Transmit B - output	Lights to indicate that RS-232 serial data is being transmitted out port J2.
RXB	Receive B - input	Lights to indicate that RS-232 serial data is being received on port J2.
TXA	Transmit A - output	Lights to indicate that RS-232 serial data is being transmitted out port J1.
RXA	Receive A - input	Lights to indicate that RS-232 serial data is being received on port J1.

The two test LEDs should light continuously during the boot-up cycle, then flicker and go out right before the terminal enters operational mode (the front panel “READY” LED is lit).

Testing the TNPP Card

Another way to troubleshoot the TNPP link status is to short the transmit and receive signals (pins 2 and 3) on the serial interface port together. This effectively sends the pages out and right back into the TNPP card. Once the pins are connected, the network link should report as “up.” If this does not produce a cyclical passing of pages, then the interface card itself is malfunctioning.

Network Interface Unit (*niu*) Diagnostics

When a down TNPP link is suspected, the *niu* command provides some useful diagnostics of the network interface unit. The command can be issued from the plus prompt (+) to determine the nature of the trouble. In addition, the *-l* switch tells the paging terminal to provide information on the status of each link. For a detailed description of the *niu* command, see the *Model 640 Operating and Programming Manual* (Part No. 025-9417).

TNPP Packet Troubleshooting

The TNPP protocol uses mostly printable ASCII characters transmitted by way of asynchronous RS-232 data communication. As a result, troubleshooting can be done with a dumb-terminal emulator on an IBM PC. Problems are often caused by faulty data communications between TNPP nodes. Inaccurate destination ID programming is another source of difficulties. Both types of trouble can be detected by monitoring the received and transmitted data with a PC.

A dedicated dumb terminal or PC is needed for TNPP packet troubleshooting (not the same PC used for MCU and ZLINK operations). Viewcom is an inexpensive terminal emulator program that works well for this application. Do not use ProComm® or Crosstalk, as these types of communications packages tend to strip useful control characters from the packets. In addition, a cable is required to connect the PC's receive data line in parallel with either the transmit (pin 2) or receive data (pin 3) signal of the TNPP serial port under test.

The TNPP protocol sends RS-232 data packets one after another. The paging packets contain no carriage returns or line feeds so the data might look a bit confusing. Once you know what to look for, you can pick out packets easily. All packets start with an SOH (start of header) character, which looks like an outline of a smiley face.

Note: The TNPP information provided in this section is only meant to be a basic overview of the specification and its uses. Contact Zetron to order full detailed documentation on TNPP.

Packet Structure

A TNPP packet is a maximum of 1024 characters long and includes six pieces of information. The basic structure is shown in Figure 64. The shaded boxes are broken down in the following subsections.

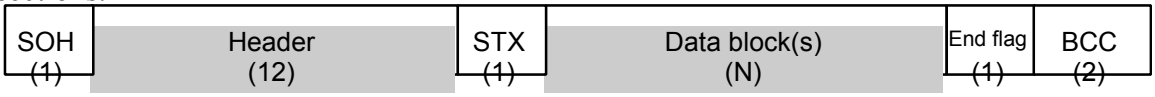


Figure 64. General TNPP Packet Structure

The fields are defined as follows:

- Start of header flag — SOH "☺." This field is 1 character long and remains constant.
- Header — The header is 12 characters long. It includes the packet addressing information for routing through the TNPP network. The Model 640 looks at the destination address and serial number to determine if it should page the subsequent data blocks. See Table 24 for details on the header fields.
- Start of text flag — STX " ☻" This field is 1 character long and remains constant.

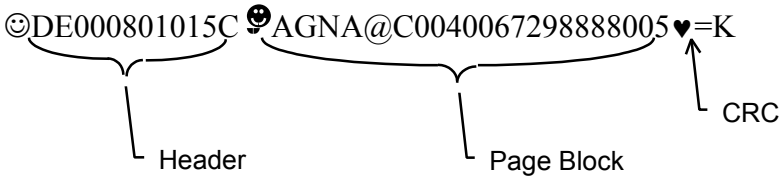
- **Data block(s)** — Each data block contains one page. A TNPP packet can contain more than one data block if each page contains the same routing information (same header). This field is limited in size only by the 1024 character maximum per packet.

  The Model 640 supports both full capcode paging and ID paging for TNPP networking. Each type of data block has a slightly different format. See Table 25 and Figure 67 for details on the data block fields.

- **End Flag** — ETX "♥." This field is 1 character long and remains constant.

- **CRC-16 BCC (block check code)** — The CRC-16 is a 2-character error-detection protocol. Usually the CRC information consists of strange looking control characters. Communication errors are very unlikely to go undetected when using CRC-16.

Here is how a typical capcode page packet might look on a PC:



Because the delimiters in the packet are control characters, some terminal emulators might show the funny characters like:

^ADE000801015C^BAGNA@C0040067298888005^C=K

Header Elements

The packet header is 12 characters in length and includes four pieces of information. The header structure is shown in Figure 65.

Destination address (4)	Inertia (2)	Source address (4)	Serial number (2)

Figure 65. Header Structure

Table 24 describes each header element and the possible values. Note that the "Example" column identifies the element in the example packet above.

Table 24. TNPP Packet Header Fields

Example	Valid Entries	Description
DE00	4 hex digits 0001 - FFFF	Destination address - the node the packet designated for
08	2 hex digits 00 - FF	Inertia - controls the maximum number of "hops" in a network
0101	4 hex digits 0001 - FFFF	Source address - the originating node

Example	Valid Entries	Description
5C	2 hex digits 01 - FF	Packet serial number - differentiates between redundant and original packets

Data Block Elements

The data block is of variable length. Recall that several data blocks can be included in one packet. Each block must end with an ETB (end of text block) character and the last block must end with an ETX (end of text) character. The block format depends on whether the TNPP format is capcode or ID paging.

The data block structure for an ID page is shown in Figure 66.

Block type (1)	Function code (1)	Identifier (10)	Message text (N)	End flag (1)

Figure 66. Data Block Structure for an ID Page

The data block structure for a capcode page is shown in Figure 67.

Block type (1)	Page type (1)	Page class (1)	RF channel (1)	RF zone (1)	Function code (1)	Capcode (8)	Message text (N)	End flag (1)

Figure 67. Data Block Structure for a Capcode Page

Table 25 describes each data block element and the possible values. Note that the shading in each row identifies whether the fields are used in a capcode page (no shading), an ID page (light grey), or both (dark grey). The “Example” column shows the elements in the example packet on page 131, where applicable.

Redundant Packets

In simplex systems, the originating encoder is not aware of errors and should transmit the packet multiple times. TNPP has serial numbers on all packets so the redundant packets are ignored by the Model 640 if they have already been received and processed without error. If reliable data circuits are used, this retransmission procedure may not be necessary.

Table 25. Explanation of TNPP Packet Data Block Characters

Example	Valid Entries	Description
A	A = full capcode page B = ID page	Block type flag
G	G = Golay P = 512 baud POCSAG p = 1200 baud POCSAG Q = 2400 baud POCSAG 2 = 2-tone 5 = 5/6-tone H = HSC N = NEC D3 B = Blick M = Multitone	Page type (format)

Example	Valid Entries	Description
N	N = numeric A = alphanumeric B = beep (tone-only)	Page class
A	A = 1 B = 2 C = 3 D = 4	RF channel designator
@	A = 1 B = 2 C = 3 D = 4	RF zone designator (same as channel designator)
C	1 - F	Page function code - 1 hex digit
00400672	5 - 7 digit capcode with leading zeros (hex F indicates 5/6-tone)	Pager capcode - always 8 ASCII characters
replaces capcode	20 - FE hex	Identifier - customer ID, always 10 ASCII characters
98888005	depends on pager type	Message - variable length
♥	constant value ASCII value 03 or ^C	End of text (ETX) character

Traffic Command

The *traffic* command provides another way to troubleshoot individual TNPP pages. The command is available from the plus prompt (+) and identifies the status of each page sent and received by the Model 640.

Table 26 shows the TNPP packet responses provided by the *traffic* command, what they mean, and some solutions to failed pages.

Table 26. Outbound TNPP Page Responses

TNPP Response	Description	Solution
ACK	Acknowledge - the packet was received by the destination node. The page was **successful**.	No solution required.
CAN	Cannot acknowledge - the destination node did not recognize the node ID or did not like something about the page. The page **failed**.	Double check the destination node ID. Ensure that the information in the TNPP packet is valid: capcode or pager ID, page class, page type, etc.
NAK	No acknowledge - the page was not properly received by the destination node. The page **failed**.	Check the RF link for excessive noise and proper configuration and connections. Ensure that the information in the TNPP packet is valid: capcode or pager ID, page class, page type, etc.

TNPP Response	Description	Solution
RS	Resend - the destination node could not accept the page at this time. An <RS> response usually indicates one of three conditions: • the link is too busy (too much traffic or too many long messages) • the destination node is too busy • the page is to long for the destination node to handle The page **failed**.	Check the RF link for excessive traffic. Check the destination node for excessive traffic. Ensure that the page is not too long for the destination node to process. In most situations, the page can be resent when traffic conditions die down.

Zetron has attempted to provide as much information about failed pages as possible. As a result, the *traffic* command also includes some information pertaining to TNPP pages that is not defined in the specification. These messages are summarized in Table 27.

Table 27. TNPP-Related Traffic *Messages*

Traffic Message	Description	Solution(s)
port link up	Indicates that the other node is up and running. This message is a response to a link test.	No solution required. The other node is available to accept TNPP pages.
port link down	Indicates that the connection to the other node is down.	Do not send any pages to this node until a "port link up" message is received.
port reset sent	Indicates that the Model 640 has sent a reset packet to the other node.	No solution required. This is done when first connecting to the other node.
port reset seen	Indicates that the Model 640 has received a reset packet from the other node.	No solution required. This is done when the other node is first connecting to the Model 640.
page no dest	Inbound page - indicates that the received page was incorrectly addressed. (wrong node ID) Outbound page - indicates that the destination address is incorrect. (wrong node ID or name)	Check the NETWORK.CUS file for missing paging link information.
page bad dest	Indicates that the Model 640 does not recognize the destination node ID.	Check node ID programming.
page dest down	Indicates that the outbound port is currently down. Usually a handshaking problem.	Wait for node to come back up before resending the page. Check the TNPP card for proper transmission per "Testing the TNPP Card" on page 129.
port unk node	Indicates that the inbound packet was received on a port that did not recognize the destination address.	Check the TNPP routing.

Traffic Message	Description	Solution(s)
page timed out	Indicates that the outbound page did not receive a response within the specified time-out interval.	Check the link connection for excessive noise or a weak signal. This may indicate the network packet modem(s) successfully sent the packet, but the round trip time was too long.
packet timed out	Indicates that the inbound packet was not received successfully. Usually there was too long of a gap between characters.	Check the link. A noise burst on an RF or phone link could cause this problem. If this message appears consistently, check the inter-node link connection.
packet too far	Indicates that the inbound packet had an inertia value of one.	Check the network programming for conflicting or incomplete routing data. The source node may have inertia set too low.
packet too big	Indicates that an inbound packet appears to exceed the character limit (1024 bytes).	Check link for noise or excessive traffic on a simplex or blink link. Check that incoming packet is within the 1024 maximum.
packet bad CRC	Indicates that the inbound packet failed the CRC error check.	Check link for noise or interference. If this message appears consistently, check the inter-node link connection.
packet SUB-ETB	Indicates that the inbound packet had a non-standard control sequence. The end of text block character appeared as an escaped character pair, <SUB>W.	Some TNPP implementations send this character sequence. Check with Zetron for software modifications to accommodate this anomaly. In rare cases, the <ETB> is actually part of the message.

For further details on the *traffic* command and examples of its format, see the *Model 640 Operating and Programming Manual* (Part No. 025-9417).

RESTORING THE DEFAULT DATABASES

The default database configuration can be restored at any time by reformatting the RAM disk. This procedure may be required in the event of a corrupted database that is unrecoverable, a BIOS upgrade, installation of a new ROM card, or other hardware or software changes which significantly affect the data processing architecture. Following a RAM disk reformat, the Model 640 database requires complete re-programming.

CAUTION

This procedure destroys all data on the RAM disk! Before starting the reformat, backup the database and system voice prompts using MCU V2.2 or later. Verify the integrity of the backup by *printing* out a copy of the backup database.

Please consult Zetron technical support if assistance is required.

Reformatting the RAM Disk

Follow the procedure below to test, format, and copy the standard databases onto the RAM disk:

[ ] 1. Ensure that a backup of the current databases and voice prompts is available. The data will need to be restored following the reformat procedure. Refer to the *Model 640 Operating and Programming Manual* (Part No. 025-9417) for details.

[ ] 2. Verify that the ROM disk EPROMs (Part No. 601-0329) are version 2.01 or later.

[ ] 3. Power down the paging terminal.

[ ] 4. If this reformat coincides with a ROM disk software update, remove the current ROM disk (Part No. 702-9389) and replace it with the new one.

If only the ROM disk EPROMs are being updated, remove the ROM disk. Then remove the EPROMs from the disk and replace them with the new ones. The new chips should be installed in U1-U4.

[ ] 5. Verify that the BIOS version is 1.0 for the currently shipping V53 microprocessor (Part No. 601-0696). The BIOS EPROM is located to the immediate left of the RAM disk on the main processor board.

[ ] 6. Install JP9 and JP10 on the main processor board. The jumpers are located together on the right rear corner of the board, next to the ROM disk.

[ ] 7. Power-up the paging terminal.

[ ] 8. The front panel COM and MODEM lights (on the left) blink in the sequence shown in Table 28.

Table 28. LED Operation during RAM Reformat Procedure

LED Blinking Sequence	Time Between Sequences	Description
COM + MODEM twice	1 sec after power up	CPU self test
COM + MODEM twice	30 seconds	
COM once	5 seconds	Start of stage 1
COM + MODEM twice	50 seconds	
COM once	5 seconds	End of stage 1
COM + MODEM twice	10 seconds	
COM + MODEM twice	15 seconds	
COM twice	10 seconds	Start of stage 2
COM + MODEM twice	10 seconds	
COM twice	5 seconds	End of stage 2
COM + MODEM twice	10 seconds	
COM + MODEM twice	15 seconds	
COM three times	5 seconds	Start of stage 3
COM + MODEM twice COM three times	25 seconds*	End of reformat

* This sequence repeats every 10 seconds until the paging terminal is turned off.

Notes: *Any errors during the reformat procedure are indicated in the following manner:*

Fast toggle of the COM and MODEM lights followed by the COM light blinking either once, twice, or three times indicates the stage at which the reformat encountered an error. Then the MODEM light blinks several times indicating a specific error. This sequence repeats every 10 seconds.

Contact Zetron Technical Support for assistance.

[ ] 9. Once the "End of reformat" sequence is reached, power down the paging terminal.

[ ] 10. Remove JP9 and JP10. (Leave JP10 in to disable the logon password. See Section 3 for details.)

[ ] 11. Power-up the Model 640 and wait for completion of the boot sequence.

[ ] 12. Use MCU to restore the databases and voice prompts to the RAM disk.

[ ] 13. Reboot the terminal to initialize the database restoration.

The paging terminal is ready for normal operation.

Note: *When updating from a version 1.11 or earlier ROM disk, the DigDataPolarity field in the Transmitter Key Up Control database should be reversed (from the previous setting) following the reformat procedure.*

TROUBLESHOOTING ZLINK COMMUNICATIONS

The communications program that is required to access the paging terminal from a remote site (ZLINK.EXE) should have been installed on the office computer (as a part of MCU) in Section 4. Since the computer environment is the hardest for us to predict and control, problems may vary from incompatibility with modems to incorrect cables for the application.

Note: *Remember that most configuration changes require a reboot for the paging terminal to recognize the updates. This includes hardware settings (jumpers and switches) and Model 640 database updates except in the Subscribers and System Databases.*

Table 29 contains information on isolating communication problems between the Model 640 and the office computer.

Table 29. ZLINK Troubleshooting Guide

Symptom	Possible Problems	Solution
Error "no response..."	Com port contention	Check that the modem is configured for a unique port number.
	Modem not configured for "word result codes"	Check the modem manual for the proper DIP switch settings.
	External modem cable is pinned out incorrectly	Check that the cable passes the signals from pins 2-8 and 20 directly between the computer and the modem.

Symptom	Possible Problems	Solution
Error “no carrier...”	Terminal not answering the line	Verify that the Model 640 is operating correctly. Verify that the database line type configuration settings are correct. Verify that the matrix plug is installed in the proper position.
	Phone number dialing string is incorrect	Select Edit, Locations in MCU to modify the phone # field. Ensure that the entry does not confuse local and modem settings.
Computer calls, Model 640 responds “no carrier...”	Modem not configured for “word result codes”	Check the modem manual for the proper DIP switch settings.
Computer calls, Model 640 responds “connect,” but no “ready”	Line is too noisy or signal is too quiet	Call the paging terminal and listen to the modem tones. Try a different phone line or modem.
	If Model 640 has console option, console may already be logged on	Verify that a console kit is not logged on. Log off, if already ZLINKed. Only one ZLINK connection can be active at any given time.
Error “baud rate wrong OR cable unplugged OR using modem COMM port OR terminal off”	Any one or combination of the four errors listed	Verify the baud rate, cable hookup, and terminal power.
	Using MCU from a MS Windows DOS-shell	Do NOT attempt to use MCU from Windows. Exit to DOS and restart MCU.
Error “no response from modem”	Phone number dialing string is incorrect	Select Edit, Locations in MCU to modify the phone # field. Ensure that the entry does not confuse local and modem settings.
	Modem initialization string is incorrect	Create or modify ‘modem.ini’ file in the appropriate site subdirectory. See Section 4 for details.
Can’t ZLINK from a dumb terminal (not same as console kit)	DTR signal miscommunication	Disconnect the DTR pin (4) and attempt to ZLINK again. Once connection is established, reconnect signal.
System doesn’t recognize database changes	Modifications haven’t been updated to the paging terminal RAM disk	Execute the ZLINK *reboot* command to initialize changes.

GLOSSARY

This glossary provides definitions of some industry-specific terms. Many of the glossary words are defined loosely because they are used in a wide variety of applications. In addition, some of the glossary words can be defined differently when they are out-of-context. These glossary definitions are meant to be applied only to the text of this and other related Zetron manuals.

Term	Definition
ACK	A response from a TNPP paging encoder that a paging packet was successfully received. The ACKnowledgment tells the sending node that the packet need not be resent.
ACT LEDs	Four lights (one for each trunk) on the front of the paging terminal that indicate trunk activity. The ACT LED lights when the trunk is receiving digit feed or voice input.
AGC (Automatic Gain Control)	A circuit feature designed to maintain constant signal output levels. The AGC automatically and continuously modifies the amplification of the varying input signal.
Alarm	A monitor of specific critical conditions at the site.
Alert	A method of notifying someone that a specific condition exists. A page is an alert; it lets the subscriber know that someone is trying to reach them.
Alphanumeric Paging	Display paging that combines alphabetic and numeric characters to form a text message. An alphanumeric page can include symbols, such as punctuation marks, depending on the paging format and terminal software.
ANA PTT LED	A light on the front of the paging terminal that indicates the analog push-to-talk is active. The ANA PTT LED lights when the radio station is sending voice or tone audio.
ANS LED	Four lights (one for each trunk) on the front of the paging terminal that indicate the trunk has been answered. The ANS LED lights when trunk supervision between the telco CO and the Model 640 has been initiated.
Answer Originate	Defines the handshaking protocol used for communication between modems. When the answer originate mode is reversed, the modem that initiates a call acts as though it were receiving a call. This handshaking sequence “tricks” the other modem into thinking it initiated the call. See also **Handshaking**. The human equivalent of reverse answer originate would be calling someone and starting the conversation with, “why did you call me?”

Term	Definition
ASCII Character	A letter, number, or symbol belonging to the American Standard Character set. The standard includes 256 characters, each identified by a three-digit decimal number (000-255).
Audio	Identifies anything that is “heard,” either by the human ear or by some equipment. In the Model 640, audio can indicate incoming trunk data (voice, DTMF, or serial) or outgoing station data (voice, serial, digital, or analog).
Autoformatting	A feature that defines the way numeric display messages are printed in the pager display window. Autoformatting inserts spaces and hyphens for numbers greater than 6 digits in length. Formatted pages are usually easier for the subscriber to decipher.
Batching	The way in which the paging terminal radio station groups pages for transmission. Each batch contains pages of like format and priority. Batching organization uses airtime efficiently and allows pagers with the same preamble to use battery saver mode.
Battery Saver	A circuit used in some pagers to extend battery life. Battery saver essentially allows the pager to use minimal battery power to monitor airwaves for a “wake up” signal (preamble), before going into a fully operational mode.
Baud Rate	The communications speed (in bits per second) of a modem or serial computer interface.
Blick	An older analog pager format that is similar to Multitone in functionality. The Blick format supports tone and numeric display pages. The Blick capcode is a 5-digit number.
Boot Sequence	The cycle the paging terminal goes through upon power-up to load and initialize all software, hardware, and database operations. The sequence lasts around 1½ minutes for the Model 640.
Breakthrough	The highest paging priority assignment where the page is immediately cut-through on the air for live voice. Breakthrough pages should be used only in emergency situations as they severely hamper paging efficiency.
Bridging Clips	An electrical conductor used to connect signal leads on the opposing sides of a punchdown block. Some clips are fused to alleviate equipment damage in circuit overload conditions.
Broadcast	A transmission delivery to at least 2 radio stations simultaneously. A broadcast is usually received over a bus-type local network or satellite.
Buffer	A temporary storage area for holding pages or other data. Most buffers operate generally on a first-in, first-out (FIFO) basis like a fast-food drive-through line.

Term	Definition
Busy	An already-in-use condition in the radio transmission equipment or phone line.
BUSY LED	A light on the front panel of the paging terminal that indicates when the radio station is currently being used. This LED corresponds to the busy input signal (pin #41) on the trunk and radio station interface connector.
Buttset	A modified telephone designed for troubleshooting and repair of telecommunications equipment.
Cable	An electrical interface comprised of one or more wires used to transmit a current or signal.
Cable Ties	Small plastic fasteners included with the installation interface assembly option. Cable ties are used to secure several wires together in a neat, organized bundle.
CAN	A response from a TNPP paging encoder that a paging packet was unsuccessfully received. The CANnot acknowledgment tells the sending node that the packet is formatted or addressed incorrectly and was not delivered.
Canned Messages	A Model 640 database that provides commonly used text phrases for alphanumeric display pagers. Callers can piece together canned messages to send an alphanumeric page from a standard touch-tone phone.
Call Counts	A counter that records and increments the number of calls received by each subscriber. The call counts are used for billing and for traffic management.
Capacity	An average amount of traffic that a circuit can handle. The capacity is given as a guide for maximum consistent load on a system.
Capcode	A pager “address” number that allows callers and the paging terminal to identify the specific subscriber being contacted. It indicates the format and duration of the signaling tones. The capcode is up to 8 characters long and is defined by the unique pager format (Golay, POCSAG, 2-tone, etc.).
Carrier	A physical connection carrying more than one communication channel.
Carrier Operated Relay (COR)	A data input that determines when the transmission path is already busy.
Carrier Detect (CD)	A data input that indicates when a modem connection has been established with another computer.
Central Office (C.O.)	The telephone company’s circuits that connect a private network to a public switched network.

Term	Definition
Channel	An electronics communications path. A narrow band of frequencies (assigned by the FCC) that a radio system must operate within to avoid interference with other adjacent channels.
Circuit	A pathway for electrical signals.
Class of Service (COS)	A set of operating parameters that defines certain paging subscribers. The class of service identifies settings like paging coverage zones, voice and display page limits, caller security codes, etc.
Clear to Send (CTS)	A data input that determines when the line is clear (not busy) for transmission of information.
Colocated	Refers to two or more pieces of paging equipment that are located at the same site. This type of system allows for direct cable hookup, rather than modem or RF-type connections.
COM LED	A light on the front panel of the paging terminal indicating when a local serial communications link has been established between the Model 640 and a computer or dumb terminal. This LED flashes rapidly during data transfers and flashes intermittently when a link is present but no data is being transferred.
COM Port	A serial communications connector. On the Model 640, the COM port is used for ZLINK connection to the PC's own COM port. Most COM ports follow the RS-232 conventions for serial interface.
Coverage	The useable radio time and geographic area of a system.
CPU (Central Processing Unit)	The "brains" of a computer or paging terminal. The CPU controls data acquisition, processing, and transfer to other peripheral cards in the hardware.
CRC (Cyclical Redundancy Check)	An error-detection process used in the TNPP protocol. The CRC computes a general polynomial based on the entire TNPP binary data packet. In the protocol packet structure, the CRC occupies the last 2 bytes of data.
Clear to Send (CTS)	A data input that indicates when it is okay to send data to the radio station equipment. This signal is used in cross-busy applications to ensure that two encoders do not attempt to key up simultaneously.
Current	The flow of electricity through a circuit (measured in amperes).
Database	A software program that stores many records of information. Each record shares the same parameters (with different settings). A database can be sorted by each of its characteristics. In the Model 640, the databases store valuable system information including subscriber records, transmitter settings, and telephone trunk descriptions.
Data Terminal Ready (DTR)	A data output that determines when the receiving party is set to accept information.

