



**Model MT5634ZPX**  
*Internal ISA Data/Voice/Fax Modem*  
**User Guide**



## User Guide

MT5634ZPX - Internal ISA Voice/Data/Fax Modem  
S000117C Rev. C

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### Record of Revisions

Revision	Date	Description
A	09/28/00	All pages released at Revision A
B	11/20/03	Substitute the Plug and Play wizard directions. Moved AT Commands and Fax Commands into a separate document.
C	06/22/04	Changed the temperature range on page 40.

### Patents

This device is covered by one or more of the following patents: 6,031,867; 6,012,113; 6,009,082; 5,905,794; 5,864,560; 5,815,567; 5,815,503; 5,812,534; 5,809,068; 5,790,532; 5,764,628; 5,764,627; 5,754,589; D394,250; 5,724,356; 5,673,268; 5,673,257; 5,644,594; 5,628,030; 5,619,508; 5,617,423; 5,600,649; 5,592,586; 5,577,041; 5,574,725; D374,222; 5,559,793; 5,546,448; 5,546,395; 5,535,204; 5,500,859; 5,471,470; 5,463,616; 5,453,986; 5,452,289; 5,450,425; D361,764; D355,658; D355,653; D353,598; D353,144; 5,355,365; 5,309,562; 5,301,274. Other patents pending.

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India	support@multitechindia.com	+91 (124) 6340778
U.K.	support@multitech.co.uk	+(44) 118 959 7774
U.S. and Canada	support@multitech.com	(800) 972 -2439
Rest of the World	support@multitech.com	+(763) 717-5863

### Recording Your Modem Information

Record the following information about your Multi-Tech modem before calling Technical Support. These numbers are printed on the bottom of the modem.

Modem Model No.:

Modem Serial No.:

### Trademarks

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## Chapter 1 - Introduction and Description

## Introduction

***Congratulations*** on your purchase of one of the finest internal data/fax/voice modems available today - the MultiModemZPX™ from Multi-Tech Systems.

## Product Description

**One Modem, Worldwide Use.** The MultiModemZPX MT5634ZPX global build is designed for global applications with approvals in many countries. This means one modem can ship around the world. The global modem is ideal for businesses with global operations that want to standardize on one modem and are looking to simplify the ordering process. Visit [www.multitech.com/](http://www.multitech.com/) to see a complete list of all the countries for which this modem has approvals.

The MultiModemZPX is an internal, half-length, fax modem card that can be plugged into any 16-bit ISA expansion slot. Your MultiModemZPX incorporates *V.90/K56flex™* modem technology, which enables Internet connections at data rates up to 56 Kbps over standard telephone lines. V.90/K56flex technology is able to propel data downstream from the Internet to your computer at speeds of up to 56 Kbps because data is digitally encoded instead of modulated. Upstream transmission, mostly keystroke and mouse commands from your computer to the central site, continues to flow at the conventional data rate of 33.6 Kbps.

*Note: Though this modem is capable of 56 Kbps download performance, line impairments, public telephone infrastructure, and other external technological factors currently prevent maximum 56 Kbps connections.*

Your MultiModemZPX offers interactive automatic dialing, as well as command mode option configuration. You can store two command line/telephone numbers, of up to 40 characters each, in the modem's nonvolatile memory. The modem pulse or tone dials and recognizes dial tones and busy signals for reliable call-progress detection. The modem can detect AT&T calling card tones. It is FCC-Registered for connection to telephone networks without any Data Access Arrangements (DAAs).

The MultiModem ZPX is a full-featured internal data/fax/voice modem designed for Pentium computers in either Windows Plug and Play or non-windows environments.

## General features

- Compliance with major ITU-T, TIA, and EIA international standards to ensure compatibility with other modems
- Distinguishes data, fax, and voice calls
- Easy Windows Plug and Play (PnP)
- Compliance with the V.80 standard, allowing video conferencing over analog telephone lines with any H.324 video phone system

### Data

- Supports V.90/K56flex™ for data transmission speeds up to 56 Kbps while maintaining compatibility with lower-speed modems

*Note: The V.90/K56flex standard asymmetrically transfers data-client downloads at speeds up to 56 Kbps; client uploads at speeds up to 33.6 Kbps*

- Supports the enhanced ITU-T V.34 standard with data transmission speeds to 33.6 Kbps while also maintaining compatibility with lower-speed modems

- Supports V.90/K56flex speeds plus 33.6K, 31.2K, 28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9.6K, 7.2K, 4.8K, 2.4K, 1.2K, and 0–300 bps
- Automatic fallback to slower speeds in noisy line conditions and fall-forward to faster speeds as conditions improve (line quality monitoring)
- ITU V.42 LAP-M and MNP Class 3 and 4 error correction
- ITU V.42bis (4-to-1) and MNP 5 (2-to-1) data compression
- H.324 compliant (videophone ready)
- Automatic disabling of compression when transferring already compressed files
- Autodial, redial, pulse (rotary), and touch-tone dial
- Dial tone and busy signal detection for reliable call-progress detection
- Distinctive ring support to route voice, data, or fax calls on a single phone line
- Plug and Play (*PnP*) support
- FlashROM upgradable (customer upgradable in a Windows environment)
- Compatibility with the standard AT command set used by most communication programs
- Stores up to two telephone numbers