Term	Definition
Decoder	A device that receives input data and translates it into a usable format.
Delay	The time difference between initiation of an event and the response.
Destination	The final paging terminal or coverage region (TNPP node address) for which a page is intended.
Deviation Level	The range of variation of a specific tone level. The tone deviation is usually set between 3.0 and 4.0 kHz for the Model 640 radio station audio.
Dial Click	The audio data produced by a rotary dial telephone. The “clicks” are a result of the phone line loop current being broken and reconnected. Each digit is a series of one to ten clicks produced by a rotary phone.
Dial tone	A phone line condition that indicates to the calling party that the exchange is ready to receive digits (either DTMF or MF).
DID (Direct Inward Dial)	A type of phone line (from the CO) that transfers the last few digits of the phone number dialed. A DID line allows direct dialing to a PBX network without operator assistance.
DIG PTT LED	A light on the front of the paging terminal that indicates the digital push-to-talk is active. The DIG PTT LED lights when the radio station is sending digital paging data.
Disable	To make a feature or system inoperative.
Disable Tones	PURC tones that tell the transmitter to disregard the paging data to follow. Also referred to as knockdown or death tones, they allow the transmitter to only send pages intended for its area of coverage.
Display Message	The text that is sent to a numeric or alphanumeric pager.
DTR (Data Terminal Ready)	An output signal that indicates to the receiving equipment that the sender is ready to transmit data.
DTMF (Dual Tone Multi-Frequency)	A common touch-tone protocol used in telephone equipment. DTMF combines two voice-band tone signals into one “beat” frequency. DTMF signaling provides 16 distinct signals.
Dual Trunk Card	A card that can be used in the paging terminal to provide two incoming telephone trunk interfaces. Each half of the dual trunk has a modem, a 9-pin serial port, and can be configured for DID, end-to-end, E&M, or ground start signaling.
Dumb Terminal	A “brainless” computer. A dumb terminal consists of a monitor and a keyboard. Often times a computer is made to look like a dumb terminal through the use of a terminal emulator software program. A dumb terminal can be connected to the Model 640 to access the plus (+) prompt commands and system databases.

Term	Definition
DVM (Digital Voltmeter)	A piece of test and repair equipment used to measure electrical power in volts.
E (ear) Lead	The receive line of an E&M trunk.
E&M	A telephone line type that indicates seizure and supervision on two separate wires. E and M refer to the two data wires - Ear (receive) and Mouth (transmit).
Empty Message	A tone-only alert that is received by a pager. An empty message is sent when the caller fails to key in a valid page and the EmptyMsg field is set to 'Y' in the corresponding Pager Definition database.
Encoder	A converter used to create a message in a specific format.
End-to-End	A standard telephone line type like that available in a home. Also referred to as a POTS (plain old telephone service) line.
ETB (End Of Text Block)	An ASCII character that indicates the end of a TNPP packet text block. If the packet only contains one text block, the ETB is not used. The ETB is always followed by another text block. The last text block in a packet is flagged with an ETX character.
ETX (End Of Text)	An ASCII character (♥) that indicates the end of the text in a TNPP packet. Every TNPP packet should contain this character.
Exciter	The portion of the transmitter that creates the radio signals. The exciter processes the paging data and sends it to the power amplifier circuitry in the transmitter.
Extender Card	A circuit board designed to physically raise one of the Model 640 trunk cards up out of the chassis for pot adjustments. The extender card plugs directly into the trunk card slot and then accepts the trunk card on top of it.
Falsing	The erroneous activation of a decoding device as a result of misleading signals. Falsing in the paging world is when a pager alerts that should not have.
FAULT Connector	A male 6-pin Wiedmueller connector on the rear panel of the Model 640 chassis. The fault interface indicates a paging terminal malfunction. This connector is usually interfaced to an alarm for applications where paging terminal operation is critical (hospitals, emergency response centers, etc.).
FCC	Federal Communications Commission. The U.S. government agency that regulates non-governmental domestic communications systems.
Feed Digits	The DTMF signals sent to the paging equipment by the telco CO. The feed usually ranges from three to seven digits. In the Model 640 Trunk Valid Numbers database, the FeedDigits field identifies how many digits the paging terminal should expect to receive on a given trunk.

Term	Definition
Ferrite	A metal casing designed to block RF noise interference from the radio station equipment. Six ferrites are included in the installation interface assembly option to protect each of the telco trunk and the radio station connectors.
Field	A parameter in the Model 640 database that requires a formatted entry. Each database record is made up of one or more fields.
Field-Upgrade	A modification to the paging terminal equipment that is performed by a technician at the site. Field-upgrades are any changes that are not made at the Zetron factory, prior to shipment.
Flying Leads	The ends of any cable that does not have a standard connector (phone plug, Wiedmueller, DB-9, etc.) attached to it. The flying leads are each of the separate signal leads that are available for termination.
Foreign Exchange (FX)	A telco service provider for compact communities distant from the local exchange. A foreign exchange service is usually provided at reduced costs compared to a regular long-distance carrier.
Foreign Key (FK)	A database field that points to another database record located elsewhere. A foreign key field must identify another record that has been previously created in the system. This structure effectively creates a "nesting" structure where a record contains more data than it first appears to.
Frequency	An alternating current (AC) signal's cycles per second (Hz).
Frequency Shift Keying (FSK)	A method of translating analog modem tones into usable digital data for the transmitter.
Function Code	A variable entry that indicates a specific set of operating parameters for a pager. The function codes available are determined by the pager format (Golay, 2-tone, etc.) and model. Function codes usually correspond to operations such as paging types (voice, tone, numeric, alphanumeric, etc.), the number of display characters, and the number and type of signal alerts (beeps, tones, etc.).
Function Tones	PURC® tones that indicate the mode (analog or digital) that the transmitter should key up in. Function tones indicate the end of the key up sequence from the radio station.
5/6-tone	An analog pager format based on the 2-tone format. The 5/6-tone format supports tone and voice paging and battery saver operation like 2-tone. However, the 5/6-tone format increases the number of available pagers in a system significantly, while cutting transmission time.
Gap Time	The space between transmission of the first and second alert tones for a 2-tone pager. The gap time allows the pager a chance to accurately identify the addressing information. Other gap times are used during transmissions between mode (analog and digital) changes.

Term	Definition
Glare	A condition caused when opposite ends of a loop start telephone line are seized simultaneously. A glare condition results in misdirected or incomplete calls.
Golay Sequential Code (GSC)	A high-capacity digital paging format. Golay is registered to Motorola and features advanced error-correction and fade resistance. The GSC format supports tone, voice, numeric, and alphanumeric paging.
Ground Start	A telephone signaling protocol where a ground condition represents seizure of the phone line by the originating equipment.
Group Call	A feature that allows several pagers in a specified group to be alerted simultaneously. Group paging is commonly used for alerting emergency response teams.
Guard Tones	PURC® tones that indicate the first part of the transmitter key up sequence. Guard tones are sent by the radio station to effectively "warm up" the transmitter.
Handshaking	The initial communications between modems to establish a connection. Handshaking allows modems to confirm communications parameters such as baud rate, parity, and number of stop bits.
Histogram	A statistical graph of paging terminal history produced by MCU. Histograms for the Model 640 show the peak and average values for each hour in the last 7 days.
Hook	Refers to the telephone cradle. A phone is idle in the on-hook condition and busy (in use) in the off-hook condition. Generally, loop current flows during the off-hook condition.
Hot Installation	A method of adding circuit boards to the paging terminal while it is currently up and running. Zetron paging terminals do NOT support hot installation. The Model 640 must be powered down before any cards are installed or removed to avoid damage to the products.
HSC (Hexadecimal Sequential Code)	A paging format similar to 5/6-tone pagers. The HSC format supports tone, voice, and numeric display pages and battery saver operation. The HSC capcode combines a 5-digit address with a service block and beep duration.
Hybrids	Two potentiometers that isolate the FROM TEL and TO TEL audio signals. The hybrids (BAL R and BAL C) eliminate sidetone when properly adjusted for the specific telco line impedance.
Immediate Start	A telephone signaling protocol that does not require a start indication. The CO sends digits to the terminal immediately after the line is answered.
Interface	A connection between multiple pieces of hardware equipment.

Term	Definition
Interference	Any noise source that impairs the communication link between two pieces of equipment. Interference can affect telephone connections, RF and μwave connections, and paging transmissions.
Initialization String	See **Modem Initialization String**.
Installation Interface Assembly	An optional kit that simplifies the radio station and telco connections to the Model 640. The option includes a terminal block adapter, 2 Wiedmueller connectors, wire wrap cabling, phone cabling, and ferrites for noise protection. The terminal block adapter plugs directly into the RJ21 on the rear of the paging terminal chassis to separate the receive and transmit signals.
Jumper	A hardware connection between two electrical pins. A jumper is a small plastic rectangle with metal pin holes in the center to conduct electricity between the signals.
LED (Light Emitting Diode)	A small round light that identifies portions of the paging terminal operation. Most of the Model 640 LEDs are visible on the front panel of the chassis. However, the optional TNPP interface card also has several LEDs that can be observed by simply removing the top cover of the terminal.
LINE LED	Four lights (one for each trunk) on the front of the paging terminal that indicate trunk activity. The ACT LED lights whenever loop current is present on the trunk.
Line Type	The signaling format used by the telco CO to connect the phone line. The line type usually determines the number of signal leads used, their functions, and the way a call is initiated. The most commonly used types are E&M, end-to-end, and DID.
Link	A communication connection used to pass information to a remote location or another piece of equipment. See **ZLINK** and **RF Link**.
Local Connection	A cable interface between two pieces of equipment that are located at the same site. For example, a local connection can be between the office computer and the paging terminal or the paging terminal and the transmitter equipment.
Log Files	ASCII files that store virtually every detail about the paging terminal's activity. The log files are a useful diagnostic tool when troubleshooting malfunctions and failed pages. The Model 640 stores two log files.
Loop Start	A telephone signaling protocol that initiates a call upon connection of the tip and ring leads (loop closed).
Main Processor Motherboard	The circuitry in the Model 640 that performs traffic management for all the page processing. The main processor controls paging terminal timing, the PCM highway signals, voice prompt processing and storage, and all of the system operating software.

Term	Definition
Maintenance Port	An RS-232 data communication interface between the Model 640 and the office PC. It can be either a local serial connection or a remote modem connection. The maintenance port is needed for updating the database and modifying system operating characteristics. Zetron strongly recommends that a *modem* maintenance port be available at all times for factory support and troubleshooting.
Matrix Plug	A small four-position circuit card that plugs into the dual trunk card to set the telco line type. Each trunk card has two matrix plugs; one for each of the trunks. The label on bottom of the matrix plug facing the rear of the trunk card indicates the current line type configuration.
MCU (Model 640 Communication Utility)	Zetron's communication software for use with the Model 640 paging terminal. MCU provides a user-friendly interface to the paging terminal for system management, ZLINK maintenance, and database programming. MCU uses a local serial connection or a remote modem link to communicate with the Model 640.
Menu	Any set of options that allows the user to navigate through the database or communication functions. A menu does not allow the operator to enter or alter any data directly; it simply provides a path to a database record or another menu.
Microwave (µwave)	Radio frequency commonly used for long-distance telephone communications. (Frequencies above one gigahertz - 1,000 MHz.)
M (mouth) Lead	The transmit line of an E&M trunk.
Modem	A computer communications device that transmits and receives analog data over telephone lines for remotely located systems.
Modem Initialization String	A set of commands issued to a modem to define its operating characteristics. The modem initialization string usually consists of standard Hayes "AT" commands. Refer to the modem manual for model-specific commands.
MODEM LED	A light on the front panel of the paging terminal indicating when a modem communications link has been established between the Model 640 and the office computer. This LED flashes rapidly during data transfers and flashes intermittently when a link is present but no data is being transferred.
Morse Code ID	A station identification sequence assigned by the FCC when an RF transmission site license is acquired. The ID is usually a set of 8-10 call letters that uniquely identify the licensee. The ID is played over the air at a specified interval to comply with FCC regulations.
Multi-frequency (MF)	A touch-tone protocol used in telephone equipment. MF is similar to DTMF, but uses different combinations from another tone set. Unlike DTMF, MF signaling is used between switches in the network rather than by the subscriber.

Term	Definition
Multitone	A digital pager format that supports tone, voice, and numeric pages. Although somewhat obscure, Multitone pagers are popular for health care applications where combined voice and display messages (such as a patient room number) are desired.
NAK	A TNPP packet response that a page was not properly received by the destination node. A No AcKnowledge response can indicate too much RF link noise or invalid packet data (capcode, pager format, etc.)
NEC D3	A medium-speed digital pager format that supports tone and numeric display pages. The format is very similar to 2-tone in functionality.
Network	A set of communications lines or devices that are connected together to provide greater coverage area and availability. See also **TNPP** and **TAP Protocol**.
Nextout	An emergency priority that allows a page to move immediately to the front of the queue. Nextout pages take priority over all other pages, except breakthrough.
Node	A single TNPP address. Each node is identified by a unique four-digit number. The node usually indicates the paging system where a page originates or is destined.
Noise	Any interference in a communications link. In the paging world, noise can cause missed or garbled pages, false alerts, and inaccurate data.
Numeric Display Paging	A display paging format that combines numeric characters to form a phone number message. Numeric pages can include spaces and hyphens, depending on pager type and terminal software.
Nurse Call System	A display page (usually alphanumeric) input device used in hospital applications. Most nurse call systems allow an operator to manually enter pages to an in-house paging terminal for immediate alert of medical situations. The nurse call input device usually interfaces with the Model 640 by way of a local serial connection for reliability and fast system response.
Outdial TAP	A common means of sending a small to medium volume of alpha-numeric pages to another paging terminal, usually through a dial-up connection. Outdial TAP pages can only be sent to the node address for which the page is intended - the page cannot be passed through a series of networked terminals. Outdial TAP is limited by its inability to support capcode paging, or send function codes and priority pages.
Overdial	Touch-tone signals sent to the hardware from a modem or telephone keypad. Overdial often indicates that tones are dialed before the prompt is through playing.

Term	Definition
Packet	A page or set of pages sent between TNPP nodes. Each packet can contain several blocks of data, up to 1024 total characters. A block contains one page and identifies parameters such as the page type, the subscriber ID or capcode, the origination and destination nodes, and the message text.
Packet Modem	A modem designed for sending TNPP page packets. The packet modem is usually dedicated to TNPP paging applications.
Pager	A small portable radio receiver that notifies the subscriber almost immediately when someone has called them. Most pagers beep or vibrate to signal a call.
Pager Definition	A database that defines how a pager should function. Each format (Golay, POCSAG, etc.) has its own set of parameters that make up the database. Most formats include settings like function codes, display message autoformatting, and alert signal timing.
Paging Format	The parameters that define how a pager communicates with the paging terminal. The format designates specialized codes and carriers that are compatible with the pager. Some of the commonly used formats are POCSAG, Golay, and FLEX.
Paging Terminal	The processing unit that receives incoming paging data (by way of phone line or RF/µwave link), encodes it, and passes it to the paging subscriber. The paging terminal defines who is paged (subscribers), when they are paged (priority and repeats), where they are paged (transmitter coverage zones), how they are paged (tone, voice, display, etc.), and what they are paged with (pager format).
Password	Any security word (letters or numbers) that is required for access to a specific part of the paging terminal operation. The Model 640 allows password programming to access ZLINK communications, specific databases (by way of MCU privileges), individual trunks and subscribers. All passwords can be bypassed - that is, made inoperable.
PBX	Private Branch Exchange. A private telephone network switch that connects lines at a single site to the public switched network.
Peripheral Motherboard	The secondary processor board in the Model 640 that interfaces the radio station and trunk card portions of the paging terminal to the main processor. The peripheral board has an RJ21 connector that provides signals for the telco and transmission equipment interface.
Pin-out	A description of each signal lead for an interface connector or cable. The pin-out identifies each signal by name, number, and function so that the proper connections can be made between equipment.

Term	Definition
Plus (+) Prompt	The actual prompt that indicates a ZLINK connection has been established and the terminal is awaiting a command. The plus prompt is similar to a DOS prompt. It allows the user over 60 commands that provide maintenance and diagnostics of the paging terminal. When the system operator is at the plus prompt, the <Enter> key can be pressed to access the Model 640 databases.
POCSAG (Post Office Code Standardization Advisory Group)	A high-speed digital paging code format that supports tone, voice, numeric, alphanumeric, and group paging. POCSAG offers 3 data speeds (512, 1200, and 2400 baud) and over 2 million capcodes.
Polarity	The electrical signal "orientation". The polarity determines whether a high signal (usually +5 volts) is identified as a digital 0 or 1. Generally, data polarity settings allow the system to be easily customized for interface with different manufacturers' equipment.
Port	A pathway for information passing. Most ports have connectors for hookup to other equipment. Examples: RS-232 serial ports - DB-9, DB-25, etc., RJ-type telephone connectors - RJ-21, RJ-11, etc., and Wiedmueller connectors.
Potentiometer (pot)	An analog circuit adjustment control for setting levels. Most pots look like screws and can be set using a small flathead screwdriver.
Preamble	The first part of a pager signaling address. The preamble effectively increases the number of available capcodes per pager type and allows the pagers to use battery saver operation. The preamble says to the pagers, "hey you guys with *black hair, blue eyes, and 10 fingers*, (or the equivalent in paging-speak) pay attention to the following pages!"
Primary Key (PK)	The main field in a Model 640 database that uniquely identifies each record. The primary key cannot be identical for two records. By convention, the primary key is usually the first field in each record.
Priority Paging	Paging speed based on subscriber rank. Pages designated with higher priority are transmitted faster than standard pages. The Model 640 offers four levels of priority: low, high, nextout, and breakthrough.
Privileges	A feature in MCU that allows the system operator to assign password protection to individual databases in the paging terminal. MCU provides three levels of privilege assignments - standard (everyone can view and edit the database), read-only (everyone can view, but only users with the appropriate password can edit the database), no access (only users with the appropriate password can view and edit the database). In addition, MCU sets a fourth password to allow access to reassigning the privilege levels themselves.

Term	Definition
Progress Tones	Different tones and beeps the paging terminal plays to callers to indicate what the Model 640 is doing. Progress tones are invaluable when troubleshooting paging malfunctions. Different tone sequences allow the experienced technician to identify when an error occurred and what the source of the error may be.
Prompts	A tone or voice message that guides a user through the paging process, telling the user when and what type of action is appropriate.
Protocol	The rules of operation that govern a communication network.
PSTN	Public Switched Telephone Network. A commonly accessed domestic telecommunications network provided by the telephone company.
PTT (Push-to-Talk)	On a mobile radio, the button that must be pushed to access the communication system and transmit. On a transmitter, the signal input that is used to key up the unit before sending data.
Punchdown Block	A terminal block that connects pairs of wire together by insulation displacement. 66-type punchdown blocks are commonly used by telephone companies to bring trunks (up to 25, 2-wire) into a building.
PURC® (Paging Universal Remote Control)	A protocol that defines the signals and key sequence used to control a remotely located paging transmitter. The PURC® protocol is a trademark of Motorola and is commonly used in paging transmitters.
Queue	The prioritized, orderly “waiting line” for access to a system. In paging, the queue refers to the order in which pages are batched for transmission - generally first in, first out (FIFO).
RF (Radio Frequency)	The portion of the electromagnetic spectrum used for audio communications (around 10 kHz).
RF Link	A communications interface between equipment by way of the radio frequency. RF links are commonly used to send paging data to remotely located transmitters to increase the coverage area.
Radio Station	The transmission equipment. The radio station includes all link transmitters and receivers, paging transmitters, link controllers and any other simulcast or encoding equipment used to get pages from one place to another. In the paging terminal, the term refers generally to the output section of the processor.
RAM Disk	Storage in the Model 640 for the voice prompts and database files. It functions essentially like the hard disk in a computer. The RAM disk is written to on boot up from the nonvolatile ROM disk.
Range	The usable coverage area of a radio system or transmitter.
READY LED	A light on the front panel of the paging terminal, indicating when the Model 640 has completed its boot sequence and is ready for paging input. It should be solid on at all times during normal operation.

Term	Definition
Receiver	An RF unit that accepts incoming signals, extracts the audio portion, amplifies it, and converts it back to the original sound waves.
Record	A unique set of database parameters. Each database contains one or more records that define some portion of the paging terminal operation. For example, in the Subscriber database, individual paging customers have a record that defines their service.
Reformat	A reset of the original skeleton databases from the ROM disk. When the RAM disk is reformatted, all the current databases and voice prompts are erased. Do NOT perform a reformat unless current copies of the system files are available.
Remote Connection	A communications interface made between two pieces of equipment that are not located at the same site. The remote connection can refer to a modem link between the office computer and the paging terminal or an RF or μwave link between the paging terminal and a transmitter.
Remote Control	See **PURC®.**
Repeater	A radio station that rebroadcasts input data to increase the coverage area of a given system.
Repeat Page	A resend of a page that ensures the subscriber receives notification. Repeat pages are often sent for pages that are critical and need to be "guaranteed."
Request to Send (RTS)	A data output that announces to the receiving party that data is ready for transmission and requests a chance to send it.
Result Codes	Modem communication codes that identify the success of data transmissions. Result codes tell the sending modem whether or not the information was received and accepted.
Ring	1. One of the two signaling leads used in most telephone line types. Part of the **tip** and ring audio pair. 2. An audible ring is returned to the calling party to indicate that the line has been connected and the called telephone is ringing. Also an alert ring notifies a called subscriber of an incoming call.
Roaming	Refers to a paging subscriber traveling outside of their "home" area and accessing another site. Paging service can be provided to roaming subscribers by way of a networked paging encoder at the remote site.
ROM Disk	The nonvolatile Model 640 card that stores read-only data. The ROM disk stores the original system voice prompts and skeleton databases, and the paging terminal software.
Rotary Dialing	See **Dial Click**.

Term	Definition
Routing	The data path through which calls or information are passed. In a TNPP or TAP system, routing is the sequence in which a page is passed between paging terminals.
Satellite	An orbiting system in space that receives radio communications from earth transmitters and resends the information to remote locations.
Security Code	A number required to access some portion of the paging terminal operation. Different security codes can be enabled to access system voice prompt programming mode and individual subscribers.
Sensitivity	The minimum input signal strength required to receive a given radio transmission.
Sequenced Subscribers	Two or more subscriber records that have either consecutively numbered capcodes, or phone numbers, or both. A set of sequenced Subscriber records can easily be created using the S command.
Sidetone	An undesirable audio echo that occurs when the audio hybrids are not properly balanced. Sidetone is caused when the FROM TEL and TO TEL connections are not isolated from one another.
Signaling	The exchange of information between functional parts of a communication system. Telephone signaling generally refers to the type of trunk (DID, end-to-end, etc.) and the call initiation circuit (loop, ground, or wink start).
Silence Compression	A feature in the paging terminal that eliminates periods of excessive silence from voice recordings. Silence compression can be enabled to shorten custom voice prompts and voice pages in which the speaker pauses too much between phrases.
Simulcasting	Simultaneous transmission of paging data from several transmitters in overlapping regions to achieve wide-area coverage. Simulcasting requires a high degree of accuracy to avoid garbled signals.
Site	The radio equipment at a single location. The site may consist of a single paging terminal or several terminals with connected equipment.
Sorting	A method of organizing database records so the pertinent data is easily recognized. For example, it may be useful to sort the Subscriber database by name to locate a specific customer's record. The Model 640 databases can be sorted by any field using the F (ind) command.
Source	The origination of some type of data. Often the source refers to the TNPP node from which a page originated. Note that the source node is not necessarily the paging terminal that sent the page directly to the Model 640.
SOH (Start of Header)	An ASCII character used in TNPP packets to indicate the beginning of the packet header data. (The header identifies the packet.) The SOH character (☺) should be included in every valid TNPP packet.