**Fax**

- Supports V.17, Group 3 fax communication standards, allowing it to communicate with other fax modems as well as with fax machines
- Responds to Class 1 and Class 2 fax commands, enabling it to exchange editable and encrypted faxes with other Windows computers
- Sends and receives faxes from your computer at 14,400 bps, 9600 bps, 7200 bps, 4800 bps, 2400 bps, or 300 bps

**Voice**

- Full duplex speakerphone support with adjustable speaker volume control; can record and play back answering machine messages using optional microphone and speaker
- Remote/local telephone answering machine (TAM) capabilities include voice mail control, record/playback, and call screening
- Supports the TIA/EIA IS-101 AT+V voice command set

## Manual Organization

This User Guide will help you to install, configure, use, and troubleshoot your modem. The manual is divided into seven chapters and four appendices:

**Chapter 1: Introduction and Description.** This chapter Introduces the MT5634ZPX, briefly describing features and technical specifications.

**Chapter 2: Hardware Installation.** Chapter 2 contains information about unpacking your MultiModemZPX adapter. It also provides information on safety warnings and describes how to install the modem in your computer and connect it to a telephone, telephone line, microphone, and speaker.

**Chapter 3: Driver Installation.** Chapter 3 describes how to install the modem's drivers under various operating systems. This chapter also describes the process for configuring your modem's initial setup for operation within your country.

**Chapter 4: Using your Modem.** In this chapter, instructions are provided for configuring your communications software and Windows Dial-up Networking. The chapter also describes several tests which can assist you in confirming that your modem is installed properly.

**Chapter 5: AT Commands, S-Registers and Result Codes.** Chapter 5 refers you to separate reference guides:

- AT commands, S-Registers, and Result Codes
- Fax Commands Class 1
- Fax Commands Class 2

**Chapter 6: Troubleshooting.** The troubleshooting chapter describes common problems you may have with your modem and how to solve them.

**Chapter 7: Warranty, Service and Technical Support.** This chapter provides information on the terms of your warranty and describes how to get help with your modem from Multi-Tech Systems Technical Support group.

### **Appendix**

Appendix A: Regulatory Compliance

Appendix B: Updating Your Modem's Firmware

Appendix C: Global Wizard Configuration Utility

Appendix D: ASCII Conversion Chart

# Technical Specifications

<b>Trade Name</b>	MultiModemZPX
<b>Model Number</b>	MT5634ZPX
<b>Client-to-Server Data Rates</b>	V.90/K56flex* speeds when accessing an ISP-type K56flex server (actual speed depend on server capabilities and line conditions)
<b>Client-to-Client Data Rates</b>	Enhanced V.34 speeds to 33,600 plus 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, 2400, 1200, 0-300 bps
<b>Fax Rates</b>	14,400, 12,000, 9600, 7200, 4800, 2400, and 300 bps
<b>Data Format</b>	Serial, binary, asynchronous
<b>Data Compatibility</b>	V.90/K56flex, ITU V.34 extended, V.34, ITU V.32bis, V.32, V.22bis, V.21, V.22, V.23; Bell 212 and 103; ITU V.42, V.42bis
<b>Fax Compatibility</b>	ITU Group 3, T.4, T.30, V.21, V.27ter, V.29, V.17, and TIA/EIA 578 Class 1, Class 2
<b>Voice Compatibility</b>	TIA/EIA IS-101, H.324 (V.8, V.25ter), V.80
<b>Voice Mode Sampling</b>	Up to 44.100 kHz (down-sampled to 11.025 kHz)
<b>Plug and Play</b>	PnP ISA Specification 1.0a for one logical device, PnP autoconfiguration sequence compliant, full 16-bit address decode to meet Microsoft's PC 95 requirements for Windows Logo certification.
<b>Error Correction</b>	ITU V.42 (LAP-M and MNP Classes 2–4)
<b>Data Compression</b>	ITU V.42bis (4:1 compression) and MNP 5 (2:1 compression)
<b>Speed Detection</b>	Automatic speed detection and switching between available speeds
<b>Fallback</b>	In adverse line conditions, the modem falls back from its current operating speed to the next reliable slower speed in 2400 bps decrements (V.34 mode). If conditions improve, the modem falls forward to the fastest reliable speed in 2400 bps increments. In V.90/K56flex mode, modem falls back and falls forward in increments of 2000 bps
<b>Modes of Operation</b>	Full-duplex operation over dial-up lines, automatic dialing, automatic or manual answer
<b>Flow Control</b>	Software (XON/XOFF), hardware (RTS/CTS)
<b>Intelligent Features</b>	Fully AT command compatible, autodial, redial, pulse or tone dial, dial pauses, call status display, auto-parity and data rate selection, keyboard-controlled modem options, nonvolatile memory and on-screen displays for modem parameters
<b>Command Buffer</b>	40 characters
<b>Data Modulations</b>	FSK at 300 bps, DPSK at 1200 bps, QAM at 2400, 4800, and 9600 bps (non-trellis), QAM with trellis-coded modulation (TCM) at 9600, 12,000, 14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, 33,600 and 56,000 bps
<b>Fax Modulations</b>	V.21 CH2: FSK at 300 bps V.27ter: DPSK at 4800 and 2400 bps V.29: QAM at 9600 and 7200 bps V.17: TCM at 14400, 12000, 9600, and 7200 bps

<b>Carrier Frequencies: V.34/V.90/K56flex</b>	1600, 1646, 1680, 1800, 1829, 1867, 1920, 1959, 2000 Hz
<b>Carrier Frequencies: V.32terbo/V.32bis/V.32</b>	1800 Hz
<b>Carrier Frequencies: ITU-T V.22bis/V.22 or Bell 212A Standard (2400 &amp; 1200 bps)</b>	Transmit Originate: 1200 Hz Transmit Answer: 2400 Hz Receive Originate: 2400 Hz Receive Answer: 1200 Hz
<b>Carrier Frequencies: Bell 103 (300 bps)</b>	Transmit Originate: 1270 Hz mark 1070 Hz space Transmit Answer: 2225 Hz mark 2025 Hz space Receive Originate: 2225 Hz mark 2025 Hz space Receive Answer: 1270 Hz mark 1070 Hz space
<b>Fax Carrier Frequencies</b>	V.21 CH2 (half duplex): 1650 Hz mark, 1850 Hz space for Transmit Originate 1650 Hz mark, 1850 Hz space for Transmit Answer V.27ter: 1800 Hz Originate/Answer V.29 QAM: 1700 Hz Originate/Answer V.17 TCM: 1800 Hz Originate/Answer
<b>Diagnostics</b>	Power-on self-test (POST) and local analog loop
<b>Transmit Level</b>	Transmit level varies by country where the device is used
<b>Frequency Stability</b>	±0.01%
<b>Receiver Sensitivity</b>	-43 dB under worst-case conditions
<b>AGC Dynamic Range</b>	43 dB
<b>Serial Interface</b>	ITU-T V.24/V.28
<b>Bus Type</b>	16-bit ISA or EISA
<b>Connectors</b>	Two RJ-11 phone jacks and two plugs for microphone, and speakers
<b>Cables</b>	One RJ-11 phone cable
<b>Environmental</b>	Temperature range 0° to 40° C (32° to 104° F), humidity range 20–90% (non-condensing)
<b>Dimensions</b>	0.7" W × 4.8" H × 5.8" L 1.8 cm × 12.2 cm × 14.7 cm
<b>Limited Warranty</b>	10 years



## Chapter 2 - Hardware Installation

## Hardware Installation - Introduction

This chapter describes how to install the MultiModemZPX hardware into your computer.

Installing the MultiModemZPX consists of five steps:

1. Installing the modem in the computer.
2. Connecting the modem to the telephone line and, optionally, to an external speaker and microphone.
3. Installing the modem's drivers.
4. Configuring your modem for country-specific operation.
5. Configuring your communications software.

### Unpacking your MultiModemZPX

- One MultiModemZPX internal modem.
- One telephone cable.
- One MultiModemZPX CD, which includes modem drivers, the MultiModemZPX User Guide in Adobe .pdf format, PhoneTools (communications software), and Adobe Acrobat Reader.
- Quick Start Guide.
- One brochure with a warranty card.

If any item is missing, please contact Multi-Tech Systems or your dealer/distributor.

### What You'll Need

Before you start, make sure you have everything you need:

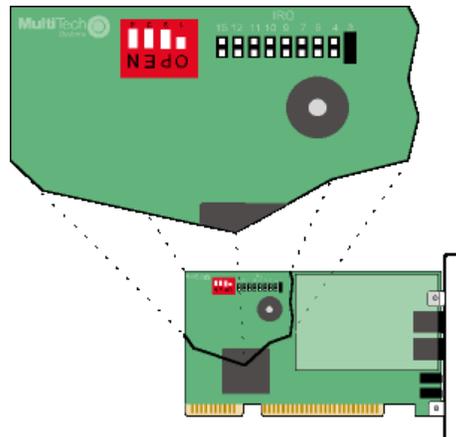
- The contents of your MultiModemZPX package.
- A PC with Windows 95, 98, Me, 2000 or Linux operating system installed.
- CD-ROM drive.
- An available 16-bit ISA expansion slot.
- Tools to open your computer.
- Your PC manual.
- A nearby telephone line jack.
- An external speaker or headphone (optional).
- An external microphone (optional).