Term	Definition
Static	Interfering noise picked up by a receiver. Static is often caused by lightning or conflicting man-made electrical products.
Station	See **Radio Station**.
Statistics	A mathematical analysis of data. The Model 640 offers statistics on many characteristics of the paging system. For example, a statistics file is available that shows the average and maximum number of pages transmitted per minute. Statistics can be viewed using either ZLINK or MCU. Statistics help the system operator manage the paging terminal more efficiently, identify the need for more resources, and troubleshoot throughput problems.
STX (Start of text)	An ASCII character used in TNPP packets to indicate the beginning of the message data. The STX character (☺) should be included in every valid TNPP packet.
Subscriber	A paging customer. In the Model 640 databases, a subscriber is a record that identifies the customer's name, phone number, pager capcode, security code, status, call count, and class of service.
Supervision	When a switching network monitors the status of a telephone line for the duration of a call.
Switch	A telecommunication device that connects multiple line inputs and outputs. The switch controls the routing and organization of the data transmission paths.
System Configuration Files	Several customized files stored in the Model 640 that define the operating characteristics of the paging terminal. System configuration files are factory programmed and are usually only modified by qualified Zetron personnel.
Talkback Paging	A feature in the Model 640 that allows a subscriber with a mobile radio to be connected with a caller for 2-way communication. When the paging terminal receives a talkback call, the subscriber is paged to alert them of a waiting caller. When the subscriber calls into the paging terminal, they are automatically connected to the calling party.
Telco	A local telephone service provider. The telco leases line types and services to customers.
TAP (Telocator Alphanumeric Paging) Protocol	A standardized alphanumeric paging format that enables paging encoders to pass pages between remote sites. TAP networking is similar to TNPP, but the format is less rigid, allowing for a greater variety of paging types and data.
TNPP (Telocator Network Paging Protocol)	The most popular format for wide-area paging networks. TNPP supports both capcode and ID paging in virtually every format available. The protocol uses RS-232 data in ASCII character format to send and receive pages between remote paging encoders.

Term	Definition
Terminal Block Adapter	An optional interface card for simplified connections to the radio station and telco equipment. The terminal block adapter is part of the installation interface assembly option and plugs easily into the rear panel RJ21 connector. It splits the 50 signals into four 8-pin telephone jacks and two 12-pin Wiedmueller connectors for the analog and digital portions of the transmitter interface.
Terminal Emulator	A software communications program that mimics a dumb terminal. A terminal emulator program can be used on the office computer to interface with the Model 640 for ZLINK communications.
Throughput	The paging channel input and output efficiency. Throughput refers to the ability of the paging terminal to accept, process, and transmit pages in a timely fashion.
Tie Trunk	A telephone circuit that connects two PBXs. A tie trunk is generally a leased line at a cut-rate.
Time-out	A specified time limit in which a certain condition must be met before a default action takes place. For example, the maximum time a caller is allowed between keying DTMF digits before the paging terminal considers the page complete.
Time stamp	An attachment that indicates the current time. Each page is time stamped as soon as it is received by the paging terminal.
Tip	One of the two signaling leads used in most telephone line types. Part of the tip and **ring** audio pair.
Tone-only Paging	A page that only causes the pager to alert (beep, vibrate, etc.). A tone-only page does not include a display or voice message to relay any further information to the subscriber.
Touch-tone	Telephone push-button dialing. See also **DTMF**.
Traffic	1. The frequency, volume, and duration of calls on a radio system. 2. A **plus (+) prompt** command that displays a real-time log of paging terminal activity.
Transmission	Broadcast of communications data over a specific frequency range.
Transmitter	A device used to send RF data to remotely located receiving equipment. Transmitters can send data in a variety of frequencies, formats, and power levels (determines range).
Transmitter Controller	A piece of equipment that governs how the paging transmitter sends out pages. The transmitter controller is physically installed between the paging input and the transmitter. The controller differentiates between digital and analog transmission modes and demodulates FSK signals from the paging terminal. A transmitter controller is required when the radio station output of the paging terminal is not adequate to drive the transmitter, when the transmitter is not PURC-compatible,

Term	Definition
	when the transmitter is remotely located, or when the transmitter is part of a simulcast system.
Transmitter Link Controller	A piece of equipment that governs how the link transmitter sends out data. The transmitter link controller performs the same functions as a transmitter controller, except it is interfaced to a link transmitter rather than the paging transmitter.
Transmitter Zone	See **Zone**.
Trunk	A wireline data path between communications switching equipment. On the paging terminal, a trunk describes an input/output port for passing paging information.
Trunk Card	A dual-port telephone line interface for the paging terminal. A Zetron trunk card can also receive RS-232 serial data and communicate with remote equipment by way of a modem. The trunk card can be configured to connect to a variety of telephone line types and data input devices.
Tutorial	An educational lesson about the operating characteristics and programming procedures for the Model 640 paging terminal. The tutorial is part of the MCU software and provides a convenient on-line method of learning about the paging terminal for first-time users.
2-tone	An older analog paging format. The 2-tone format supports tone and voice pages. This format sends two separate tone signals that identify the pager address. The 2-tone format is compatible with battery saver transmissions and group calls.
UPS	An uninterruptible power supply that obtains standby power from storage batteries to sustain system operation through brownouts and blackouts.
Video Controller Card	An optional interface card included with the console kit. The video controller card is installed in one of the open slots on the left side of the paging terminal motherboard. The card provides a serial port that connects to a monochrome display terminal for ZLINK access.
Voice Paging	1. A paging format that records a caller's live voice message and replays it out the speaker in the pager. Voice paging is most commonly used in medical (hospital and nurse call) applications. 2. A feature Zetron prefers to call "PageSaver". PageSaver actually stores voice messages on to a separate hard disk for later retrieval by the subscriber (like voice messaging). The PageSaver option is only available on the 2000 Series paging terminals.

Term	Definition
Voice Prompts	A voice message that guides a caller in using the paging system. Voice prompts tell the user when and what type of action is appropriate. The voice prompts are recorded at the Zetron factory, however, they can be field-recorded for custom applications.
Voice Storage	The amount of memory available in the paging terminal for temporary storage of recorded voice pages and system voice prompts. Note that the Model 640 does not provide permanent storage of voice pages. The message is stored only until it is transmitted, then it is permanently purged from memory.
Warm Up	A pre-transmission period in which the paging transmitter is allowed to fully power up and prepare to send data. The warm up period aligns the transmitter for digital keying. The warm up is also referred to as high reliability mode.
Watchdog	An emergency monitoring system that oversees the operation of the paging terminal's ZPAGE software. The watchdog expects to see a reset signal at specified intervals. If the software fails and the watchdog is not "kicked" at the expected time, the terminal reboots to reestablish proper operation.
WATS (Wide Area Telecom Service)	A long-distance telephone service provided by the telco for bulk-rate billing. Usually toll-free business "800" numbers are referred to as WATS lines.
Wink Start	A telephone signaling protocol that initiates a call with a current "wink." The wink consists of an on-hook condition followed rapidly by an off-hook and another on-hook.
Zone	The geographic coverage region of a paging transmitter. In a paging system that reaches several areas, each zone identifies a transmitter and locale to which the subscriber can travel and still receive pages.
Zone Address	A label that uniquely identifies a transmitter coverage region. In the Model 640, the zone addresses range from 0 to 15. The zone address (node) for TNPP applications is generally a four-digit number.
ZLINK	Zetron's communication software for linking into the paging terminal. The ZLINK program is similar to DOS in format and actually includes some useful commands from that operating system. ZLINK provides advanced diagnostics and maintenance features for the paging terminal. ZLINK has been rolled into the MCU program for ease of use and convenience.

PARTS LISTS AND SCHEMATICS

V53 MOTHERBOARD (702-9673G)

Parts List

LEGEND:
+ = OPTION
# = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY

ZETRON MODEL 640 V53 MAIN PROCESSOR MOTHERBOARD PARTS LIST: 702-9673G

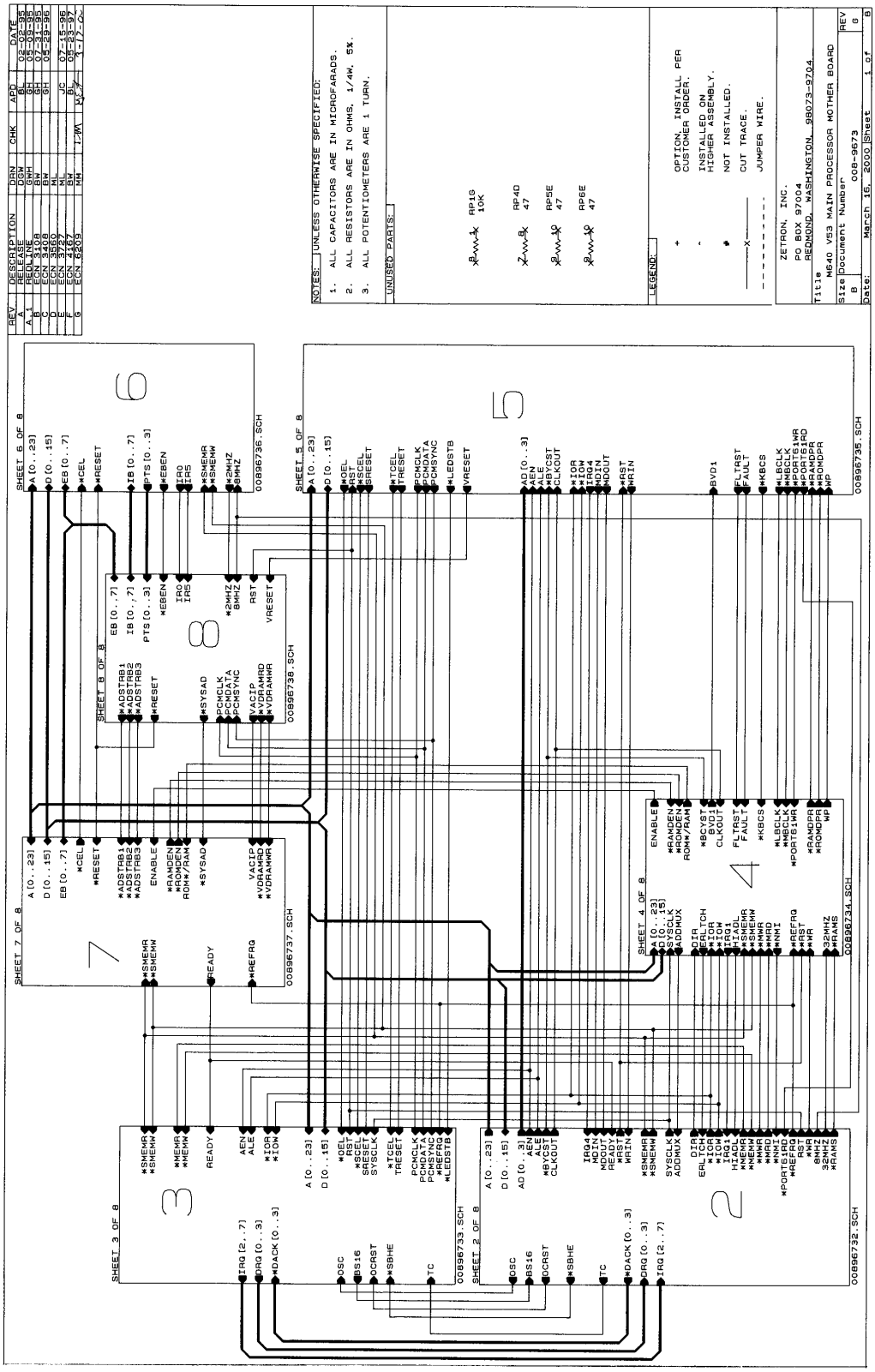
Item	Qty	Reference	Part No.	Description	Mfc. #
1	1	R24	101-0049	RESISTOR,100 OHM,1/4W,5%,CARBON FILM	100
2	5	R39,R40,R41,R44,R49	101-0057	RESISTOR,220 OHM,1/4W,5%,CARBON FILM	220
3	2	R20,R21	101-0061	RESISTOR,330 OHM,1/4W,5%,CARBON FILM	330
4	2	R4,R3	101-0065	RESISTOR,470 OHM,1/4W,5%,CARBON FILM	470
5	6	R30,R42,R45,R46, R47,R48	101-0073	RESISTOR,1.0K OHM,1/4W,5%,CARBON FILM	1.0K
6	1	R7	101-0075	RESISTOR,1.5K OHM,1/4W,5%,CARBON FILM	1.5K
7	2	R34,R35	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
8	20	R9,R10,R11,R12,R13, R14,R15,R16,R19,R22, R23,R25,R26,R27,R28, R29,R32,R33,R43,R52	101-0085	RESISTOR,3.3K OHM,1/4W,5%,CARBON FILM	3.3K
9	9	R1,R2,R5,R8,R17,R18, R31,R37,R38	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
10	1	R6	101-0145	RESISTOR,1.0M OHM,1/4W,5%,CARBON FILM	1.0M
11	1	R36	101-0148	RESISTOR,2.0M OHM,1/4W,5%,CARBON FILM	2.0M
12	2	R50,R51	109-0049	RESISTOR,100 OHM,1/8W,5%,CARBON FILM	100 1/8W
13	4	RP3,RP4,RP5,RP6	119-0002	R-NETWORK,47 OHM x 5,ISOLATED,SIP-10	47
14	1	RP2	119-0003	R-NETWORK,3.3K OHM x 7 BUSSED,SIP-08	3.3K
15	2	RP8,RP7	119-0005	R-NETWORK,3.3K OHM x 9,BUSSED,SIP-10	3.3K
16	1	RP1	119-0006	R-NETWORK,10K OHM x 9,BUSSED,SIP-10	10K
17	1	C6	150-0024	CAP,24pF,1KV,10%,CERAMIC DISC	24pF
18	2	C52,C53	150-0033	CAP,33pF,1KV,10%,CERAMIC DISC,750 PPM/C	33pF
19	4	C1,C2,C4,C5	151-0005	CAP,47pF,100V,10%,CERAMIC NPO	47pF
20	1	C3	151-0028	CAP,270pF,100V,10%,CERAMIC NPO	270pF
21	1	C25	151-0120	CAP,.01uF,50V,10%,CERAMIC X7R	.01
22	70	C7,C8,C10,C11,C12, C13,C14,C15,C16,C17, C18,C19,C20,C21,C22, C23,C24,C26,C27,C28, C29,C30,C31,C32,C34, C35,C36,C39,C46,C47, C48,C49,C50,C51,C54, C55,C56,C57,C58,C59, C60,C61,C62,C63,C64, C65,C66,C67,C68,C69, C70,C71,C72,C73,C74, C75,C76,C77,C78,C79, C80,C81,C82,C83,C84, C85,C86,C87,C88,C89 **NOTE 7**	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1
23	1	C40	151-0199	CAP,.47uF,50V,5%,POLYESTER	.47
24	1	C33	152-0089	CAP,.001uF,50V,5%,POLYESTER	.001
25	7	C37,C38,C41,C42, C43,C44,C45	154-0100	CAP,10uF,16V,10%,TANTALUM	10 TANT

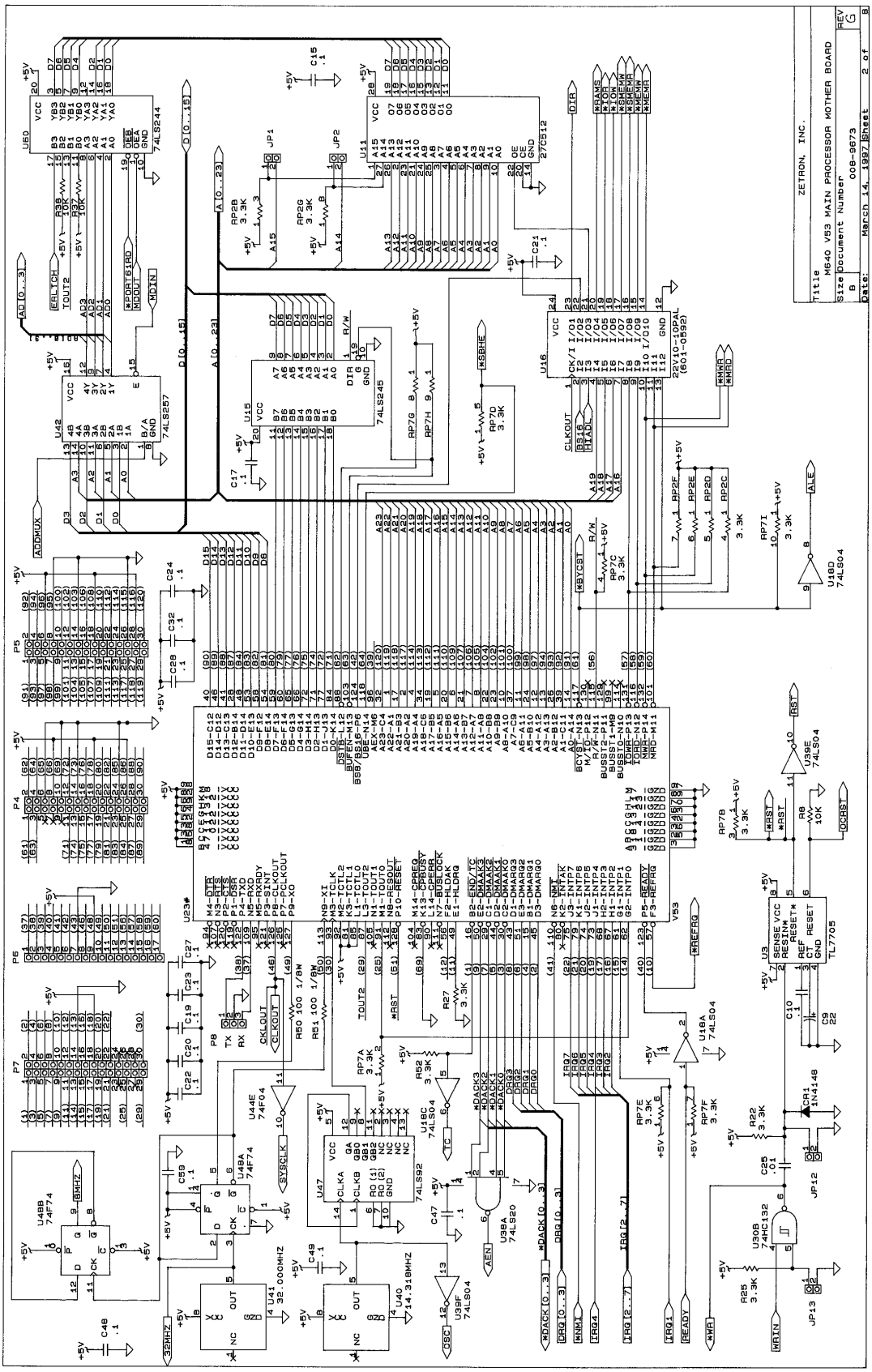
26	1	C9	155-0056	CAP,22uF,50V,20%,AXIAL,Al-E	22 50V
27	3	E1,E2,E3	305-0001	BEAD,3B FERRITE,W/LEADS	
28	9	DS1,DS2,DS3,DS4, DS5,DS6,DS7,DS8,DS9	311-0011	LED,RED,DIFFUSED,5mm CYLINDRICAL	
29	1	U21	314-4125	QUAD BUFFER TS	74LS125
30	1	U65	314-4138	DECODER 1 OF 8	74LS138
31	3	U56,U71,U83	314-4161	IC,COUNTER,BINARY,4-BIT,PRESETTABLE	74LS161
32	1	U12	314-4175	IC, FLIP FLOP,QUAD	74LS175
33	2	U45,U60	314-4244	OCTAL BUS DRIVER NON-INV TS	74LS244
34	1	U15	314-4245	OCTAL BUS TRANSCEIVER	74LS245
35	1	U24	314-4251	IC,MUX,TRI STATE	74LS251
36	1	U42	314-4257	IC,MUX,NON-INV TS,QUAD	74LS257
37	1	U49	314-4259	IC,LATCH,8 BIT,ADDRESSABLE	74LS259
38	1	U10	314-4373	OCTAL LATCH TS	74LS373
39	2	U85,U6	314-4374	OCTAL D-FF REG TS	74LS374
40	3	U25,U26,U46	314-4393	DUAL 4 STAGE BINARY COUNTER	74LS393
41	1	U57	314-4873	DUAL 4BIT FF	74ALS873
42	2	U39,U18	314-7404	HEX INVERTER	74LS04
43	1	U38	314-7420	IC,NAND,4 INPUT,DUAL	74LS20
44	3	U22,U33,U37	314-7474	DUAL D FLIP FLOP	74LS74
45	1	U51	314-7485	4 BIT COMPARE	74LS85
46	1	U36	314-7486	IC,XOR,W INPUT,DUAL	74LS86
47	1	U47	314-7492	DIVIDE BY 6 COUNTER	74LS92
48	1	U5	315-7406	HEX BUFFER INV OC HIGH-VOLT	7406 O/C
49	1	U1	315-7407	HEX BUFFER NON-INV OC HIV	7407
50	1	U3	316-7705	POWER ON RESET	TL7705
51	1	U2	317-5406	IC,DRIVER,RS-232,+-12V POWER,DUAL	MC145406
52	1	U77	321-0130	IC,RAM,1K,DUAL PORT,120nS OR BETTER	1K RAM 120NS
53	1	U43	321-0222	IC,MODEM,1200 BAUD,5V,SINGLE CHIP	73K212
54	0	U59# **NOTE 4**	321-1001	IC,SRAM,128K x 8,100nS, 50uA,0 TO 70C	128Kx8 SRAM
55	1	U34	321-3054	IC,PCM,CODEC,U-LAW,SERIAL I/O,DUAL 5V	3054 CODEC
56	1	U9 **NOTE 6**	321-6264	IC,RAM,8K x 8,150nS (0nS write hold)	8KX8
57	1	U7	321-6450	IC,UART,2 BYTE FIFO (SEE ALSO 321-8250)	16450 UART
58	0	U23#	321-7023	IC,16 BIT HIGH INTEGRATION UP,132 PIN PGA	V53
59	1	U8	321-8242	AT KEYBOARD CONTROLLER	UPI-42
60	1	U66 **NOTE 1**	322-1604	IC,PAL,16R4	16R4 PAL
61	1	U62 **NOTE 1**	322-1618	IC,PAL,16R8,25NS,100mA ICC-MAX	16R8 PAL
62	9	U14,U31,U50,U53, U73,U75,U78,U79,U81 **NOTE 1**	322-2210	IC,PAL,22V10	22V10 PAL
63	2	U16,U20 **NOTE 1**	322-2211	IC,PAL,22V10,10nS	22V10-10PAL
64	1	U27 **NOTE 1**	322-7256	IC,EPROM,CMOS,32K x 8,250nS	27C256 EPROM
65	1	U11 **NOTE 1**	322-7512	IC,EPROM,64K x 8,120nS	27C512
66	5	U55,U64,U69,U74,U80	323-7730	ADPCM EN/DECODE	77C30
67	1	U32	324-4060	14-BIT COUNTER WITH OSCILLATOR	74HC4060
68	1	U30	324-4132	IC,NAND,HC,SCHMIDT,QUAD	74HC132
69	1	U35	324-7410	IC,NAND,HC,3 INPUT	74HC10
70	3	U54,U61,U68	325-4244	OCTAL BUFFER	74HCT244
71	2	U72,U67	325-4245	OCTAL XCVR	74HCT245
72	2	U58,U63	325-4374	OCTAL DFF REG TS	74HCT374
73	1	U19	326-4139	DUAL 1 OF 4	74F139
74	1	U82	326-4153	DUAL 4 IN MULTI	74F153
75	5	U17,U28,U29,U76,U84	326-4157	2 INPUT MULTI	74F157
76	2	U70,U4	326-4273	OCTAL DFF	74F273
77	1	U13	326-4657	OCTAL TRANSCEIVER WITH PARITY	74F657
78	1	U52	326-7400	IC,NAND,F,QUAD	74F00
79	1	U44	326-7404	HEX INVERTER	74F04
80	2	U86,U87	326-7474	IC,FLIPFLOP,D,F,DUAL	74F74
81	1	U48	327-7474	IC,FLIPFLOP,D,ACT,DUAL	74ACT74
82	4	CR1,CR2,CR3,CR4	342-3009	DIODE,SILICON,100V,250MW	1N4148
83	1	Y1	376-0185	XTAL,1.8432MHZ,HC-49	1.8432MHZ
84	1	Y3	376-1106	XTAL,11.0592MHZ,CL=18pF,HC-49	11.0592MHZ
85	1	U40	376-1431	OSCILLATOR,14.31818MHZ,MINI-DIP	14.318MHZ
86	1	Y2	376-3088	XTAL,3.088MHZ,HC-18	3.088MHZ
87	1	U41	376-3200	OSC,32.000MHZ,MINI-DIP	32.000MHZ
88	1	K1	380-0030	RELAY,DPDT MINI-DIP,12 V COIL	
89	1	J2	401-0021	CONN,D-SUB,9 PIN,FEMALE,PC-RA,PLASTIC	
90	2	J6,J7	401-0063	CONN,CARD EDGE,2 x 25	
91	1	J3	401-0129	6 POS RA HEADER	