## Safety Warnings

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- This product is to be used with UL and cUL listed computers.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.
- To reduce the risk of fire, use only No. 26 AWG or larger Telecommunication line cord.

## Installation Overview

The MT5634ZPX board contains a four-position DIP switch for COM port assignment and nine Berg jumpers for setting the IRQ address. The DIP switches and jumpers are located in the upper left corner of the PC board as shown below. The factory default for this board is Plug-N-Play (automatic COM port and IRQ address assignment).



**MT5634ZPX DIP Switches and Jumpers**

Installing the MultiModemZPX consists of six steps:

1. Configuring the modem's DIP Switch and Jumper settings.
2. Installing the modem in the computer.
3. Connecting the modem to the telephone line and, optionally to an external speaker and microphone.
4. Installing the modem's software drivers.
5. Configuring your modem for country-specific operation (if you are using the Global build of the MT5634ZPX).
6. Configuring your communications software.

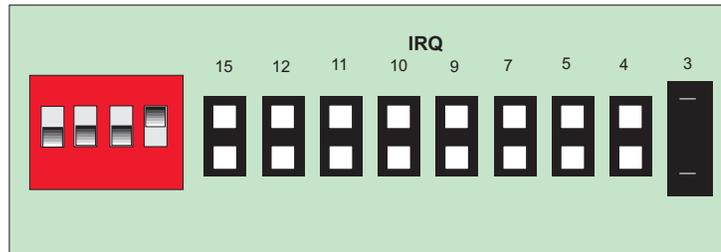
Note: unless otherwise noted, the procedures which follow apply to both PnP and non-PnP environments.

## Step 1 - Configuring DIP-Switches and Jumpers

### Windows Plug and Play

The MultiModemZPX board is shipped from the factory pre-configured for Plug and Play operation.

If you would like to use the Plug and Play feature, you do not need to make any changes to the DIP switches or jumpers.



**The MT5634ZPX Default PnP Settings**

These DIP-Switches and Jumpers would have to be changed if you wanted to use non-Plug and Play or if you did not have an available IRQ for the modem due to too many other devices attached to your PC.

Unlike an external modem, the MultiModemZPX contains its own serial port. When Windows detects the MultiModemZPX, it assigns the next available COM port number to the device. Since COM1 and COM2 are standard serial ports within Windows, COM3 will typically be assigned to the MultiModemZPX serial port. Windows also assigns the MultiModemZPX a port address and interrupt request (IRQ) number. Because the number of IRQs is limited, a computer with several accessories may not have an available IRQ for your new modem. If that is the case, you may have to decide which of the other devices you can modify or do without. If you want to change the IRQ settings, follow the directions below.

### Checking Your IRQ

**Note:** Changing resource settings improperly can disable your hardware and can cause your computer to malfunction or be inoperable. Be aware that resource settings should be changed only by users with expert knowledge of computer hardware and hardware configurations.

Use the following procedure to check the assignments Windows has made for your modem:

1. Click **Start | Settings | Control Panel**. Double-click the **System** icon.
2. When the **System Properties** dialog box displays, click the **Device Manager** tab. A list of device types appears.
3. Double-click **Modem** to display a list of modems installed in your computer.
4. Double-click **Multi-Tech Systems MT5634ZPX**. The **Modem Properties** dialog box displays.
5. Click the **Resources** tab and note the **Conflicting Device** list. If there is a conflict between your modem and another device in your computer, the information appears here. For help in resolving a conflict, click **Start | Help**, and then search the Help index for the *Hardware Conflict Troubleshooter*. When finished, click **OK** to exit the **System Properties** dialog box.

6. In **Control Panel**, double-click the **Modems** icon.
7. If prompted, enter the necessary dialing information for your location. When the **Modems Properties** dialog box displays, click the **Diagnostics** tab. A list of ports and devices appears.
8. Highlight the COM port associated with the Multi-Tech MT5634ZPX. Click **More Info**. Clicking **More Info** causes Windows to send commands to and receive responses from the modem. The system also displays information about the modem's COM port.
9. Write down the modem's port, interrupt, address, and highest speed. You will need this information to configure *legacy* (nonWindows) communications software you install.  
**Port:** COM \_\_\_\_\_ **Interrupt:** \_\_\_\_\_ **Address:** \_\_\_\_\_ **Speed:** \_\_\_\_\_
10. Click the **General** tab. **Select Multi-Tech Systems MT5634ZPX** and click **Properties** to review the modem's default communications settings. Do not change any settings unless you have special requirements.
11. From **General** tab, click **Dialing Properties** and review your dialing settings. If you are required to dial **9** to get an outside line, type **9** in the local and long distance boxes. If you have call waiting service, disable it to prevent it from interrupting a data or fax transmission. When finished, click **OK** to exit the **Modems Properties** dialog box.

**The Four Position DIP Switch**

<b>DIP#</b>	<b>Position</b>	<b>Effect</b>
<b>1</b>	Open (Up)*	Selects Plug and Play
	Closed (Down)	Selects Non-Plug and Play
<b>2&amp;3</b>	2 Open	Base Address = 3F8 COM1
	3 Open	
	2 Closed	Base Address = 2F8 COM2
	3 Open	
	2 Open	Base Address = 3E8 COM3
	3 Closed	
	2 Closed*	Base Address = 2E8 COM4
	3 Closed*	
<b>4</b>	Reserved for future use	

\* Factory Default Setting

After you have selected the desired COM Port via the 4-position DIP-Switch, you must assign an IRQ address by placing the IRQ jumper in the correct position. The figure which follows shows the jumper and DIP-switch in the default position for PnP.



Select the IRQ for your COM port by moving the supplied shorting plug, or jumper, to the two pins below the desired IRQ number. Select an address and an IRQ that does not conflict with others in your computer. Supported IRQ values for the MT5634ZPX are 3,4,5,7,9,10,11,12 and 15.

**Note:** The jumper must be in the default position (IRQ3) for PnP.

## Step 2 - Install the Modem into Your Computer

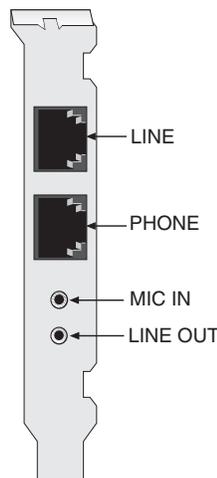
Installing the MultiModemZPX requires you to open your computer. Please consult your computer manual in addition to the following instructions:

1. Turn off the computer and unplug it. Failure to do so may result in damage to both the MultiModemZPX and the computer. Do not turn on the computer until the instructions tell you to do so.
2. Remove the cover from the computer as instructed in the computer manual.
3. Select an empty 16-bit ISA expansion slot. Remove the expansion slot cover and save the retaining screw.
4. Before handling the MT5634ZPX, discharge static in your body by touching a metal piece of the computer chassis. Carefully remove the MultiModemZPX from its antistatic bag, handling it only by the mounting bracket and edges. Do not touch the gold-plated connectors along the bottom edge.
5. Place the MultiModemZPX directly above the expansion slot and gently, but firmly, push it into the connector until the card's retaining bracket is flush against the computer chassis.
6. Fasten the retaining bracket to the computer chassis with the screw saved in step 3.
7. Replace the cover of the computer.

## Step 3 - Connect Your Modem to the Telephone Line

The MultiModemZPX communicates over public-switched telephone network lines. Use the modular telephone cable provided with the modem to connect the MultiModemZPX to your telephone wall jack. If you don't have a standard modular wall jack near your computer, install one or have one installed for you by your telephone company. In the U.S., installation kits and adapters are available wherever telephones are sold.

The MultiModemZPX offers a voice port which allows you to connect your adapter to a microphone and speaker. The microphone can be used for recording answering machine messages or for speakerphone use. The speaker can be used for playing back messages or as a speakerphone.



**MT5634ZPX Internal ISA Modem**

1. Plug one end of the supplied modular telephone cable into the LINE jack.

2. Plug the other end of the telephone cable into a working wall jack.
3. You may connect a telephone to the modem's PHONE jack.

**Note:** *The LINE jack is not interchangeable with the PHONE jack. Do not plug a phone into the LINE jack or the line cable into the PHONE jack.*

4. To use a microphone with your adapter, insert the microphone plug into the MIC IN jack.
5. To use a speaker or headphone with the modem, insert the speaker or headphone plug into the LINE OUT jack.

### **Sound Card Considerations**

If you want speakerphone functions and the ability to record sound or .WAV files through the sound card at the same time, you need:

- Two stereo PC microphones
- One stereo male-to-male patch cord
- One sound card and optional speakers

To connect a third party sound card:

1. Obtain a stereo male-to-male patch cord at a local PC retail store.
2. Place one end of the stereo male-to-male patch cord into the LINE OUT jack of the MultiModemZPX and the other end into the LINE IN jack of the sound card. This allows you to hear the activity of the modem whether it is originating or answering a call, or playing a recorded message.
3. Place the stereo microphones (do not use mono microphones) far enough apart from each other to eliminate feedback (e.g., one on each side of the monitor). Make sure speakers are amplified with a power source (either a battery or electrical source). Plug the connector of both microphones into the MIC IN jack of the Sound Card and the MT5634ZPX.