92	1	J1	401-0217	CONN,DIN,5 PIN	
93	2	J5,J4	401-0256	18/31 DUAL ISA CONNECTOR	
94	1	J8	401-0843	2 X 15 EDGE CONNECTOR	
95	1	P1	401-2648	8-POS MALE .156" CTRS SQR	
96	8	TP1,TP2,TP3,TP4, TP5,TP6,TP7,TP8	403-0001	01 OF 401-0052	
97	9	JP1,JP2,JP3,JP4,JP7, JP9,JP10,JP12,JP13	403-0002	02 OF 401-0052	
98	6	JP5,JP6,P8,JP8,JP11, JP14	403-0003	03 OF 401-0052	
99	1	P6	403-0017	17 OF 401-0052	
100	3	P4,P5,P7	403-0215	30 OF 401-0052 [15 x 2]	
101	1	P2 **NOTE 3**	404-1004	04 OF 401-1364	
102	1	P3	404-1217	34 OF 401-1364 [17 x 2]	
103	3	J9,J10,J11	407-0030	SKT,SIMM,30 PIN	
104	1	XJ2 **NOTE 2**	210-0001	NUT, KEP, 4-40, S-Zn	
105	1	XJ2 **NOTE 2**	220-0102	SCREW,4-40 x 3/8 PAN PHILLIPS	
106	2	XJ10,11	321-1009	1 MEG x 9 DRAM SIMM	
107	1	U59 **NOTE 4**	321-8256	32K X 8 RAM LP	HPD43256-15L
108	2	XJ2	401-0042	DB LOCK SCREW	
109	7	XJP5,8,11 **(POS A)** XJP6,14 **(POS B)** XJP1,2 **(IN)**	402-3040	MINI JUMPER	
110	2	XU62,66	407-0020	SKT, 20 PIN DIP	
111	11	XU14,16,20,31,50,53, 73,75,78,79,81	407-0023	SKT, 24 PIN SKINNY DIP	
112	3	XU9,11,27	407-0028	SKT, 28 PIN DIP	
113	1	XU59	407-0032	SKT, 32 PIN DIP	
114	1	XU8	407-0044	SKT, 44 PIN PLCC	
115	1	PCB	410-9673B	M640 V53 MAIN PROCESSOR MOTHERBOARD, PCB	
116	1	XU9 **NOTE 6**	416-1216	28 PIN BAT/WATCH	
117	9	XDS1-9	417-0010	LED MOUNT RA	
118	1	XU27 **NOTE 8**	601-0312	V2.0 M640 PCM TONE SOFTWARE	
119	1	XU31 **NOTE 8**	601-0313	V2.0 M640 PCM DECODE SOFTWARE	
120	1	XU73 **NOTE 8**	601-0315	V2.0 M640 PERIPHERAL DECODE 2 SOFTWARE	
121	1	XU62 **NOTE 8**	601-0318	V1.0 M640 CONTROL REGISTER 1 SOFTWARE	
122	1	XU66 **NOTE 8**	601-0319	V2.0 M640 CONTROL REGISTER 2 SOFTWARE	
123	1	XU75 **NOTE 8**	601-0320	V1.0 M640 DATA REGISTER LOW SOFTWARE	
124	1	XU78 **NOTE 8**	601-0321	V1.0 M640 DATA REGISTER HIGH SOFTWARE	
125	1	XU79 **NOTE 8**	601-0322	V1.0 M640 ADDRESS REGISTER SOFTWARE	
126	1	XU81 **NOTE 8**	601-0323	V1.0 M640 CONDITION MUX SOFTWARE	
127	1	XU50 **NOTE 8**	601-0324	V1.0 M640 CHANNEL ENABLE SOFTWARE	
128	1	XU16 **NOTE 8**	601-0592	V1.0 M640 V53 CONTROL DECODE SOFTWARE	
129	1	XU20 **NOTE 8**	601-0593	V1.0 M640 V53 DRAM INTERFACE SOFTWARE	
130	1	XU14 **NOTE 8**	601-0594	V1.0 M640 V53 PERIPHERAL DECODE 1 SOFTWARE	
131	1	XU53 **NOTE 8**	601-0595	V1.0 M640 V53 ADPCM INTERFACE SOFTWARE	
132	1	XU11 **NOTE 8**	601-0696	V4.0 M640 V53 DOS SOFTWARE	
133	1	P4-7 **NOTE 5**	702-9722B	M640 V53 ADAPTOR BOARD	

NOTES: (Notes are for production use only.)

Schematic




ZETRON, INC.
M640 V53 MAIN PROCESSOR MOTHER BOARD
Document Number 008-9673
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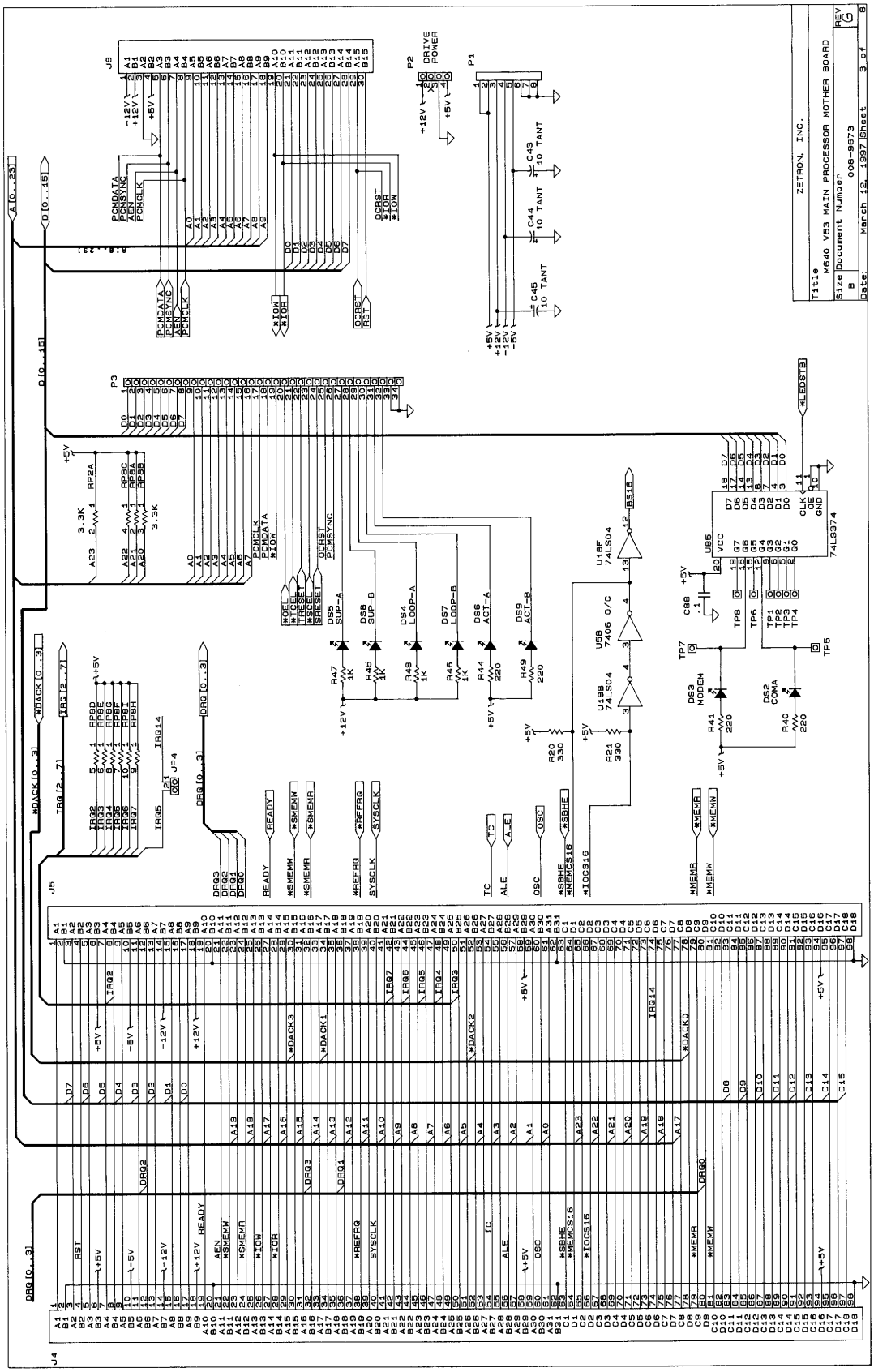
2 of 8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M840 V53 MAIN PROCESSOR MOTHER BOARD
Size
B
Document Number
008-9673
REV
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Date:
March 12, 1997
Sheet
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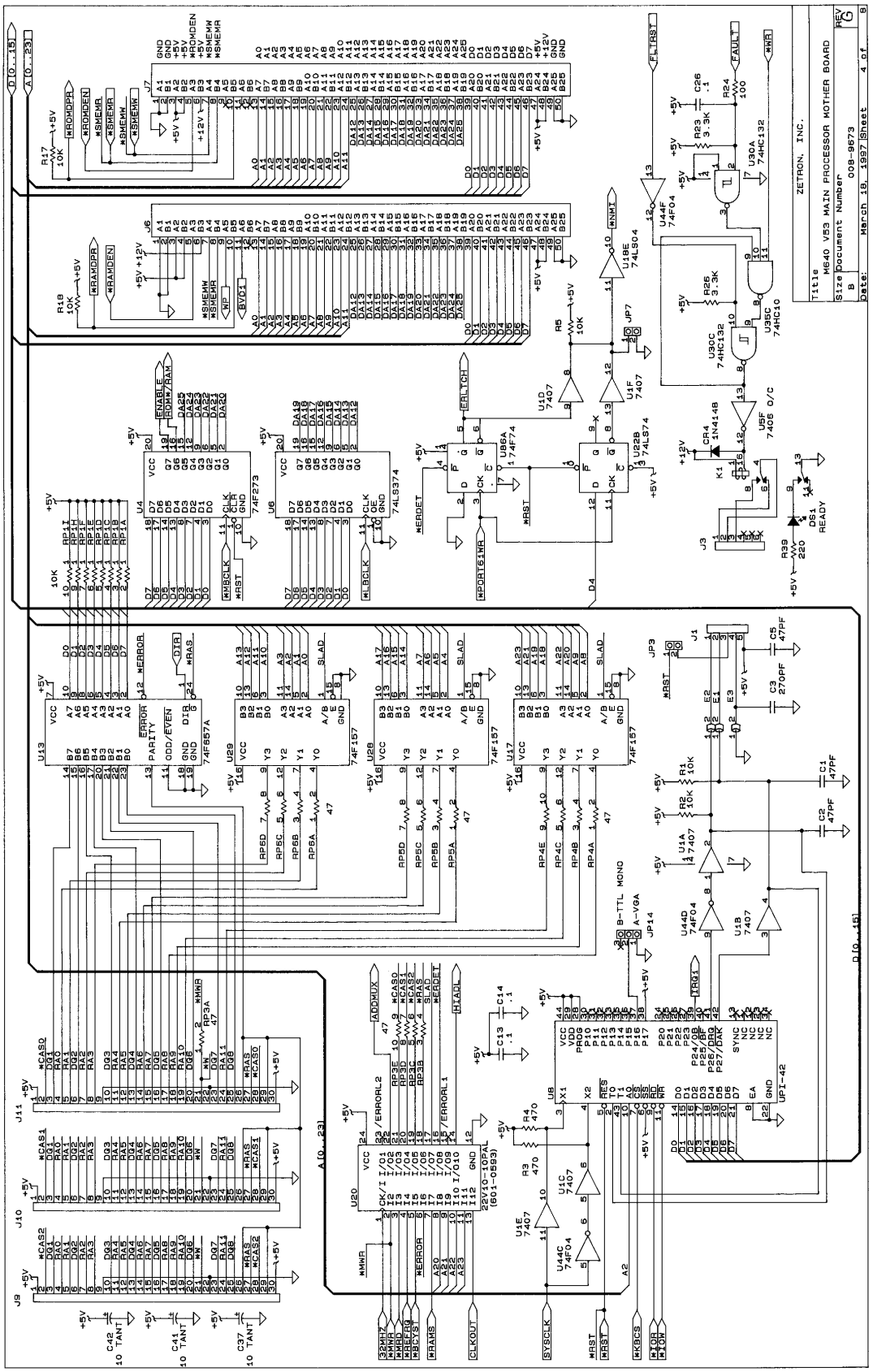
8
J4
J5
P3
J8
P1
P2
DRIVE POWER
74LS374
74LS04
7406 O/C
*DACK[0..3]
IRQ[2..7]
DRQ[0..3]
A[0..23]
D[0..15]
*LEDSTB
*MEMR
*MEMW
*IOR
*IOW
*IOCS16
*MEMCS16
*SBHE
SYSCLK
OSC
READY
TC
ALE
AEN
RST
PCMDATA
PCMSYNC
PCMCLK
SUP-A
SUP-B
LOOP-A
LOOP-B
ACT-A
ACT-B
MODEM
COMM
C43
10 TANT
C44
10 TANT
C45
10 TANT
C88
.1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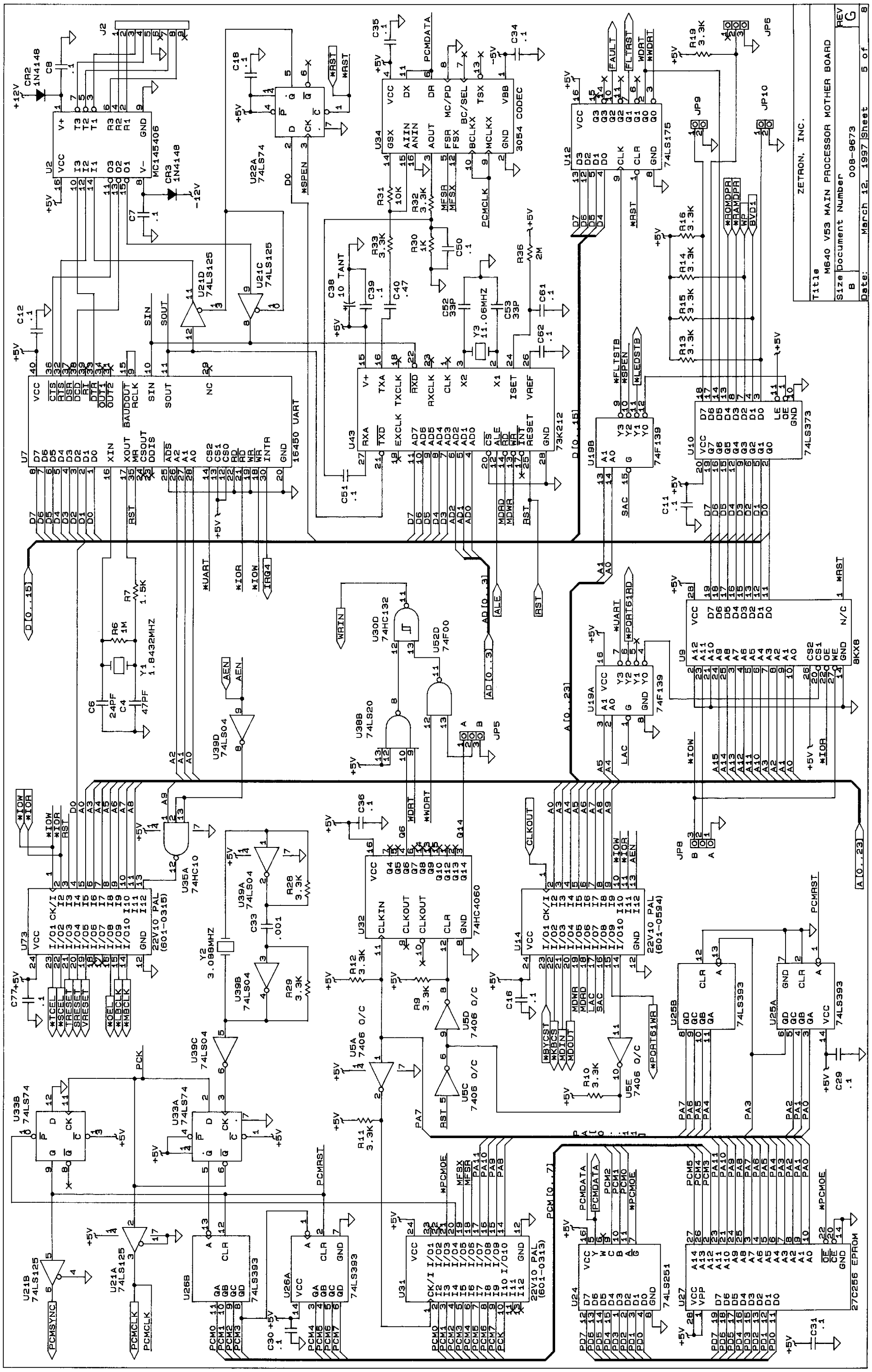
M640 V53 MAIN PROCESSOR MOTHER BOARD
Size B
Document Number 008-9673
REV G
Date: March 18, 1997 Sheet 4 of 8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M640 V53 MAIN PROCESSOR MOTHER BOARD
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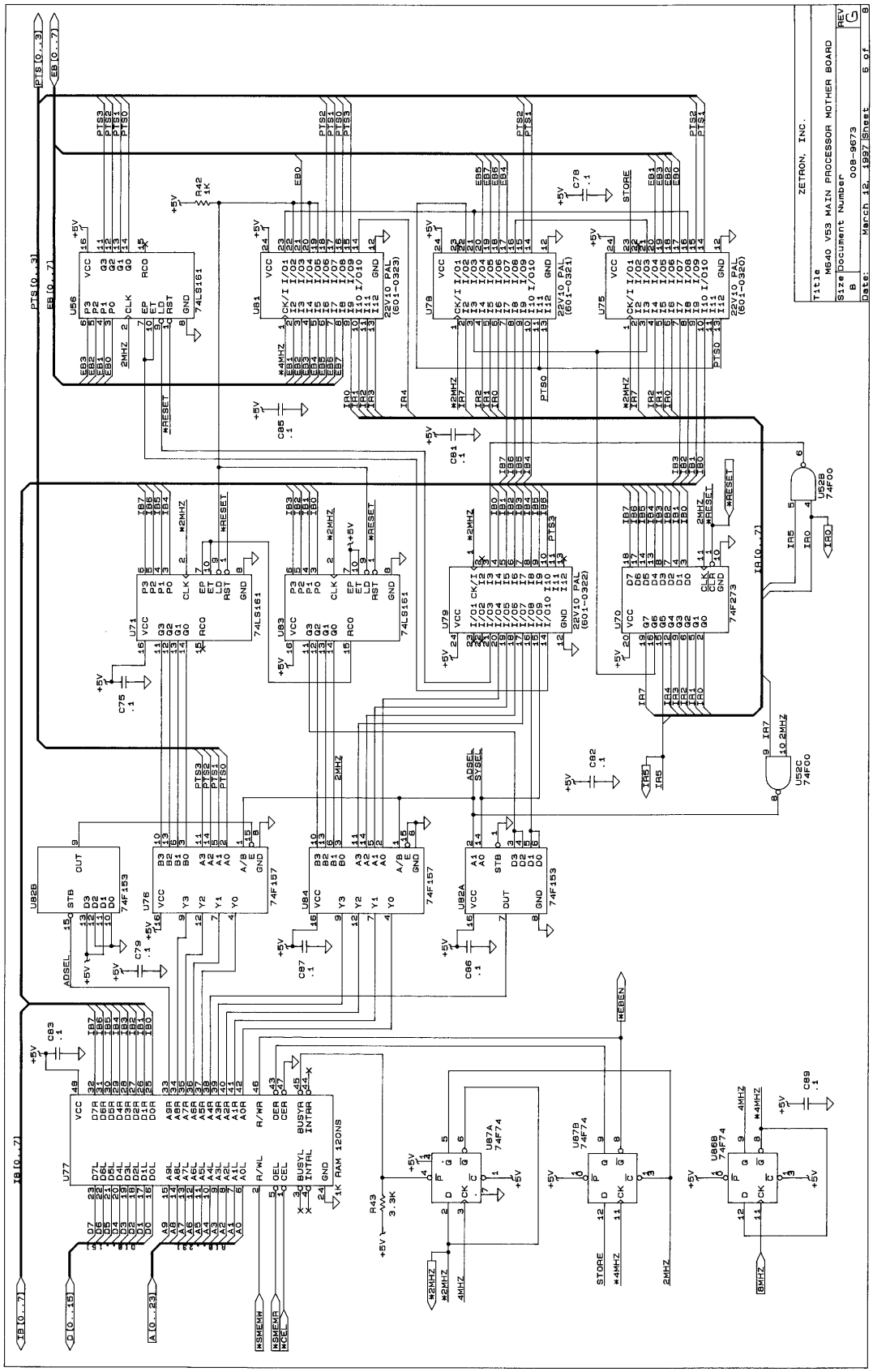
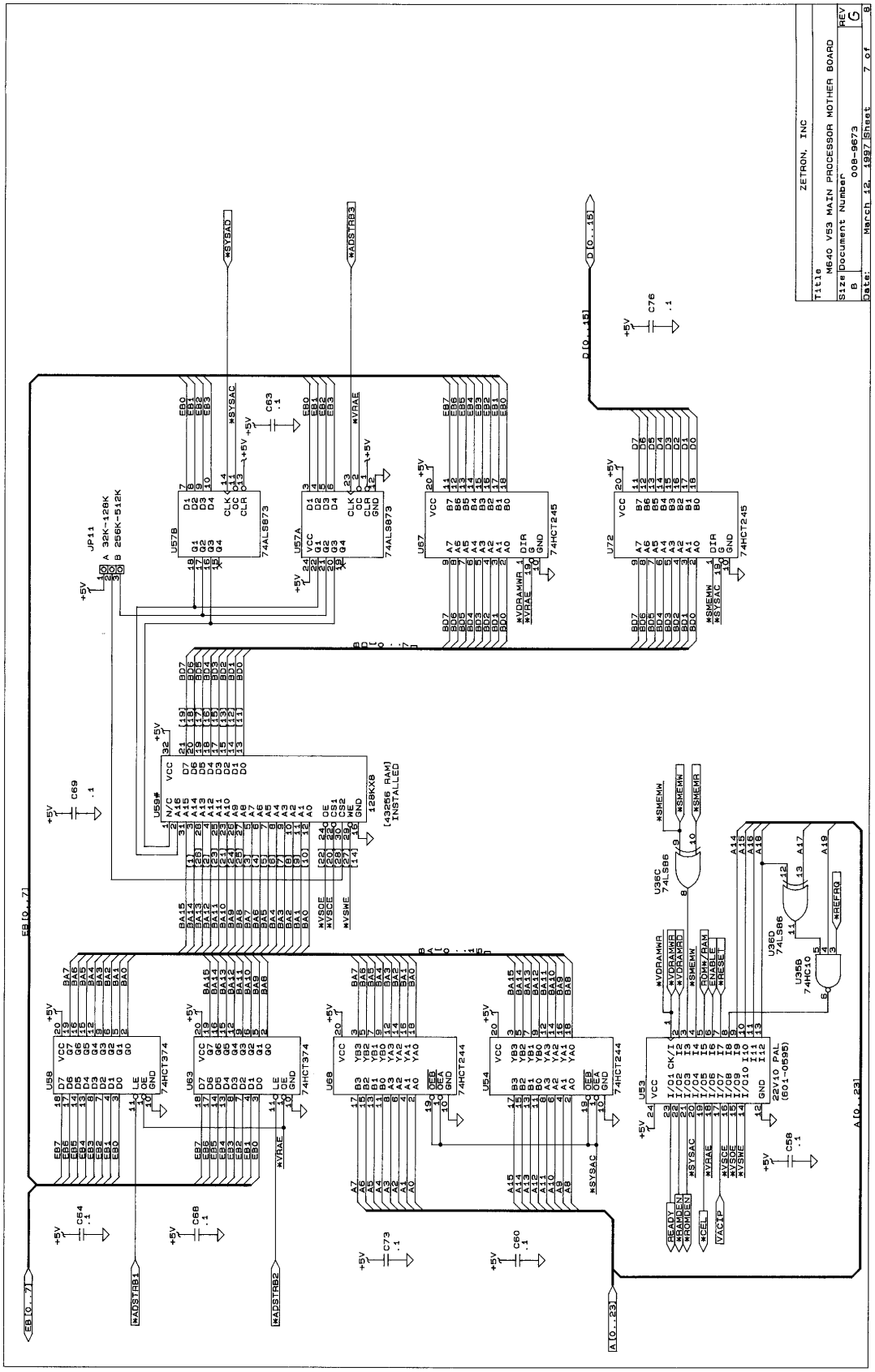

ZETRON, INC.
M640 V53 MAIN PROCESSOR MOTHER BOARD
Size B
Document Number 008-9673
REV G
Date: March 12, 1997 Sheet 6 of 8
PTS[0..3]
EB[0..7]
IB[0..7]
D[0..15]
A[0..23]
*RESET
*2MHZ
*4MHZ
2MHZ
4MHZ
8MHZ
STORE
*KEREN
*KSMEMWR
*KSMEMRD
*KCEL
ADSEL
SYSEL
1K RAM 120NS
74LS161
74F153
74F157
74F273
74F74
74F00
22V10 PAL (601-0323)
22V10 PAL (601-0321)
22V10 PAL (601-0322)
22V10 PAL (601-0320)