## Chapter 3 - Driver Installation

## Step 4 - Install the Modem Driver

If you use Windows 95/98/Me/2000, you must install the modem driver, which is installed using the Windows Plug and Play feature. Note, however, that if you use Windows NT 4.0, the modem driver must be installed manually. If you use Windows NT 4.0 or another operating system, see instructions in Chapter 2 for manual settings. Follow the four-step procedure below for installing the driver using Windows Plug and Play:

1. Make sure your modem is connected properly, and then turn on your computer. Windows should detect your new modem and open the **Install New Modem** wizard.

**Note:** If Windows cannot find a modem, your modem may be turned off, it may be plugged into the wrong connector on your computer, or the serial cable may be faulty. See "Solving Problems" in the *User Guide*.

2. Insert the CD into your CD-ROM drive, and then click **OK**.
3. Windows installs the modem driver. Just follow the steps as you go through the driver installation Wizard.
4. Click **Finish** to exit.

### ***Removing a Previous Modem from Your PC***

This example uses Windows 2000

1. To remove a modem adapter from Windows 2000, click **Start | Settings | Control Panel**. Double click **Add/Remove Hardware**.
2. The **Add/Remove Hardware Wizard** displays. Click **Next>**.
3. When the **Choose Hardware Task** dialog box displays, select **Uninstall/Unplug a device**.
4. Next, in the **Choose a Removal Task** dialog box, select **Uninstall a device**, then click **Next>**.
5. The **Installed devices on your computer** dialog box provides a list of devices installed on your computer. **Select** the device you want to uninstall from the list. Click **Next>**.
6. In the **Uninstall a Device** dialog box, verify the correct device is highlighted and select **Yes**. Click **Next>** to continue.
7. The **Completing the Add/Remove Hardware Wizard** indicates Windows has successfully uninstalled the device. Click **Finish** to complete the removal of the device.

**Note:** If you are removing a Plug and Play device from Windows, you must physically remove the device from the computer or Windows will request driver installation each time the system starts.



## Chapter 4 - Using Your Modem

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## Step 5 - Configure the Modem for Your Country (Global Modem Only)

Different countries have different requirements for how modems must function. Therefore, before you use your modem, you must configure it to match the defaults of the country in which you are using it. You can use one of two configuration methods:

- ✓ Using the Global Wizard to Configure Your Modem
- ✓ Using AT Commands to Configure Your Modem

### ***Using the Global Wizard to Configure Your Modem (For Global Modems Only)***

The Global Wizard configuration utility is recommended for computers running Windows95/98/Me/2000/XP.

1. Insert the MT5634ZPX CD into the CD-ROM drive. The **Autorun** dialog box appears.
2. Click **Initial Setup and Country Selection**.
3. Choose either:
  - **Run Global Wizard from CD**. This will not load the wizard onto your hard drive, or
  - **Install Global Wizard on the HD**. This will install the wizard onto your hard drive for future use.
4. The **Global Wizard** dialog box appears. Click **Next**.
5. The Global Wizard searches for your modem and identifies it. Click **Next**.
6. Select the country in which the modem will be used, and then click **Next**.
7. Review your choice of country. If it is correct, click **Next** to configure the modem.
8. When Global Wizard announces that the parameters have been set, click **Finish** to exit.

After completing your hardware and driver installation, if you are using the Global build of the MT5634ZPX, you must configure your modem for country-specific operation.

## Step 6 - Install Data Communications Software

Data communications software is designed to send and receive messages. Multi-Tech includes PhoneTools communications software with your modem. However, the modem will work with most data communications software. To install Phone Tools, insert the CD into the CD-ROM drive; click the Phone Tools icon. You will be asked to choose your language. The software automatically loads onto your PC.

## Operating Your MultiModemZPX

If you're an experienced modem user, you may only want to check your modem's settings for data compression, error correction, and so on. You'll find you can get moving quite quickly by using a terminal window (you may use HyperTerminal in Windows) to issue the **AT&V<cr>** command. This command will list your modem's current configuration, the stored (user) profiles, and the stored telephone numbers. If you come across a setting you're unsure of, refer to the AT Command Reference Guide for AT commands and S-Register explanations and defaults.

Your MT5634ZPX can be controlled by issuing **AT** commands and setting **S-Registers**. Since your MultiModemZPX default settings use a traditional modem set to make a dial-up call to a remote installation where the call is answered automatically—you shouldn't need to change the current configuration.

In operating your MultiModemZPX, it is likely that you will use your data communications software to either:

- Enter *terminal* mode, where you can *speak most directly* to the modem by issuing AT commands, or
- Launch a data communications or Dial-Up Networking session through a set of modem configurations that you select and then associate with a target telephone number.

## Configuring Windows Dial-Up Networking

Microsoft's Dial-Up Networking (DUN) is a system component of Windows 95, 98, NT and 2000 enabling you to connect your computer to a variety of computer systems and networks, including the Internet.

Dial-Up Networking has been integrated into Windows 2000. If you are using Windows 95, 98, or Me, you may need to install the Dial-Up Networking code from the full-release Windows CD, a companion CD from your Original Equipment Manufacturer (OEM) or from a complete set of installation (\*.CAB) files on your hard drive. If you are connecting to the Internet, the TCP/IP protocol suite must also be installed on your computer.

*TCP/IP is an acronym for "Transmission Control Protocol/Internet Protocol". TCP/IP is a suite of communication protocols, or set of rules, used by computers to communicate with each other. TCP/IP is the standard protocol used on the Internet.*

If you are making a Dial-Up connection to the Internet, you'll need to set up an account with an Internet Service Provider (ISP). Your ISP should provide you with the following information:

- Your access account userid and password.
- The access phone number(s) for dialing into your Internet Service Provider.
- The protocol used to connect to your ISP (PPP or SLIP).
- Your ISP may or may not provide a *static* TCP/IP (or IP) address for your computer. If your ISP provides a static IP address for your computer or for their Domain Name Server (DNS), you'll need to enter these addresses when you configure the Dial-Up connection. Many ISPs use *dynamic* IP addresses which means they issue your computer a new IP address each time you log into their system. If your ISP uses dynamic IP addresses, you do not need to configure an IP address when you create your Dial-Up Connection.

The following instructions will guide you through setting up a basic Dial-Up Networking connection to the Internet. Many features and settings beyond those shown here are available for use when creating a Dial-Up connection.

### Windows 95/98 Dial-Up Networking

**Note:** Before beginning, make certain Dial-Up Networking and TCP/IP are installed on your computer.

1. To begin your set up:
  - a. In Windows 95, Click **Start | Programs | Accessories | Dial-Up Networking**.
  - b. In Windows 98, Click **Start | Programs | Accessories | Communications | Dial-Up Networking**.
  - c. To set up a Dial-Up Networking connection within Windows 2000, select **Start | Settings | Network and Dial-up Connections**.
2. Then follow the **Dial-Up Networking Wizard** directions.

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## Testing Your Modem

### Testing Data Functions

You can test your modem's data transfer functions by logging on to Multi-Tech's Web site to register your modem.

**Note:** *This procedure assumes you have set up a successful dial-up Internet connection and you have a web browser installed on your computer.*

1. Make your connection to the Internet.
2. Go to <http://www.multitech.com/register/>
3. Complete and submit the form.

### Testing Fax Functions

Test your modem's fax capabilities by sending a fax to Multi-Tech or to a fax machine in your office.

Windows 95, 98 and 2000 include a faxing application. If you are using Windows NT and want to fax from your computer, you will need to install a third party faxing application.

The Windows fax application can act as a stand-alone fax program, or it can be used to fax from within an application such as a word processor. If you are using Windows 2000 and are not familiar with the faxing procedure, use the Windows 2000 Help index to find the topic entitled *Fax, how to fax a document*. If you are faxing from Windows 95 or Windows 98, use the following procedure:

1. Click **Start | Programs | Accessories | WordPad**.
2. Create a message in **WordPad**, for example: **This is a test of the MultiModemZPX's fax capabilities**.
3. Save the file as **ZPXTest.doc** and exit **WordPad**.
4. Click **Start | Programs | Accessories | Fax | Compose New Fax**.
5. The **Compose New Fax** wizard appears. Click **Next**.
6. To send the file to your own fax machine or to another fax modem in your office, type the destination name and phone number in the **To** and **Fax #** boxes.
7. Click **Add to List**; then click **Next**.
8. Select a cover page; then click **Next**.
9. Type a subject line (e.g., **MultiModemZPX Fax Test**) and a note to go on the cover page; then click **Next**.
10. Click **Add File**. In the **Open a File to Attach** dialog box, select **ZPX Test.doc** and click **Open**. The ZPX Test.doc file is added to the **Files to Send** list box.
11. Click **Next**; then click **Finish**.
12. Microsoft Fax opens the ZPX Test.doc file in WordPad, prints it to the Rendering System, dials the recipient, and then sends the fax.
13. Exit Microsoft Fax when the **Status** dialog box displays that the fax was sent successfully.

### **Other Methods for Accessing Microsoft Fax**

- In Windows, select **File | Print** and select Microsoft Fax or Fax as the default printer.
- In a Windows application, select **File | Send**.
- In Microsoft Exchange, select **Compose** and then **New Fax**.

### **MultiModemZPX's Answering Machine Test**

Test the MultiModemZPX's voice function by using the included software to set up the MultiModemZPX as a telephone answering machine. Have a friend call and leave a message; then play it back.

## **Remote Configuration**

Remote configuration is a network management tool that allows you to configure modems anywhere in your network from one location. With password-protected remote configuration, you can issue AT commands to a remote MT5634ZPX modem for maintenance or troubleshooting as if you were on-site.

### **Basic Procedure**

The following procedure is valid regardless of whether the connection is established by the local or remote Multi-Tech modem.