ZETRON, INC
Title
M640 V53 MAIN PROCESSOR MOTHER BOARD
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8
JP11
32K-128K
256K-512K
U57B
74ALS873
U57A
74ALS873
U67
74HCT245
U72
74HCT245
U59#
128KX8
(43256 RAM)
INSTALLED
U58
74HCT374
U63
74HCT374
U68
74HCT244
U54
74HCT244
U53
22V10 PAL
(601-0595)
U36C
74LS86
U36D
74LS86
U36B
74HC10
*SYSAD
*ADSTRB3
*SYSAC
*VRAE
*VDRAMWR
*VRAE
*SMEMW
*SYSAC
*VSCE
*VSOE
*VSWE
*VDRAMWR
*VDRAMRD
*SMEMW
ROM#/RAM
ENABLE
*RESET
*REFRQ
READY
*RAMDEN
*ROMDEN
*CEL
VACTP
*ADSTRB1
*ADSTRB2
EB[0..7]
D[0..15]
A[0..23]
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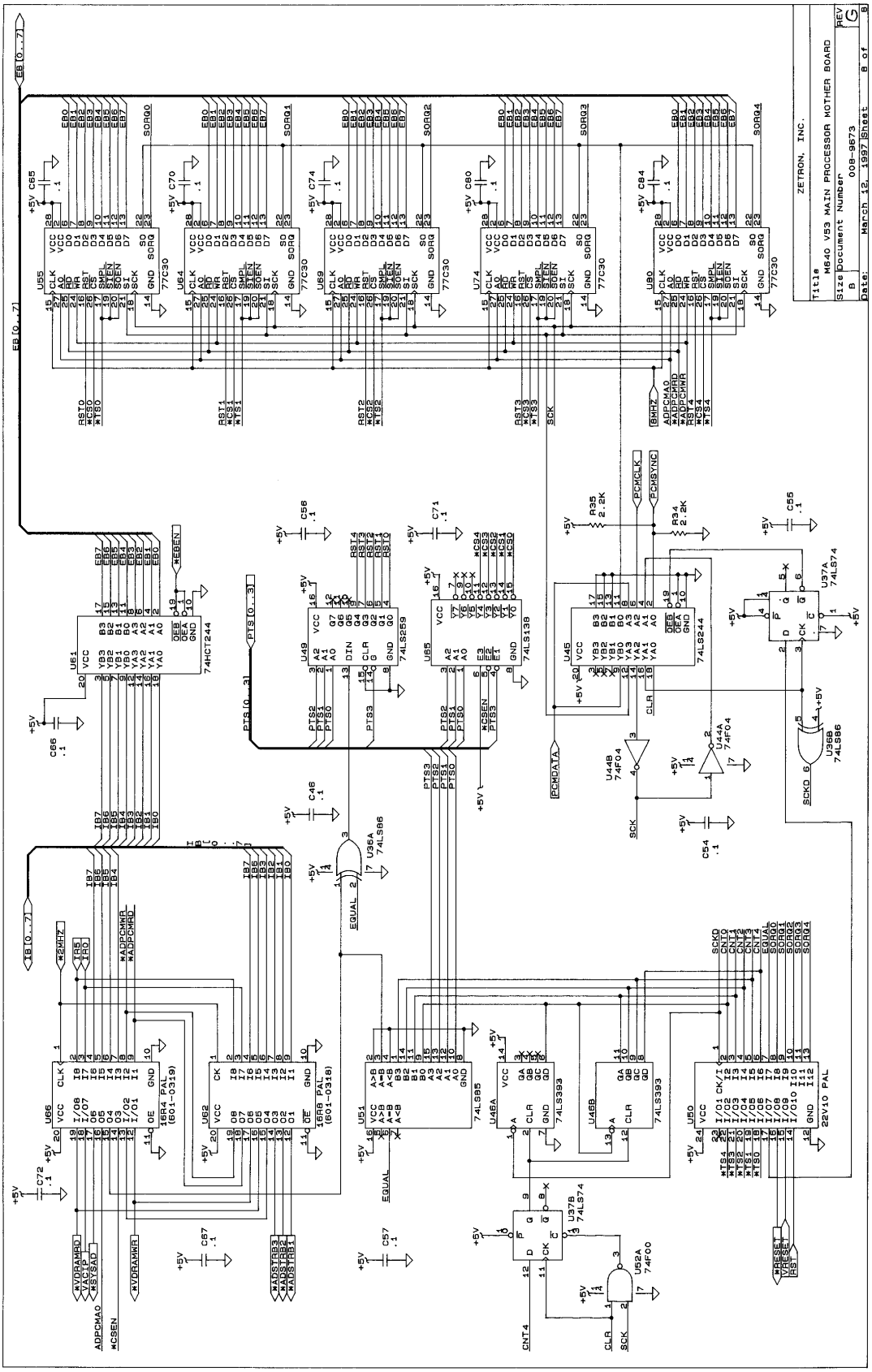
C69 .1
C64 .1
C68 .1
C73 .1
C80 .1
C58 .1
C76 .1
+5V


ZETRON, INC.
Title
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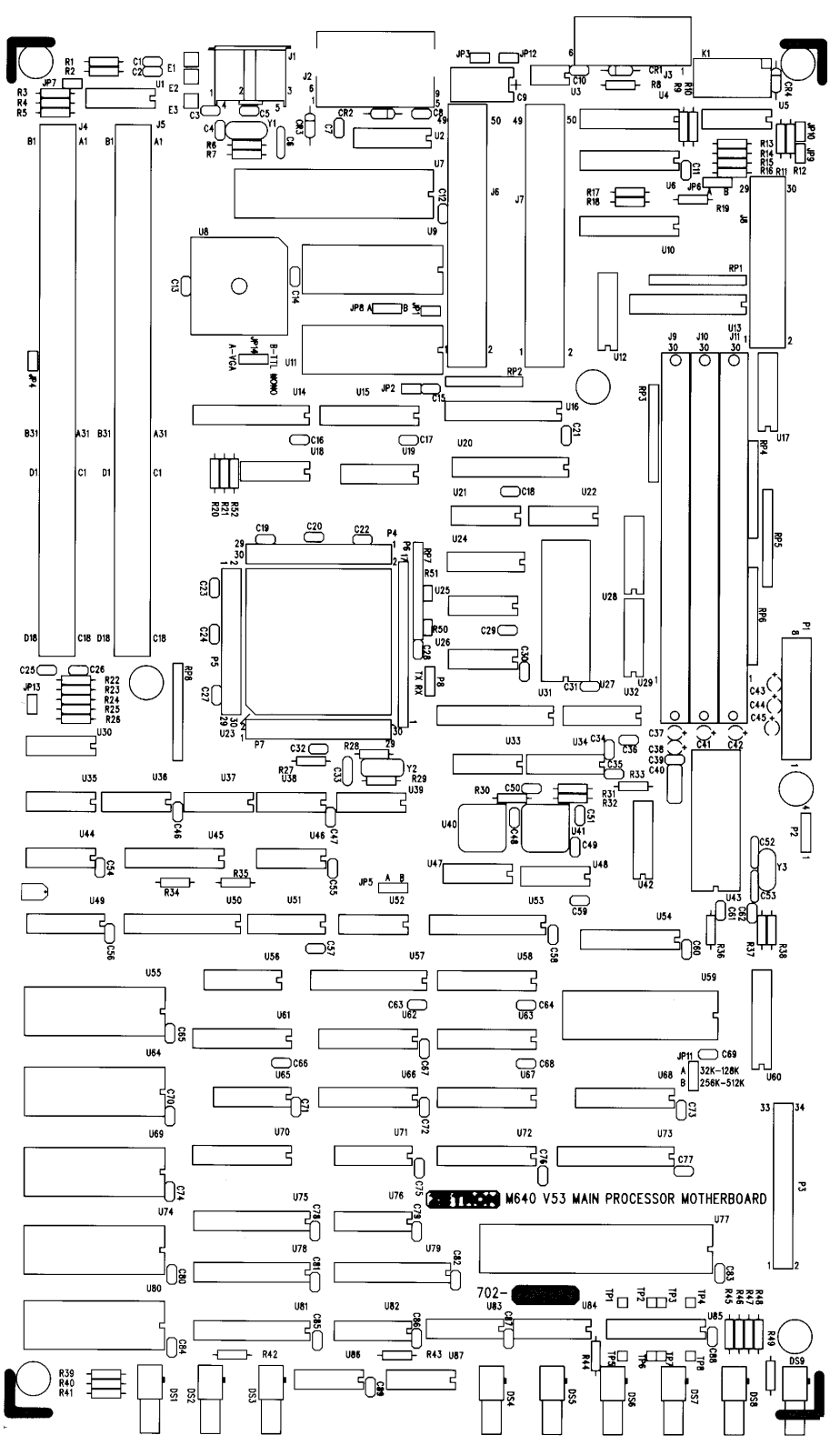
Silkscreen



PERIPHERAL BOARD (702-9360G.2)

Parts List

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

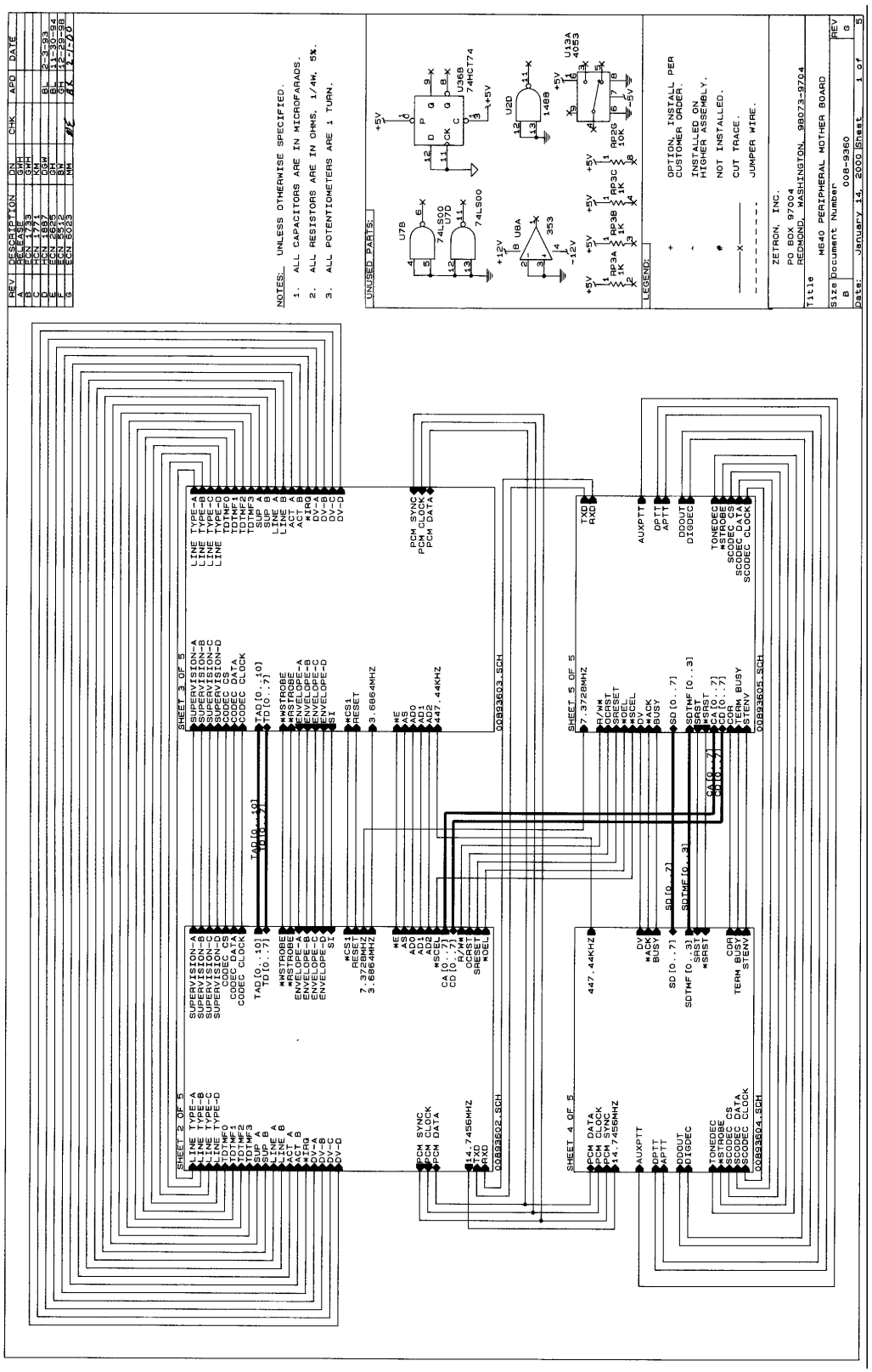
ZETRON MODEL 640 PERIPHERAL MOTHER BOARD PARTS LIST: 702-9360G.2

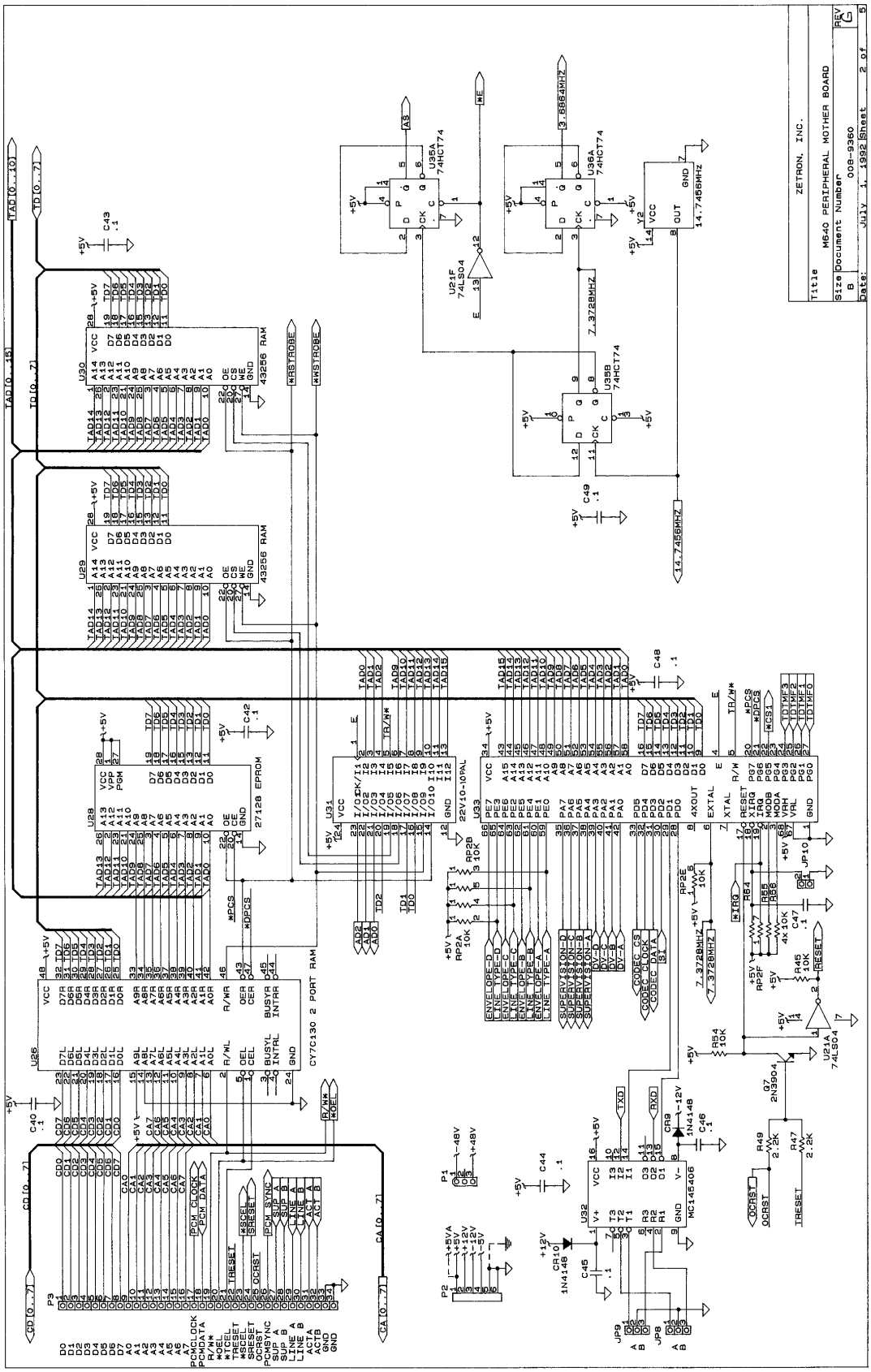
Item	Qty	Reference	Part No.	Description	Mfg.Part #
1	6	R4,R5,R6,R7,R19,R20	101-0047	RESISTOR,47 OHM,1/4W,5%,CARBON FILM	47
2	3	R63,R65,R68	101-0057	RESISTOR,220 OHM,1/4W,5%,CARBON FILM	220
3	2	R8,R11	101-0068	RESISTOR,620 OHM,1/4W,5%,CARBON FILM	620
4	9	R13,R34,R40,R59, R60,R61,R62,R66,R67	101-0073	RESISTOR,1.0K OHM,1/4W,5%,CARBON FILM	1.0K
5	5	R31,R47,R48,R49,R50	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
6	1	R69	101-0083	RESISTOR,2.7K OHM,1/4W,5%,CARBON FILM	2.7K
7	9	R10,R15,R22,R23, R24,R25,R26,R27,R35	101-0085	RESISTOR,3.3K OHM,1/4W,5%,CARBON FILM	3.3K
8	2	R70,R42	101-0089	RESISTOR,4.7K OHM,1/4W,5%,CARBON FILM	4.7K
9	17	R16,R17,R18,R30, R32,R43,R44,R45,R46, R52,R53,R54,R55,R56, R57,R64,R71	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
10	1	R33	101-0101	RESISTOR,15K OHM,1/4W,5%,CARBON FILM	15K
11	2	R39,R21	101-0103	RESISTOR,18K OHM,1/4W,5%,CARBON FILM	18K
12	4	R9,R14,R28,R41	101-0107	RESISTOR,27K OHM,1/4W,5%,CARBON FILM	27K
13	2	R12,R29	101-0113	RESISTOR,47K OHM,1/4W,5%,CARBON FILM	47K
14	2	R38,R37	101-0121	RESISTOR,100K OHM,1/4W,5%,CARBON FILM	100K
15	1	R51	101-0145	RESISTOR,1.0M OHM,1/4W,5%,CARBON FILM	1.0M
16	2	RV2,RV1	105-0001	VARISTOR,250VAC,70J	250VAC
17	2	R2,R3	108-1502	POT,5K OHM,10 TURN,R/A	5K 10T
18	1	R1	108-1503	POT,50K OHM,10 TURN,R/A	50K 10T
19	1	RP3	119-0004	R-NETWORK,1K OHM x 7,BUSSED,SIP-08	1K
20	3	RPX1,RPX2,RP2 **NOTE 4**	119-0008	R-NETWORK,10K OHM x 7,BUSSED,SIP-08	10K
21	1	RP1	119-0021	R-NETWORK,R/2R,100K/200K,SIP-10	100K/200K
22	6	C3,C4,C5,C6,C17,C18	150-0096	CAP,1000pF,1KV,10%,CERAMIC DISC,Y5P	.001 1KV
23	9	C11,C12,C14,C16, C20,C23,C60,C61,C62	151-0047	CAP,470pF,100V,10%,CERAMIC NPO	470pF
24	1	C63	151-0120	CAP,.01uF,50V,10%,CERAMIC X7R	.01
25	1	C22	151-0130	CAP,.047uF,50V,10%,CERAMIC X7R	.047
26	36	C7,C8,C9,C15,C21, C24,C25,C29,C30,C31, C32,C33,C34,C35,C36, C37,C38,C39,C40,C41, C42,C43,C44,C45,C46, C47,C48,C49,C50,C51, C52,C53,C56,C57,C58,C59	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1
27	4	C10,C26,C27,C54	151-0199	CAP,.47uF,50V,5%,POLYESTER	.47
28	3	C1,C2,C13	152-0085	CAP,.01uF,50V,5%,POLYESTER	.01
29	2	C19,C55	152-0092	CAP,.0022uF,50V,5%,POLYESTER	.0022 50V
30	1	C28	154-0025	CAP,1uF,35V,10%,TANTALUM	1 TANT
31	2	T2,T1	305-0600	XFMR,600:600 DRY TELCO,1500 VAC HIPOT	
32	9	DS1,DS2,DS3,DS4, DS5,DS6,DS7,DS8,DS9	311-0011	LED,RED,DIFFUSED,5mm CYLINDRICAL	
33	2	U23,U24	314-4377	FLIP-FLOP,D,LS,W/ENABLE,OCTAL,DIP-20	74LS377
34	1	U7	314-7400	NAND,LS,QUAD,DIP-14	74LS00
35	1	U21	314-7404	INVERTER,LS,HEX,DIP-14	74LS04
36	1	U1	315-7406	BUFFER,INVERTING,OC,HIGH-VOLT,HEX,DIP-14	7406 O/C
37	1	VR1	316-0005	REGULATOR,5V,LOW POWER,TO-92	78L05
38	4	U5,U6,U8,U14	316-0353	OP-AMP,BIFET,DUAL,DIP-8	353
39	1	U2	317-1488	DRIVER,RS-232,QUAD,DIP-14	1488
40	1	U32	317-5406	DRIVER,RS-232,+-12V POWER,DUAL,DIP-16	MC145406

41	2	U25,U26	321-0130	RAM,1K,DUAL PORT,120nS OR BETTER,DIP-48	1K RAM 120NS
42	1	U16	321-0202	DECODER,DTMF,DIP-18	75T202
43	1	U4 **NOTE 2**	321-0751	MICRO,CMOS,3.5 TO 12MHZ,0 TO 70C,DIP-24	ASIC 001
44	1	U12	321-3054	PCM,CODEC,u-LAW,SERIAL I/O,DUAL,5V,DIP-16	3054 CODEC
45	2	U15,U34	321-3155	PCM, TSAC,DIP-20	3155
46	1	U33	321-6813	UP-HC,NON-MUX W/CS,3MHZ,PLCC-68	68HC11F1
47	1	U20	321-6816	UP-HC MOS,PLCC-52	68HC11E0
48	4	U17,U18,U29,U30	321-8256	SRAM,32K x 8,100nS,50uA, 0 TO 70C	32K x 8 SRAM
49	1	U22 **NOTE 2**	322-2210	PAL,22V10,DIP-24	22V10 PAL
50	1	U31 **NOTE 2**	322-2211	PAL,22V10,10nS,DIP-24	22V10-10PAL
51	2	U19,U28 **NOTE 2**	322-7128	EPROM,CMOS,16K x 8,250nS,DIP-28	27128 EPROM
52	1	U13	323-4053	ANALOG SWITCH,TRIPLE SPDT,DIP-16	4053
53	1	U27	324-4154	DECODER,HC,1 OF 16,DIP-24	74HC154
54	1	U10	325-4174	FLIP-FLOP,D,HCT,W/COMMON CLK & RST	74HCT174
55	1	U9	325-4245	XCVR,HCT,3-STATE,NON-INVERTING,OCTAL	74HCT245
56	1	U11	325-4373	LATCH,HCT,OCTAL	74HCT373
57	1	U3	325-4374	FLIP-FLOP,D,HCT,REG 3-STATE	74HCT374
58	2	U36,U35	325-7474	FLIP-FLOP,D,HCT,W/SET & RST,DUAL,DIP-14	74HCT74
59	3	Q1,Q2,Q3	340-0014	XSTR,NPN,DARLINGTON,0.5A 30V,	MPSA14
60	4	Q4,Q5,Q6,Q7	340-3904	XSTR,NPN,40V/200MA,TO92	2N3904
61	10	CR1,CR2,CR3,CR4,CR5, CR6,CR7,CR8,CR9,CR10	342-3009	DIODE,SILICON,100V,250MW	1N4148
62	1	Y1 **NOTE 1**	376-0358	XTAL,3.579545MHZ,CL=18pF,HC-49	3.58MHZ
63	1	Y2 **NOTE 5**	376-1474	TCXO,14.7456MHZ,+-1PPM 0-50C,+-1PPM/YR	14.7456MHZ
64	3	K1,K2,K3	380-0030	RELAY,DPDT,12 V COIL,MINI-DIP	
65	1	P1	401-0029	CONN,POWER,3 PIN	
66	2	J4,J5	401-0062	CONN,CARD EDGE,2 x 31	
67	1	J1	401-0206	CONN,RJ21,50 PIN,MALE	
68	2	J3,J2	401-0843	2 X 15 EDGE CONNECTOR	
69	1	P2	401-6006	6-POS MALE	
70	2	TP1,TP2	403-0001	01 OF 401-0052	
71	2	JP7,JP10	403-0002	02 OF 401-0052	
72	8	JP1,JP2,JP3,JP4, JP5,JP6,JP8,JP9	403-0003	03 OF 401-0052	
73	1	P4	403-0006	06 OF 401-0052	
74	1	P3	404-1217	34 OF 401-1364 [17 x 2]	
75	1	XJ1 **NOTE 3**	210-0001	440 KEP NUT PLATED	
76	1	XJ1 **NOTE 3**	220-0103	440x1/2 PAN PHILLIPS	
77	6	XJP1,XJP2,XJP5 (POS A) XJP3,XJP4,XJP6 (POS B)	402-3040	MINI JUMPER	
78	1	XU2	407-0014	SKT, 14 PIN DIP	
79	1	XU32	407-0016	SKT, 16 PIN DIP	
80	3	XU4,22,31	407-0023	SKT, 24 PIN SKINNY DIP	
81	2	XU19,28	407-0028	SKT, 28 PIN DIP	
82	1	XU20	407-0052	SKT, 52 PIN QUAD	
83	1	XU33	407-0068	SKT, 68 PIN QUAD	
84	1	PCB	410-9360D	M640 PERIPHERAL MOTHER BOARD	
85	9	XDS1-DS9	417-0010	LED MNT RA	
86	1	XU28 **NOTE 2**	601-0325	V2A5 640 TRUNK SOFTWARE	
87	1	XU31 **NOTE 2**	601-0326	V1.00 640 TRUNK DECODE	
88	1	XU19 **NOTE 2**	601-0327	V1.01 640 STATION SOFTWARE	
89	1	XU22 **NOTE 2**	601-0328	V1.00 640 STATION DECODE	
90	1	XU4 **NOTE 2**	601-0361	V1.00 640 TRANSMITTER TONE ASIC SOFTWARE	

NOTES: (Notes are for production use only.)

Schematic




ZETRON, INC.
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M640 PERIPHERAL MOTHER BOARD
Size B
Document Number 008-9360
REV G
Date: July 1, 1992 Sheet 2 of 5
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TD[0..7]
CD[0..7]
CA[0..7]
43256 RAM
27128 EPROM
CY7C130 2 PORT RAM
22V10-10PAL
MC145406
74HCT174
74LS04
2N3904
1N4148
14.7456MHZ
7.3728MHZ
3.6864MHZ
*RSTROBE
*WSTROBE
*PCS
*DPCS
R/*W
*OE
*E
TRESET
*SCELT
*SCELR
OCRST
PCMSYNC
SUP A
SUP B
LINE A
LINE B
ACT A
ACT B
PCM CLOCK
PCMDATA
GND
+5V
+12V
-12V
-5V
-48V
+48V
TXD
RXD
*IRQ
*DCS1
*CS1
DTMF3
DTMF2
DTMF1
DTMF0
CODEC CS
CODEC CLOCK
CODEC DATA
ENVELOPE-D
LINE TYPE-D
ENVELOPE-C
LINE TYPE-C
ENVELOPE-B
LINE TYPE-B
ENVELOPE-A
LINE TYPE-A
SUPERVISION-D
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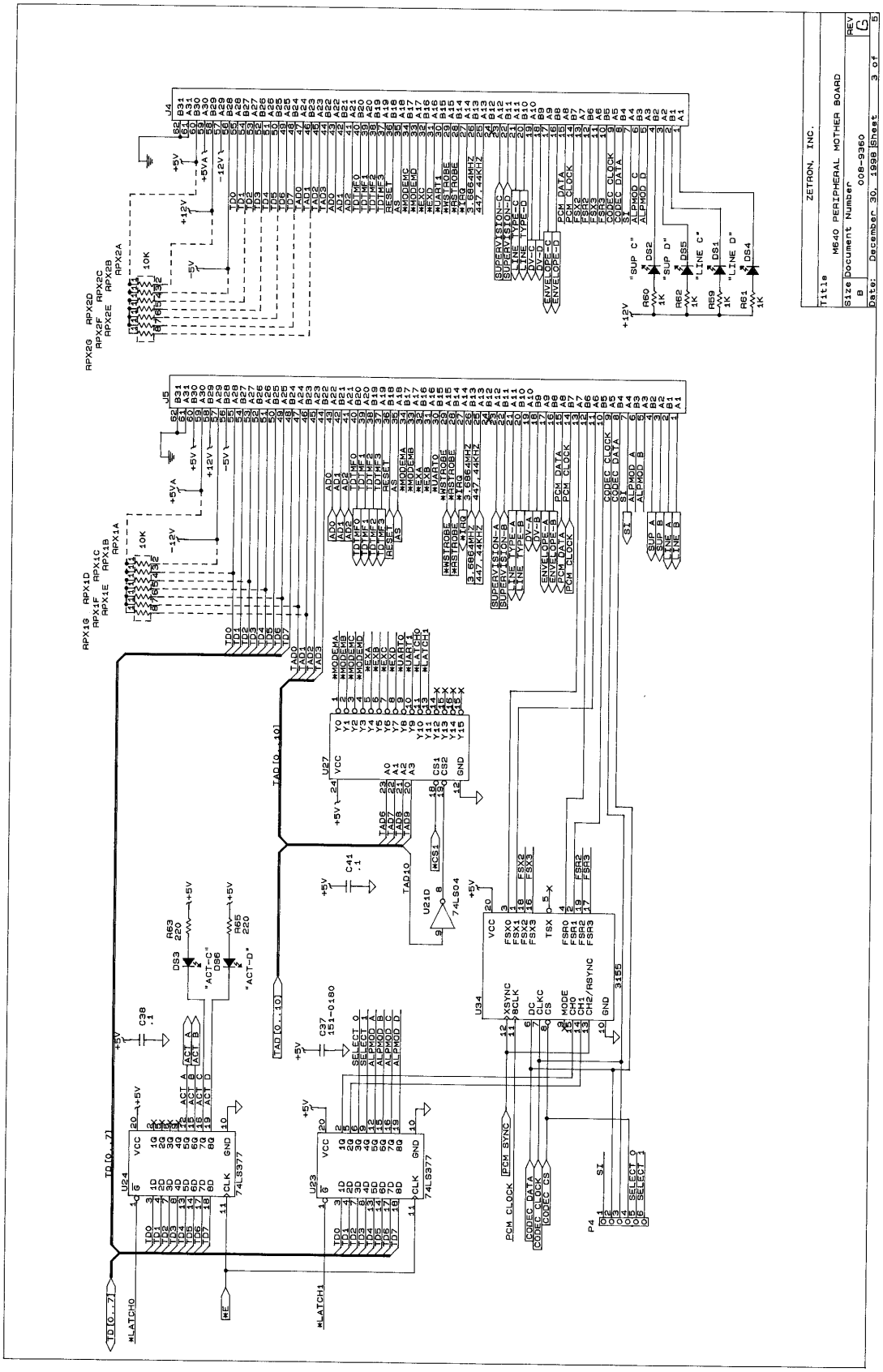
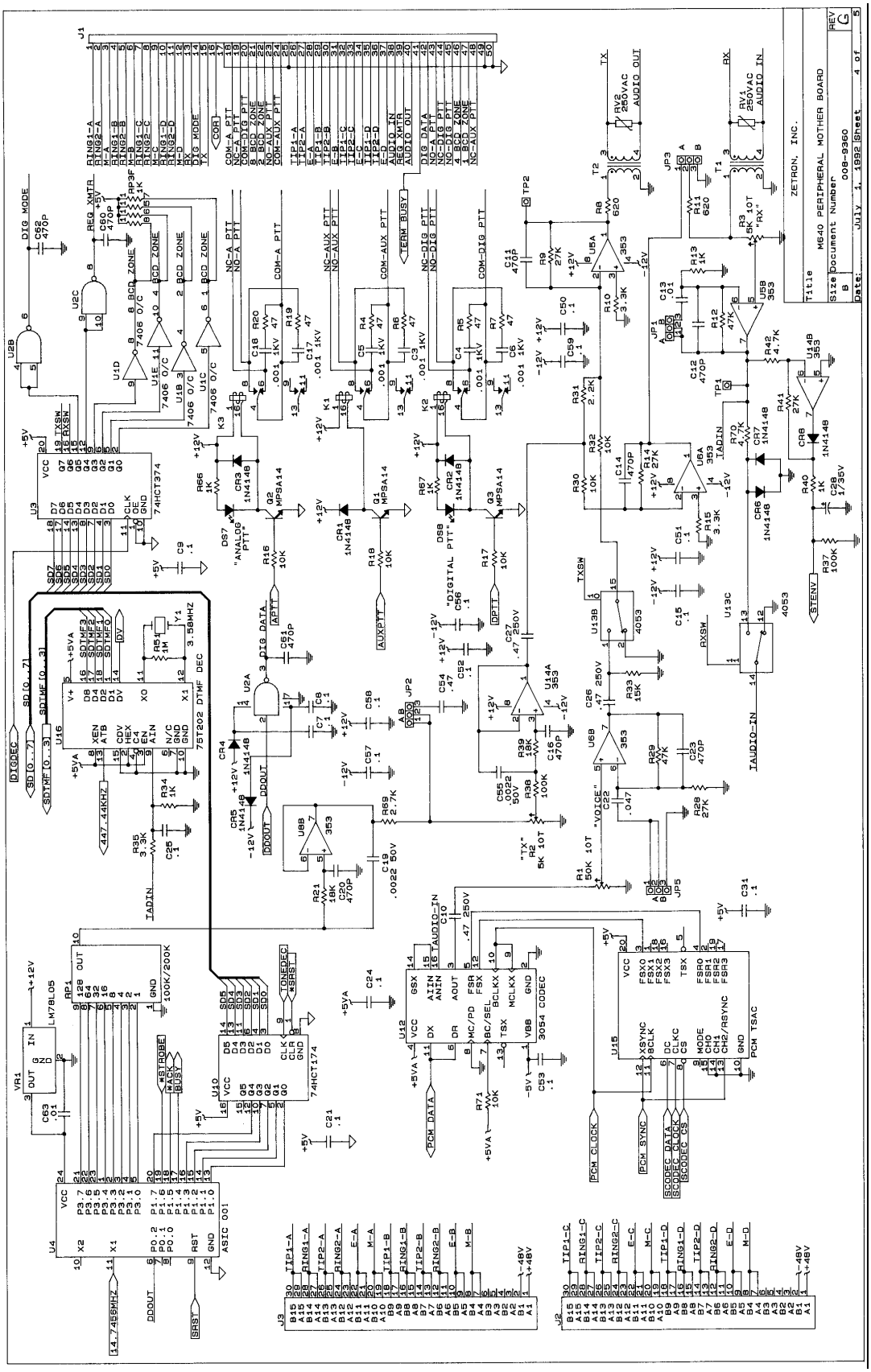
DV-D
DV-C
DV-B
DV-A
RESET
OCRST
IRESET


ZETRON, INC.
M640 PERIPHERAL MOTHER BOARD
Size B
Document Number 008-9360
REV C
Date: December 30, 1998 Sheet 3 of 5
Title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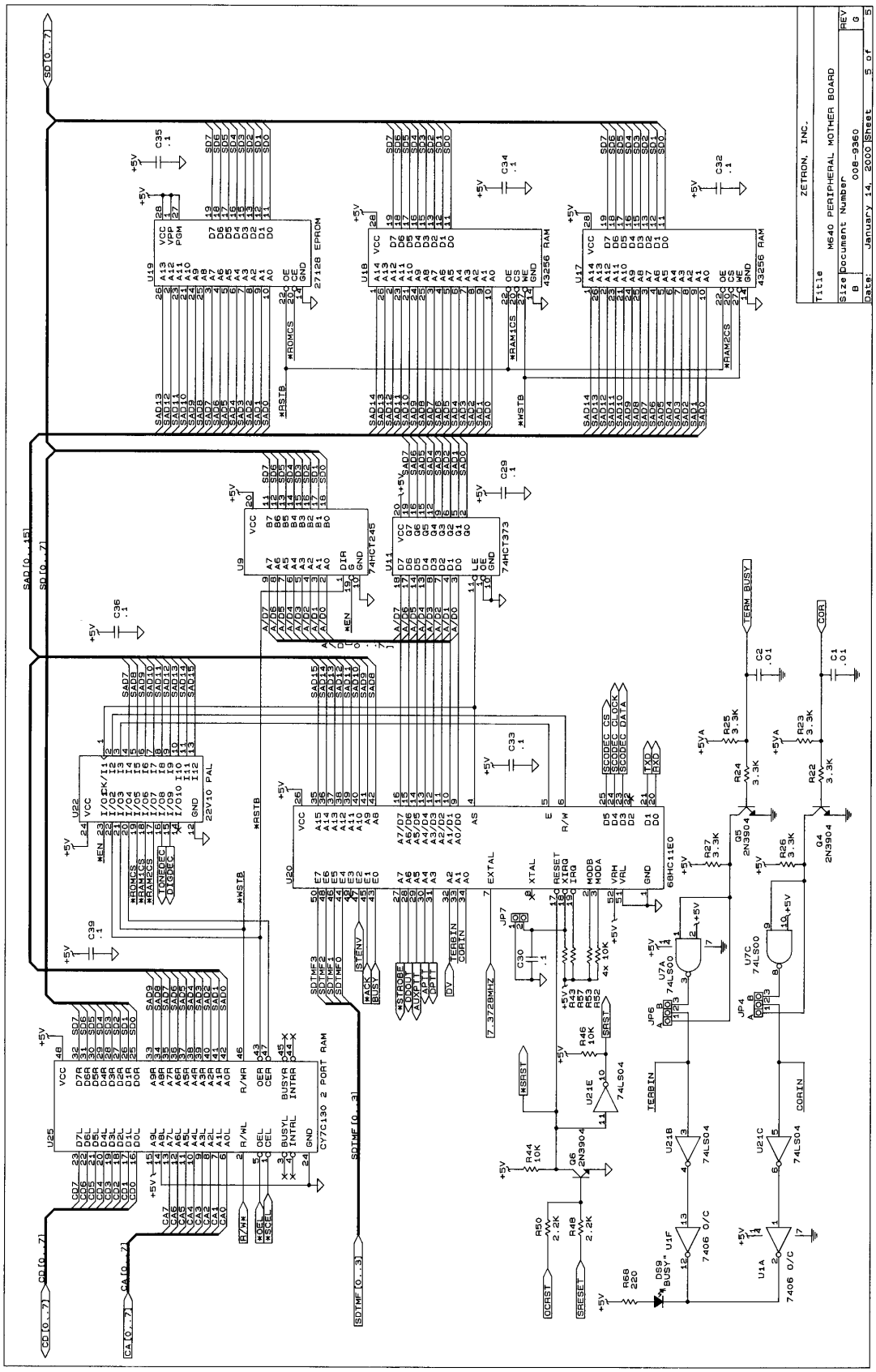
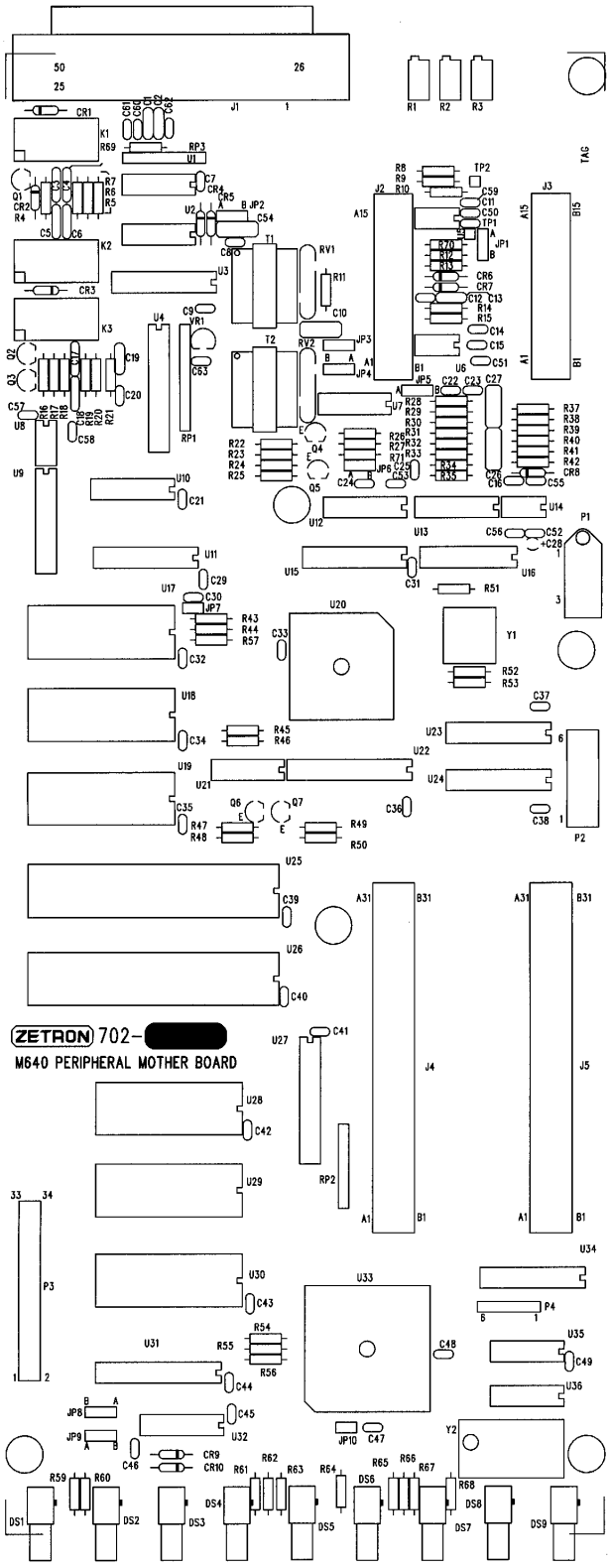
Title M640 PERIPHERAL MOTHER BOARD
Size B Document Number 008-9360 REV G
Date: July 1, 1992 Sheet 4 of 5


ZETRON, INC.
Title
M640 PERIPHERAL MOTHER BOARD
Size B
Document Number 008-9360
REV G
Date: January 14, 2000 Sheet 5 of 5
SD[0..7]
SAD[0..15]
CD[0..7]
CA[0..7]
U19 27128 EPROM
U18 43256 RAM
U17 43256 RAM
U9 74HCT245
U11 74HCT373
U22 22V10 PAL
U20 68HC11E0
U25 CY7C130 2 PORT RAM
U7A 74LS00
U7C 74LS00
U21E 74LS04
U21B 74LS04
U21C 74LS04
U1F 7406 O/C
U1A 7406 O/C
Q5 2N3904
Q4 2N3904
Q6 2N3904
JP7
JP6
JP4
7.3728MHZ
TERM BUSY
CDR
CORIN
CORST
SRESET
TERBIN
*ROMCS
*RAMCS
*RAM1CS
*RAM2CS
*RSTB
*WSTB
*EN
R/W
SDIMF[0..3]
SCODEC CS
SCODEC CLOCK
SCODEC DATA
TXD
RXD

Silkscreen



DUAL TRUNK (702-9361D)

Parts List

LEGEND:
+ = OPTION, INSTALL PER CUSTOMER ORDER
# = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY
= = SUBSTITUTE PART

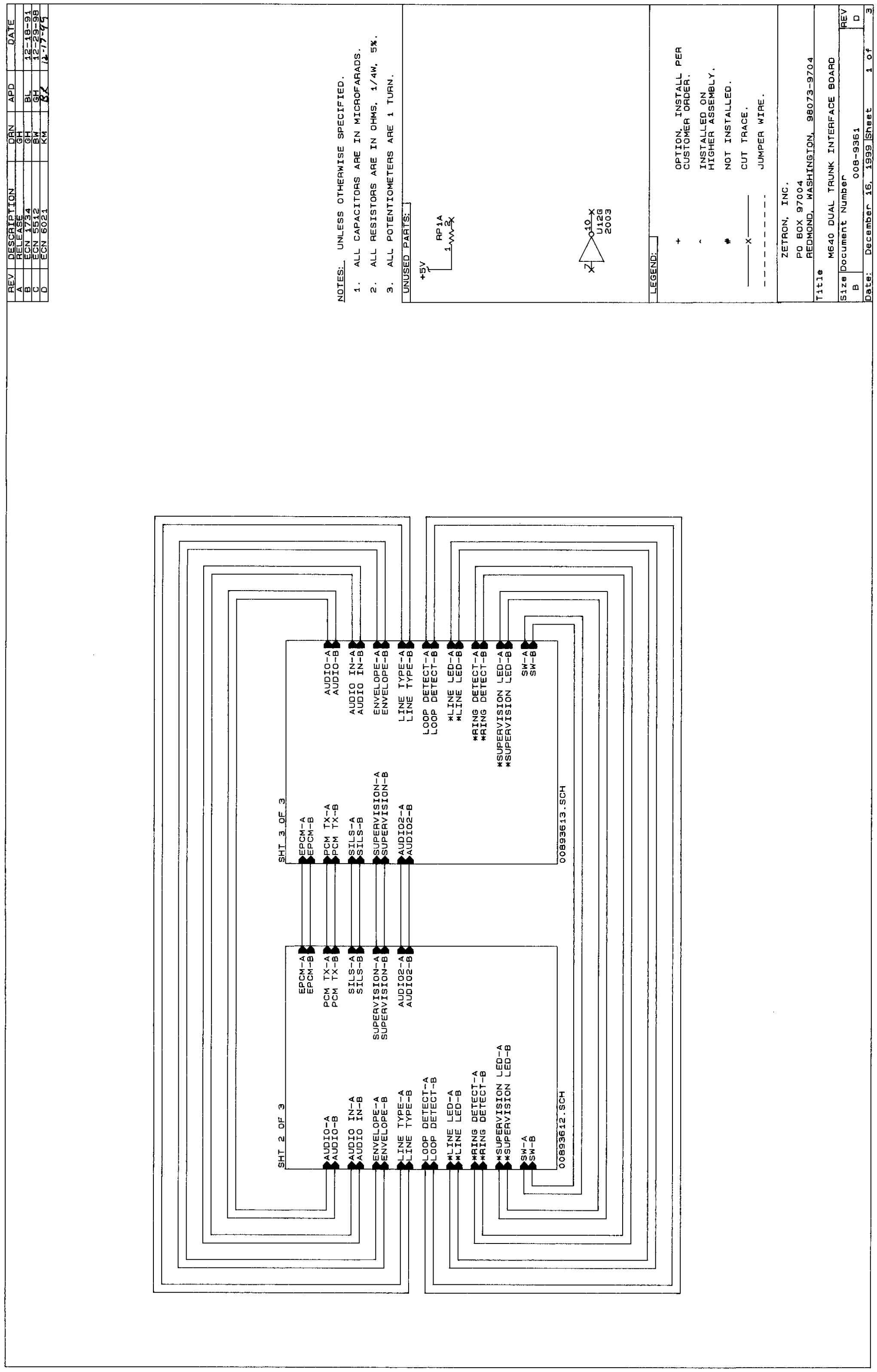
ZETRON MODEL 640 DUAL TRUNK INTERFACE BOARD PARTS LIST: 702-9361D

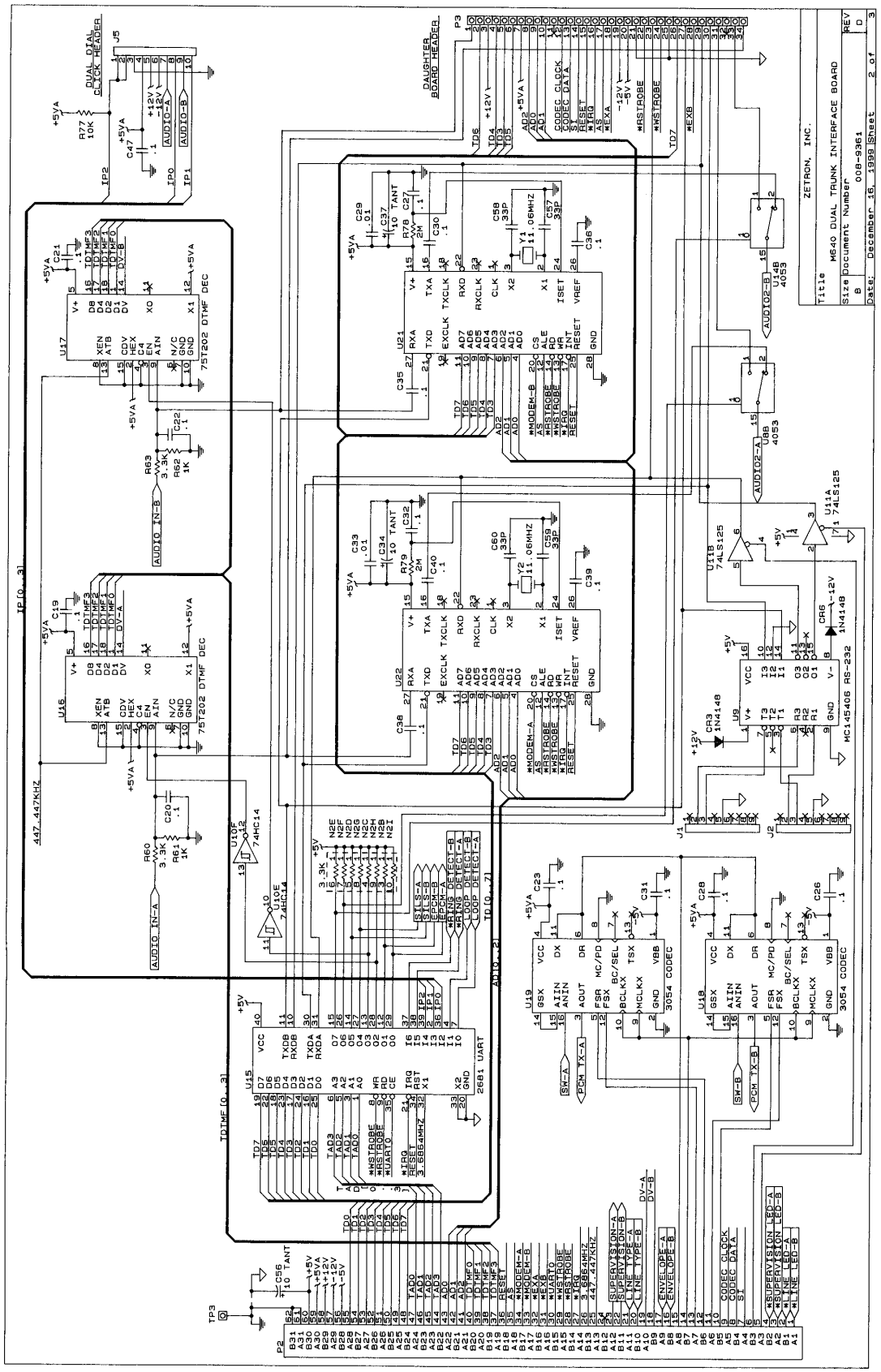
Item	Qty	Reference	Part No.	Description	Mfc. Part #
1	2	R34,R71	101-0049	RESISTOR,100 OHM,1/4W,5%,CARBON FILM	100
2	2	R6,R9	101-0057	RESISTOR,220 OHM,1/4W,5%,CARBON FILM	220
3	4	R37,R72,R94,R95	101-0063	RESISTOR,430 OHM,1/4W,5%,CARBON FILM	430
4	8	R33,R36,R45,R46,R47, R67,R69,R83	101-0065	RESISTOR,470 OHM,1/4W,5%,CARBON FILM	470
5	6	R54,R57,R61,R62,R89, R92	101-0073	RESISTOR,1.0K OHM,1/4W,5%,CARBON FILM	1.0K
6	4	R11,R13,R15,R17	101-0075	RESISTOR,1.5K OHM,1/4W,5%,CARBON FILM	1.5K
7	8	R5,R7,R48,R49,R50, R84,R85,R86	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
8	2	R63,R60	101-0085	RESISTOR,3.3K OHM,1/4W,5%,CARBON FILM	3.3K
9	4	R41,R55,R76,R90	101-0089	RESISTOR,4.7K OHM,1/4W,5%,CARBON FILM	4.7K
10	7	R8,R10,R42,R43,R44, R59,R77	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
11	2	R87,R52	101-0101	RESISTOR,15K OHM,1/4W,5%,CARBON FILM	15K
12	2	R56,R91	101-0104	RESISTOR,20K OHM,1/4W,5%,CARBON FILM	20K
13	2	R22,R21	101-0105	RESISTOR,22K OHM,1/4W,5%,CARBON FILM	22K
14	2	R75,R40	101-0107	RESISTOR,27K OHM,1/4W,5%,CARBON FILM	27K
15	2	R35,R68	101-0118	RESISTOR,75K OHM,1/4W,5%,CARBON FILM	75K
16	6	R1,R3,R53,R58,R88, R93	101-0121	RESISTOR,100K OHM,1/4W,5%,CARBON FILM	100K
17	6	R2,R4,R38,R39,R73, R74	101-0129	RESISTOR,220K OHM,1/4W,5%,CARBON FILM	220K
18	2	R16,R12	101-0145	RESISTOR,1.0M OHM,1/4W,5%,CARBON FILM	1.0M
19	2	R79,R78	101-0148	RESISTOR,2.0M OHM,1/4W,5%,CARBON FILM	2.0M
20	2	R51,R70	101-0150	RESISTOR,2.7M OHM,1/4W,5%,CARBON FILM	2.7M
21	2	R14,R18	103-3300	RESISTOR,3.3K OHM,1W,5%,CARBON FILM	3.3K 1W
22	4	R26,R27,R30,R31	104-0048	RESISTOR,75.00 OHM,1/2W,0.1%,50PPM/C	75 1/2W .1%
23	8	R19,R20,R23,R24,R25, R28,R29,R32	104-0114	RESISTOR,49.9K OHM,1/8W,0.1%,25PPM/C	49.9K .1%
24	4	RV1,RV2,RV3,RV4	105-0001	VARISTOR,250VAC,70J	250VAC
25	4	R64,R65,R80,R81	108-1502	POT,5K OHM,10 TURN,R/A	5K 10T
26	2	R82,R66	108-1503	POT,50K OHM,10 TURN,R/A	50K 10T
27	1	RP1	119-0005	R-NETWORK,3.3K OHM x 9,BUSSED,SIP-10	3.3K □
	4	C57,C58,C59,C60	150-0033	CAP,33pF,1KV,10%,CERAMIC DISC,750 PPM/C	33pF
28	2	C45,C10	151-0010	CAP,100pF,100V,10%,CERAMIC NPO	100pF
29	2	C12,C46	151-0130	CAP,.047uF,50V,10%,CERAMIC X7R	.047
30	29	C9,C11,C14,C15,C17, C19,C20,C21,C22,C23, C26,C27,C28,C30,C31, C32,C35,C36,C38,C39, C40,C42,C47,C48,C50, C51,C54,C61,C62	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1
31	2	C8,C43	152-0012	CAP,.1uF,50V,5%,POLYESTER	.1
32	2	C6,C5	152-0021	CAP,.47uF,250V,10%,POLYESTER	.47 250V
33	4	C24,C25,C29,C33	152-0085	CAP,.01uF,50V,5%,POLYESTER	.01
34	4	C7,C41,C44,C52	152-0090	CAP,.001uF,50V,2%,POLYPROPYLENE	.001 2%
35	4	C16,C18,C53,C55	154-0025	CAP,1uF,35V,10%,TANTALUM	1 TANT
36	3	C34,C37,C56	154-0100	CAP,10uF,16V,10%,TANTALUM	10 TANT
37	2	C1,C2	155-0012	CAP,2.2uF,100V,-20%,RADIAL, Al-E	2.2 100V
38	2	C13,C49	155-0052	CAP,10uF,35V,20%,RADIAL,Al-E	10
39	2	C4,C3	155-0079	CAP,100uF,100V,20%,RADIAL,Al-E	100 100V
40	0	T2#,T3#,T5#,T6#	305-0600	XFMR,600:600 DRY TELCO,1500 VAC HIPOT	

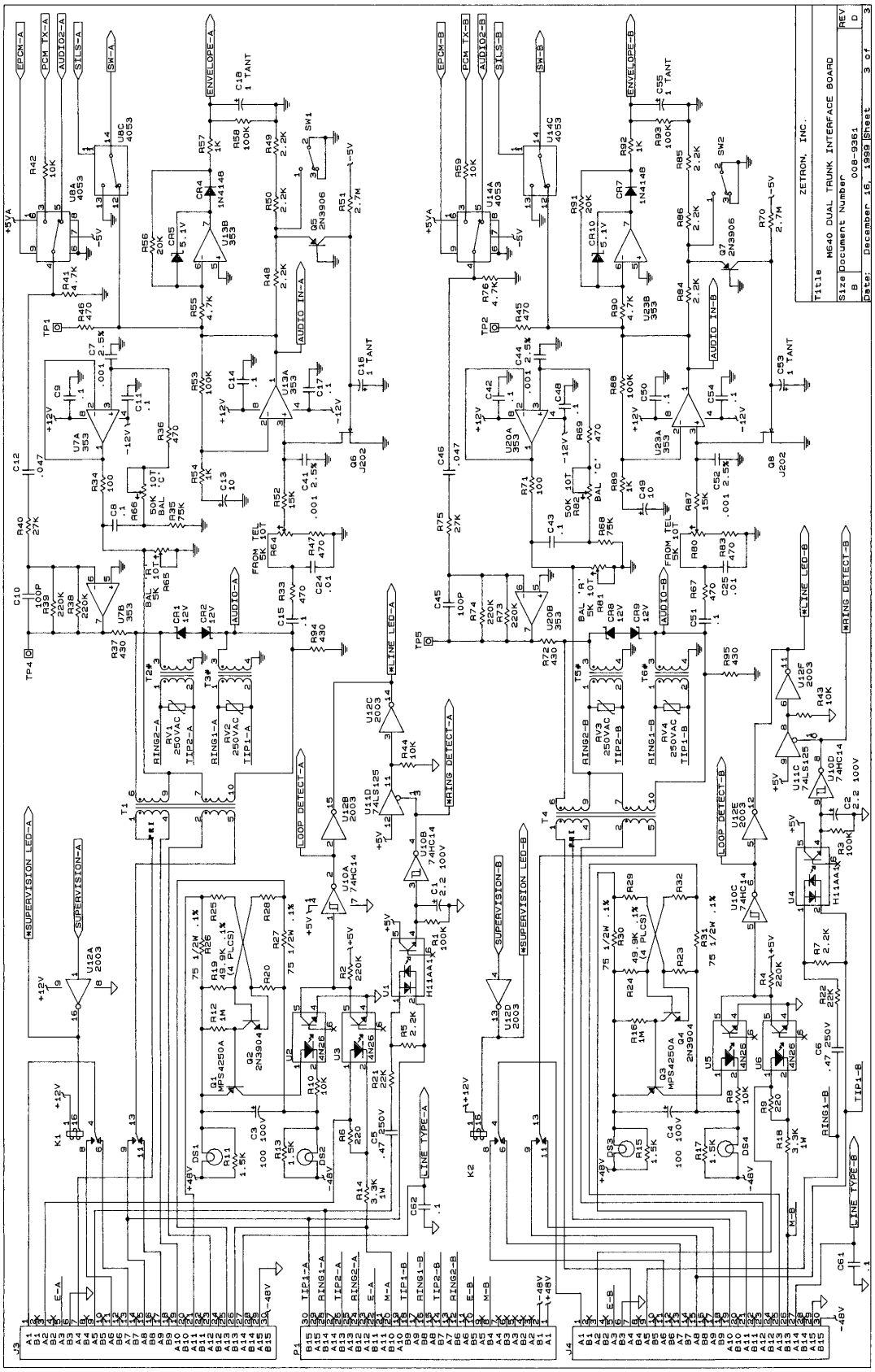
41	2	T1,T4	305-1540	XFMR,TELCO HYBRID,SMALL SIZE	
42	4	U2,U3,U5,U6	311-0008	OPTO ISOLATOR,CTR>20%,2500 VRMS	4N26
43	4	DS1,DS2,DS3,DS4 **NOTE 4**	311-0028	LAMP,INCANDESCENT,28V,T1-3/4,WIRE TERMINAL	2187
44	2	U4,U1	311-1001	OPTO ISOLATOR,BI-POLAR	H11AA1
45	1	U11	314-4125	BUFFER,LS,3-STATE,QUAD,DIP-14	74LS125
46	4	U7,U13,U20,U23	316-0353	OP-AMP,BIFET,DUAL,DIP-8	353
47	1	U9	317-5406	DRIVER,RS-232,+-12V POWER,DUAL,DIP-16	MC145406
48	2	U17,U16	321-0202	DECODER,DTMF,DIP-18	75T202
49	2	U22,U21	321-0222	MODEM,1200 BAUD,5V,SINGLE CHIP,DIP-28	73K212
50	1	U15	321-2181	UART,2681,DUAL,DIP-40	2681
51	2	U18,U19	321-3054	PCM,CODEC,u-LAW,SERIAL I/O,DUAL,5V	3054 CODEC
52	2	U8,U14	323-4053	ANALOG SWITCH,TRIPLE SPDT,DIP-16	4053
53	1	U10	324-7414	INVERTER,SCHMITT,MOTOROLA THRESHOLDS,	74HC14
54	2	Q6,Q8	340-0202	XSTR,JFET,N-CHANNEL,VGS >-4.0,TO-92	J202
55	1	U12	340-2003	RELAY DRIVER 50V/.5A,-20 to +85C,DIP-16	2003
56	2	Q4,Q2	340-3904	XSTR,NPN,40V/200MA,TO92	2N3904
57	2	Q7,Q5	340-3906	XSTR,PNP,40V/200MA,TO92	2N3906
58	2	Q3,Q1	340-4250	XSTR,PNP,60V BETA >250 (USE 340-0250)	MPS4250A
59	4	CR3,CR4,CR6,CR7	342-3009	DIODE,SILICON,100V,250MW	1N4148
60	2	CR5,CR10	343-3029	DIODE,1W 5.1V +-5% MOTOROLA ONLY	5.1V
61	4	CR1,CR2,CR8,CR9	343-3035	DIODE,ZENER,12V,1W,5%	12V
62	2	SW2,SW1	371-0012	SWITCH,SLIDE,SPDT,TOP ACTUATED,.100CTR,PCB MNT	
63	2	Y1,Y2 **NOTE 1**	376-1106	XTAL,11.0592MHZ,CL=18pF,HC-49	11.0592MHZ
64	2	K2,K1	380-0030	RELAY,DPDT,12 V COIL,MINI-DIP	
65	2	J2,J1	401-0021	CONN,D-SUB,9,FEMALE,PCB-RA,PLASTIC	
66	2	J3,J4	401-0102	CONN,CARD EDGE,30 PIN	
67	1	J5	401-6001	10-POS FEMALE	
68	2	TP4,TP5	403-0001	01 OF 401-0052	
69	1	P3	404-1217	34 OF 401-1364 [17 x 2]	
70	3	TP1,TP2,TP3	406-0001	01 OF 401-0108	
71	4	XJ1,2 **(2 EA)**	210-0001	440 KEP NUT PLATED	
72	4	XJ1,2 **(2 EA)**	220-0102	440X3/8 PAN PHILLIPS	
73	2	XJ1,2 **NOTE 2**	401-0042	DB LOCK SCREWS	
74	2	XU1,4	407-0006	SKT, 06 PIN DIP	
75	4	XU7,13,20,23	407-0008	SKT, 08 PIN DIP	
76	2	XU10,11	407-0014	SKT, 14 PIN DIP	
77	6	XU8,9,12,14,18,19	407-0016	SKT, 16 PIN DIP	
78	2	XU16,17	407-0018	SKT, 18 PIN DIP	
79	2	XU21,22	407-0028	SKT, 28 PIN DIP	
80	1	XU15	407-0040	SKT, 40 PIN DIP	
81	1	PCB	410-9361B	M640 DUAL TRUNK INTERFACE BOARD	
82	1	**NOTE 2**	415-9573A	DUAL DB9 PLATE	
83	2	XJ3,4 **NOTE 3**	702-9122C	MATRIX PLUG	

NOTES: (Notes are for production use only.)

Schematic


REV DESCRIPTION DRN APD DATE
A RELEASE GH BL 12-18-91
B ECN 1734 GH GH 12-29-98
C ECN 5512 BW GH
D ECN 6021 KM
NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.
UNUSED PARTS:
+5V
RP1A
U12G
2003
LEGEND:
OPTION, INSTALL PER CUSTOMER ORDER.
INSTALLED ON HIGHER ASSEMBLY.
NOT INSTALLED.
CUT TRACE.
JUMPER WIRE.
ZETRON, INC.
PO BOX 97004
REDMOND, WASHINGTON, 98073-9704
Title M640 DUAL TRUNK INTERFACE BOARD
Size B
Document Number 008-9361
REV D
Date: December 16, 1999 Sheet 1 of 3
SHT 2 OF 3
00893612.SCH
SHT 3 OF 3
00893613.SCH
AUDIO-A
AUDIO-B
AUDIO IN-A
AUDIO IN-B
ENVELOPE-A
ENVELOPE-B
LINE TYPE-A
LINE TYPE-B
LOOP DETECT-A
LOOP DETECT-B
*LINE LED-A
*LINE LED-B
*RING DETECT-A
*RING DETECT-B
*SUPERVISION LED-A
*SUPERVISION LED-B
SW-A
SW-B
EPCM-A
EPCM-B
PCM TX-A
PCM TX-B
SILS-A
SILS-B
SUPERVISION-A
SUPERVISION-B
AUDIO2-A
AUDIO2-B


ZETRON, INC.
Title M640 DUAL TRUNK INTERFACE BOARD
Size B Document Number 008-9361 REV D
Date: December 16, 1999 Sheet 2 of 3
DUAL DTMF CLOCK HEADER
DAUGHTER BOARD HEADER
757202 DTMF DEC
2681 UART
3054 CODEC
MC145406 RS-232
74LS125
74HC14
4053
1N4148
TDTMF[0..3]
TD[0..7]
AUDIO_21
447.447KHZ
AUDIO IN-A
AUDIO IN-B
AUDIO-A
AUDIO-B
PCM TX-A
PCM TX-B
SW-A
SW-B
CODEC CLOCK
CODEC DATA
SUPERVISION-A
SUPERVISION-B
LINE TYPE-A
LINE TYPE-B
ENVELOPE-A
ENVELOPE-B
LOOP DETECT-A
LOOP DETECT-B
RING DETECT-A
RING DETECT-B
LINE LED-A
LINE LED-B


EPCM-A
PCM TX-A
AUDIO2-A
SIGS-A
SW-A
ENVELOPE-A
AUDIO IN-A
AUDIO-A
*SUPERVISION LED-A
SUPERVISION-A
LOOP DETECT-A
*LINE LED-A
*RING DETECT-A
LINE TYPE-A
EPCM-B
PCM TX-B
AUDIO2-B
SIGS-B
SW-B
ENVELOPE-B
AUDIO IN-B
AUDIO-B
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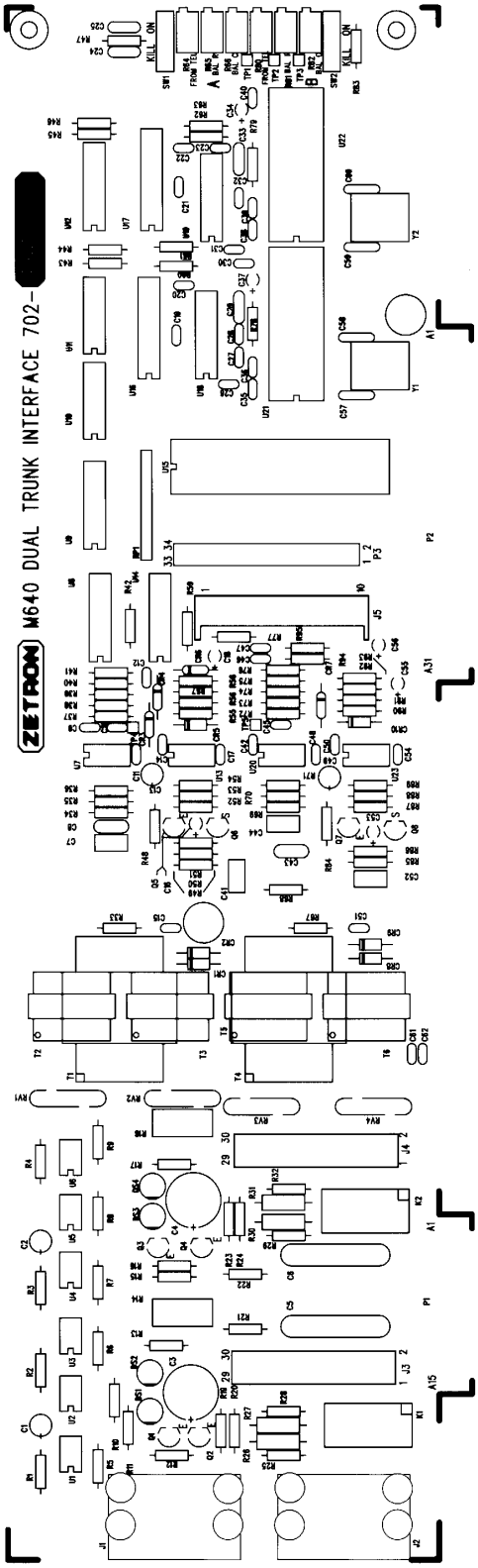
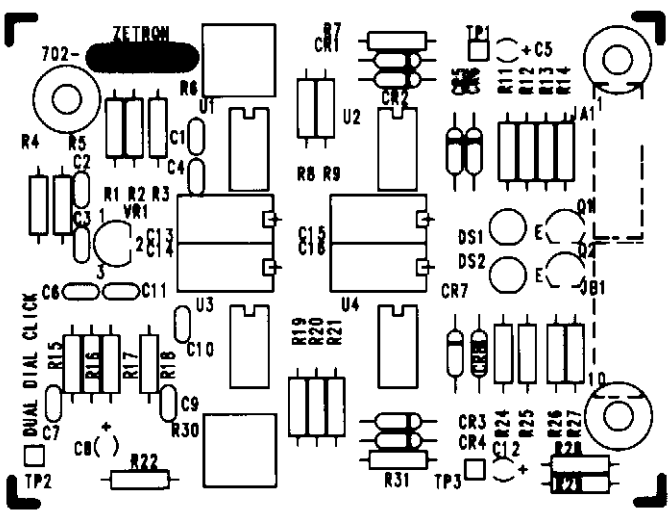
SUPERVISION-B
LOOP DETECT-B
*LINE LED-B
*RING DETECT-B
LINE TYPE-B
ZETRON, INC.
Title
M640 DUAL TRUNK INTERFACE BOARD
Size
B
Document Number
008-9361
REV
D
Date: December 15, 1999
Sheet
3 of
3

Silkscreen

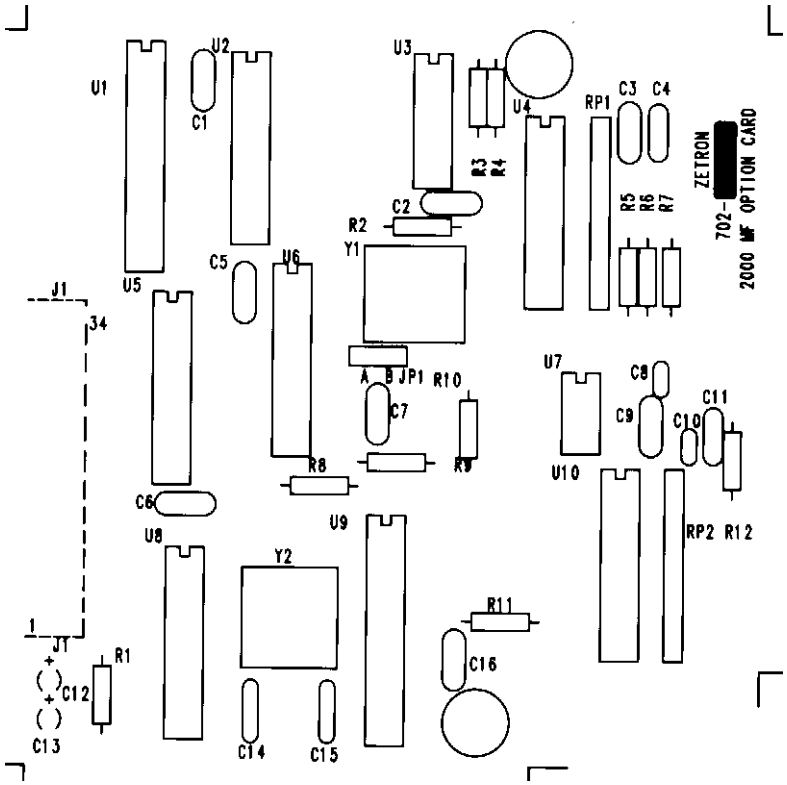


COMPONENT LOCATIONS

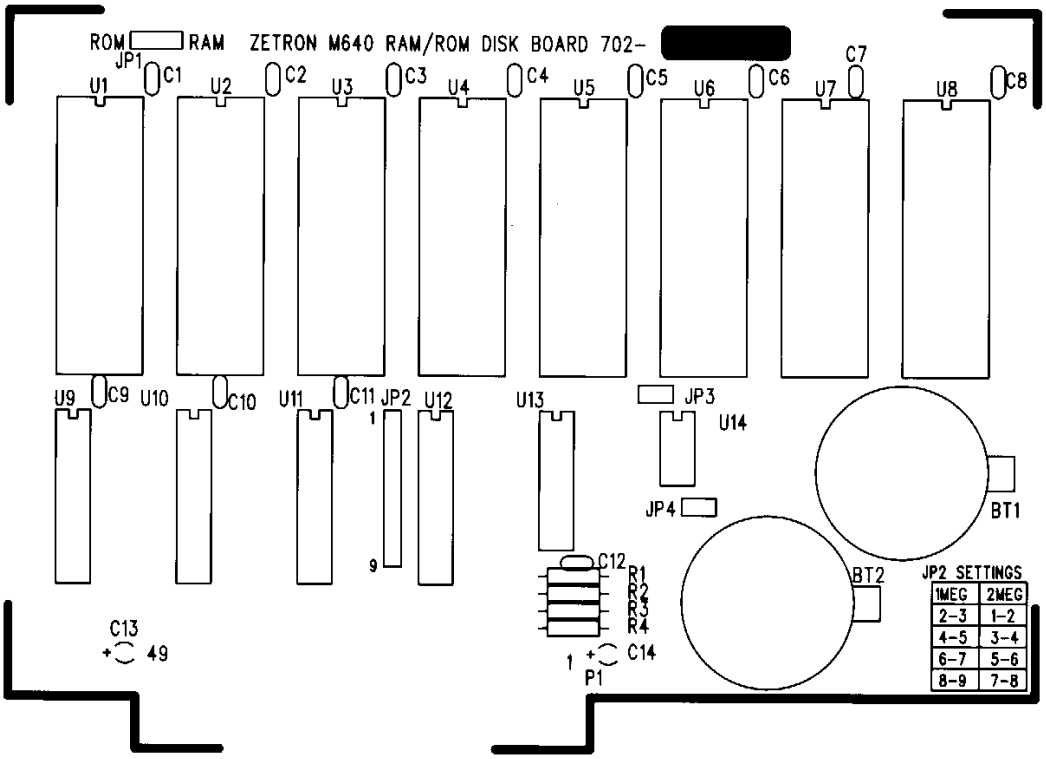
Dual Dial Click (702-9119C)



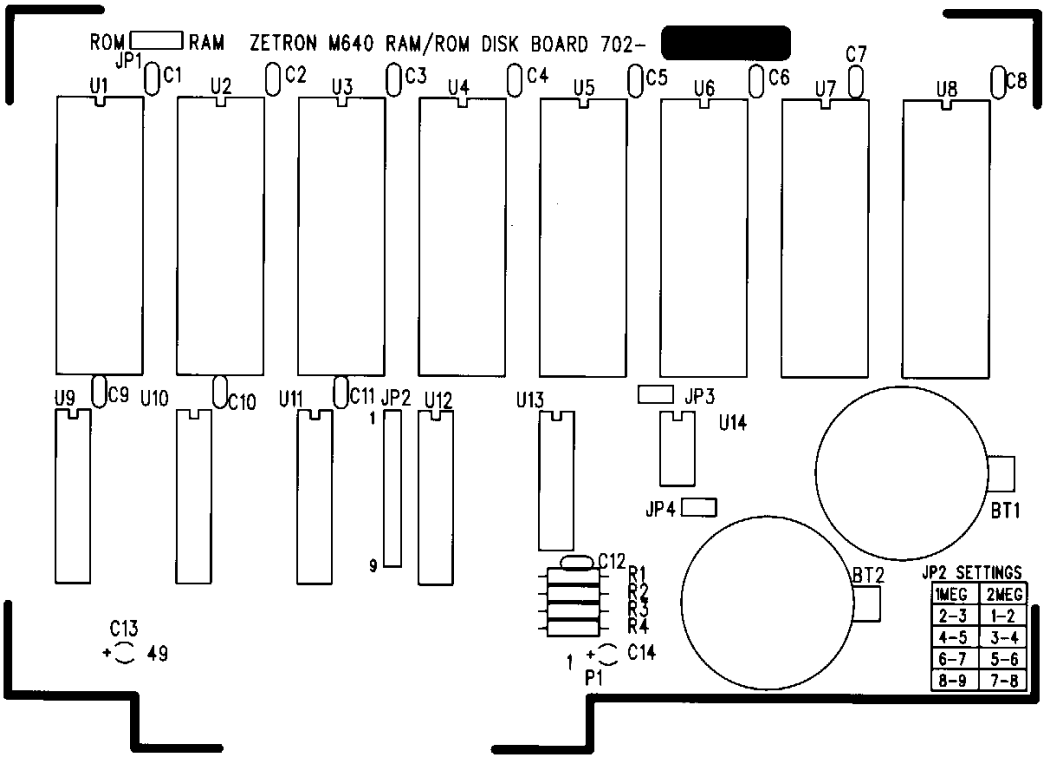
Dual MF (702-9197D.1)



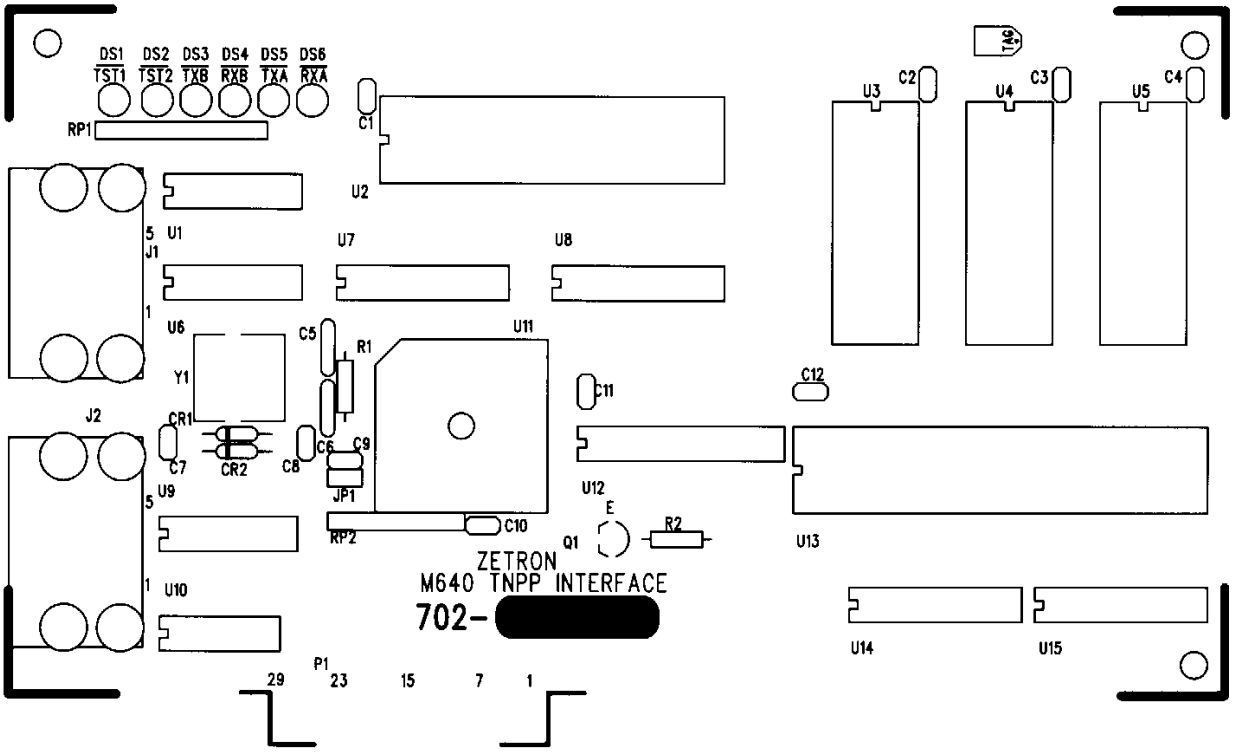
RAM Disk (702-9386B)



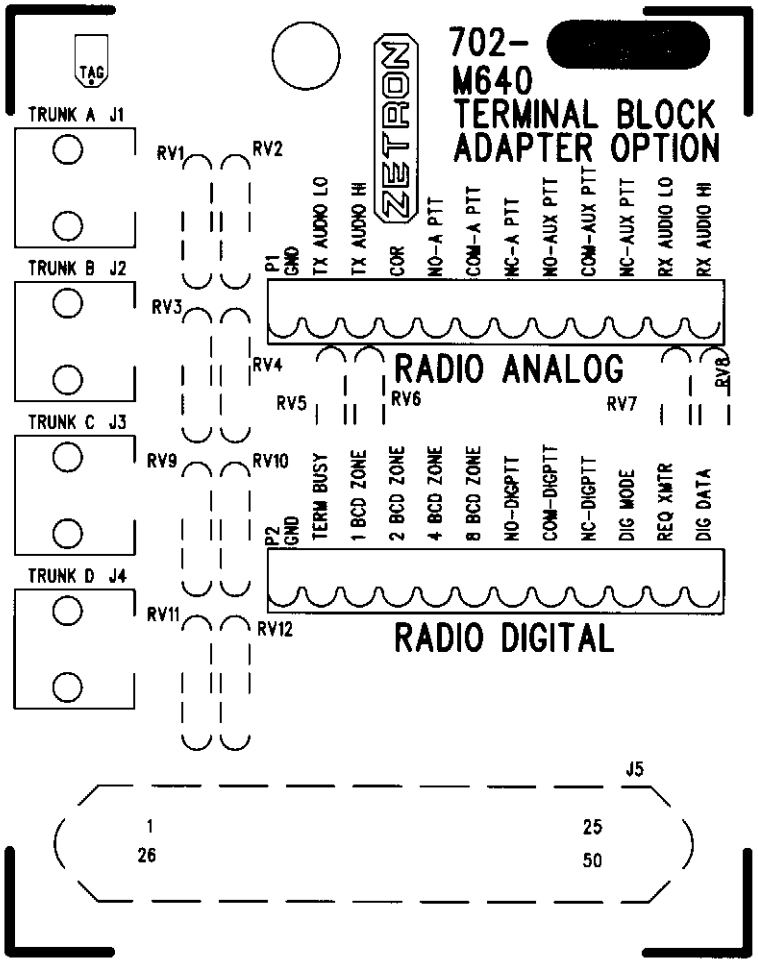
ROM Disk (702-9389B)



TNPP Interface (702-9362C.2)

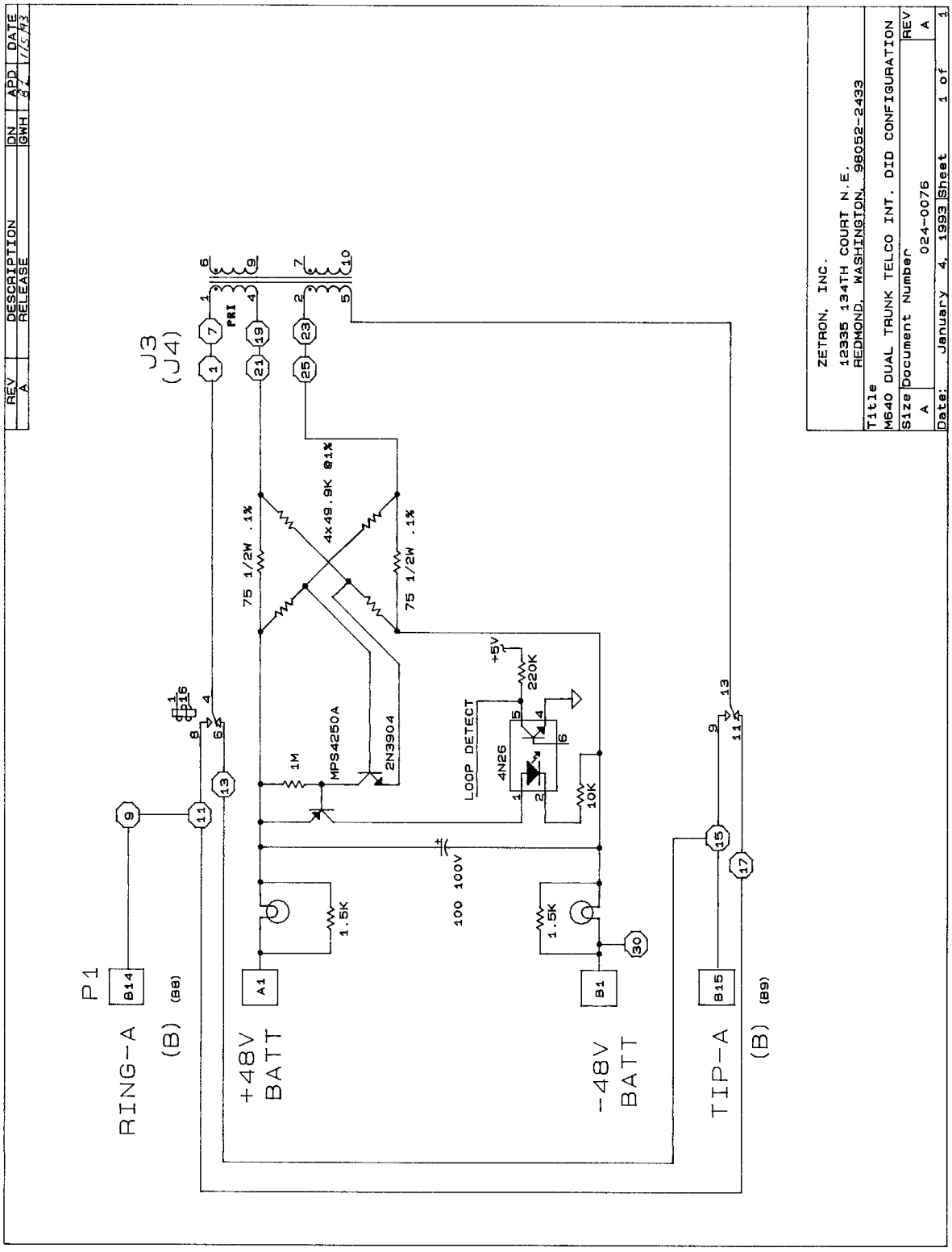


Terminal Block Adapter (702-9470B)

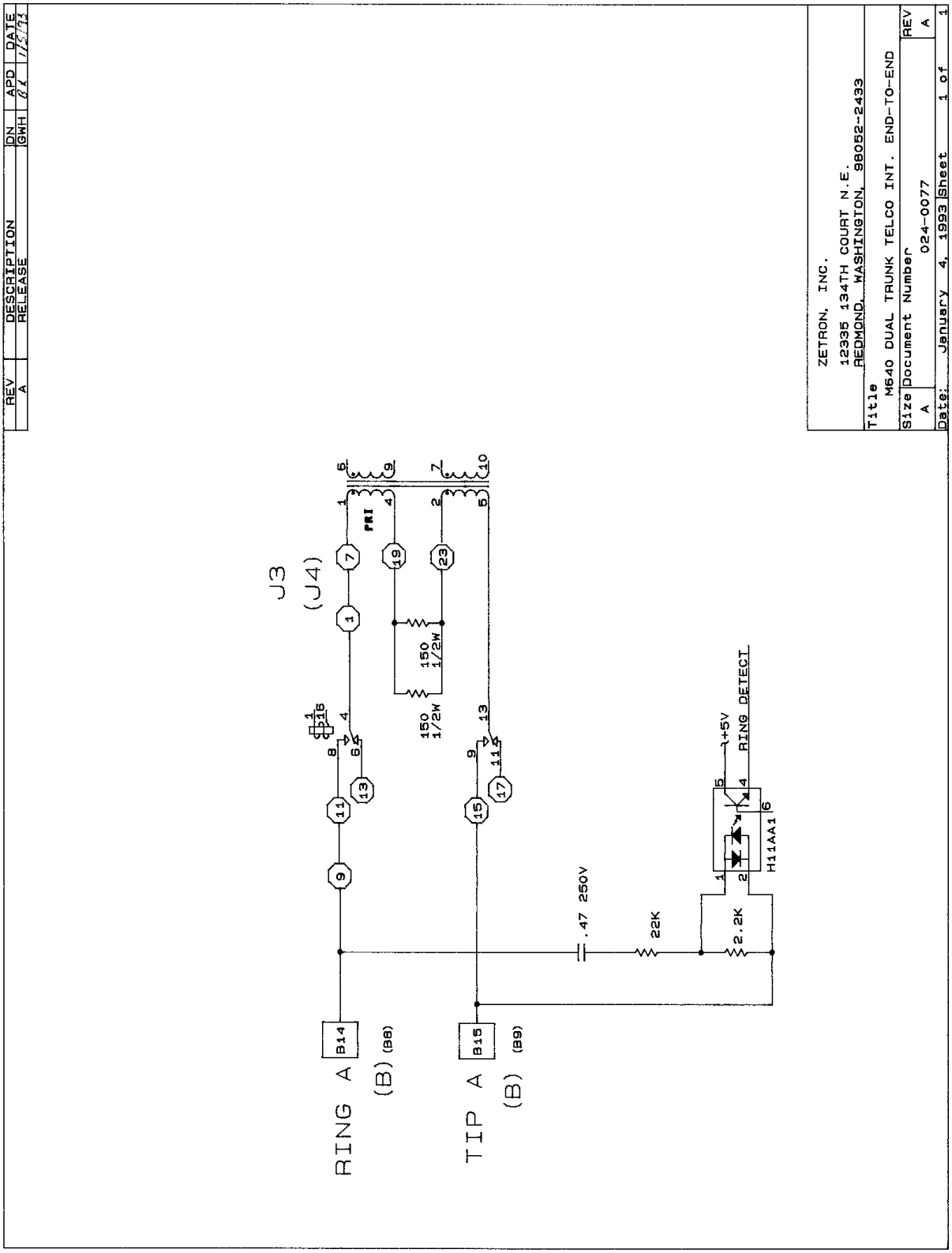


CONFIGURATION DIAGRAMS

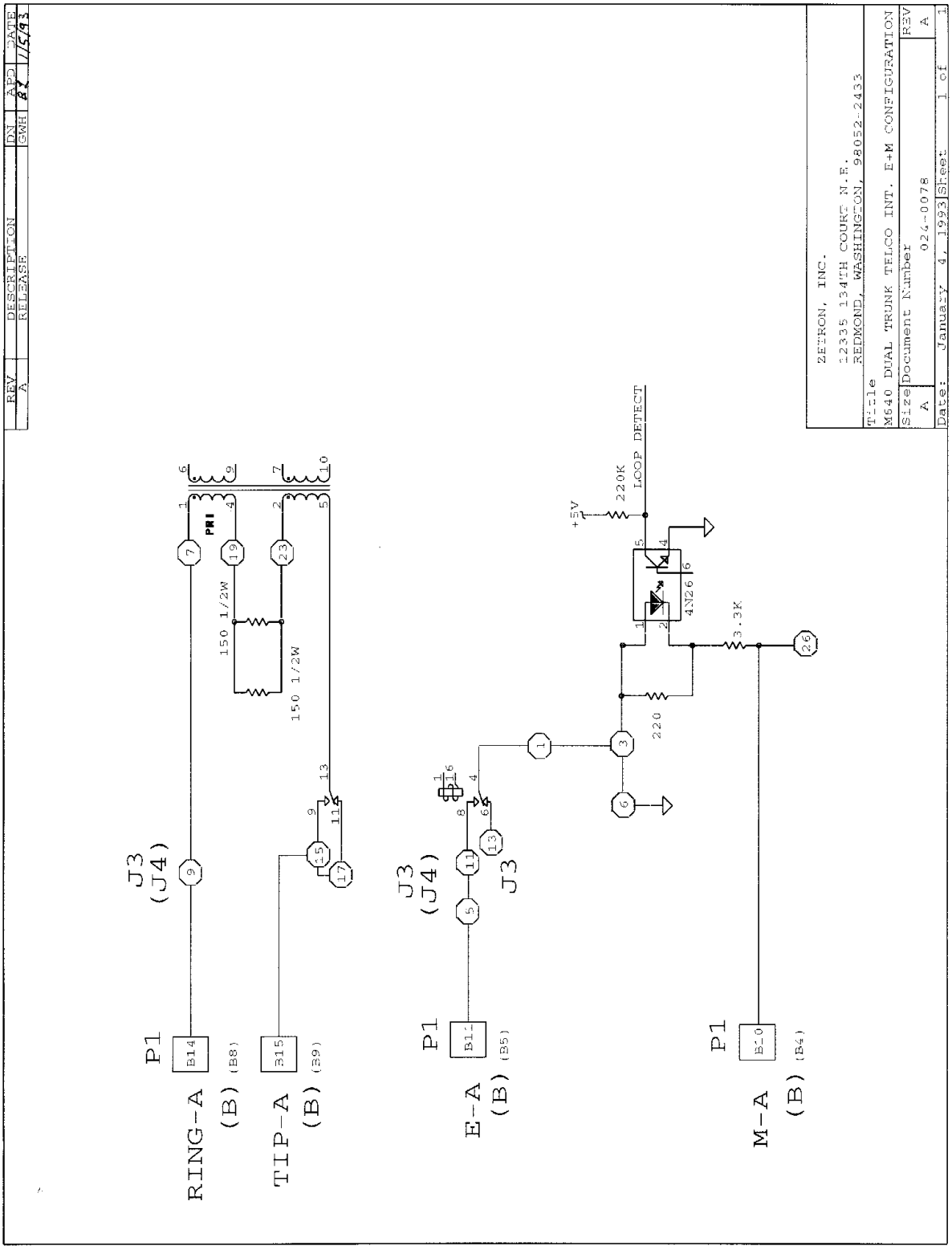
Dual Trunk Telco DID (024-0076A)



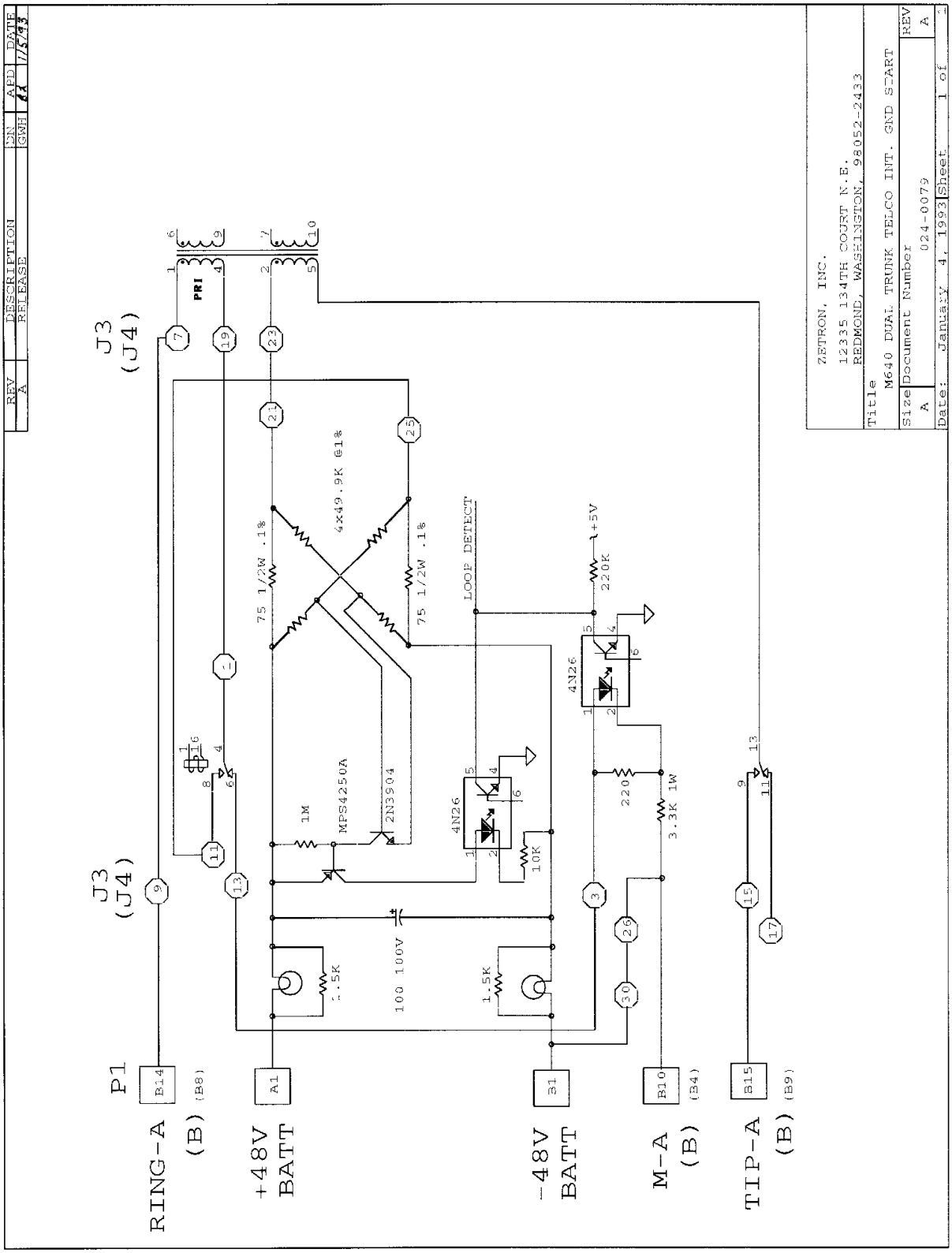
Dual Trunk Telco End-to-End (024-0077A)



Dual Trunk Telco E&M (024-0078A)



Dual Trunk Telco Ground Start (024-0079A)



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