1. Establish a data connection with a remote MT5634ZPX modem.
2. Send three remote configuration escape characters followed by **AT** and the setup password. Then press **ENTER**. Example: **%%%ATMTSMODEM**, press the **Enter** key. You have four attempts to enter the password correctly before being disconnected. If the password is correct, the remote modem responds with **OK**.  
***Note:** The default setup password for your Multi-Tech Modem is MTSMODEM. Keep in mind, passwords are case sensitive.*
3. You now can send AT commands to configure the remote modem.  
***CAUTION:** Hanging up improperly while you are in remote configuration mode can lock up the remote modem.*
4. When you finish configuring the remote modem, save the new configuration by typing **AT&W0**, press the **Enter** key. Then type **ATO**, followed by pressing the **Enter** key to exit remote configuration. You can then break the connection in the normal way.

### **Setup**

Multi-Tech modems are shipped with a default setup password (MTSMODEM). For security measures, you should change the password. As an added security measure, also change the remote configuration escape character.

### **Changing the Setup Password**

***Caution:** You can only change the setup password locally; you cannot do it remotely.*

1. Open a data communications program such as HyperTerminal.
2. In the terminal window, type **AT#SMTSMODEM** (or **AT#Syyyyyy** if you have replaced the MTSMODEM password with yyyyyy) and press **Enter**. The modem responds with **OK** if the setup password is correct and **ERROR** if it is wrong.
3. To change the password, type **AT#S=yyyyyy**, where yyyyyy is the password, and press **Enter**. The password can include any keyboard character and must be one to eight characters long. The modem responds with **OK**.

4. The new password is saved automatically. You now can enter more AT commands or exit the data communications program. The next time you remotely configure the modem you must use the new setup password.

### ***Changing the Remote Escape Character***

To increase security, you can change a remote modem's remote configuration escape character. The remote configuration escape character is stored in register **S9**. The factory default is 37, which is the ASCII code for the percent character (%). For more information on ASCII codes, refer to Appendix D.

1. Establish a remote configuration link with the remote modem as described in *Basic Procedure* on the previous page.
2. Type **ATS9=*n***, where *n* is the ASCII code for the new remote configuration escape character. Then press ENTER.

**Caution:** *Setting S9 to 0 (zero) disables remote configuration entirely—if you disable remote configuration you will no longer be able to configure this device from a remote location!*

3. To save the new value, type **AT&W** and press **Enter**.
4. Type **ATO**, then **Enter** to exit remote configuration.



## Chapter 5 - AT Commands and Fax Commands

## AT Commands

A complete AT Commands, S-Registers, and Result Codes Reference Guide can be found on the MT5634ZPX CD and on the Multi-Tech Web site.

## Fax Commands

Fax commands resemble AT commands, but are more complicated to use. Because of this, we recommend that you use a fax program to send and receive faxes rather than attempting to control the modem directly. Developers who need to know the fax commands for the MT5634ZPX can find Fax Class 1 and Fax Class Class 2 Reference Guides on the MT5634ZPX CD as well as the Multi-Tech Web site.



## Chapter 6 - Troubleshooting

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## Introduction to Troubleshooting

This chapter describes common problems you may have with your modem and how to solve them. If you are unable to make a successful connection, or if you experience data loss or garbled characters during a connection, use the *Initial Checklist* below to begin the troubleshooting process. If the problem is not resolved after going through the *Initial Checklist*, review the *Common Problems* section for further troubleshooting recommendations. If you are still unable to make a successful connection, refer to Chapter 7 for information on how to reach a technical support technician via our toll-free telephone number or the Internet. Make certain you've completed the *Recording Modem Information* section in Chapter 7 before contacting a technician.

### Initial Checklist

The following checklist will help to ensure the modem has been properly set up.

- Make sure the COM port you chose during setup matches the COM port set in your communications software. See Chapter 4 for more information.
- Check that the phone cord between the modem's LINE jack and the wall jack is undamaged and firmly connected to both.
- If you have a modem with voice capabilities and have connected a telephone to your modem, check that the phone cord between the modem's PHONE jack and the telephone is undamaged and firmly connected to both.
- If you have a modem with voice capabilities and have connected a microphone to your modem, check the connection of the microphone plug to the modem's MIC IN jack.
- If you have a modem with voice capabilities and have connected speakers to your modem, check the connection of the speaker plug to the modem's LINE OUT jack.
- Retry whatever action was not working.
- If it still does not work, check the following section for a description and possible solution to your problem.

### Common Problems

The following is a list of common problems associated with using a modem:

- The modem does not respond to commands.
- The modem dials but cannot make a connection.
- The modem disconnects while online.
- The modem cannot connect when answering.
- File transfer appears slower than it should be.
- Data is being lost.
- Garbage characters display on the monitor.
- Fax and communications software won't run at the same time.

Use the following instructions to guide you through troubleshooting these problems before contacting Technical Support:

### ***The modem does not respond to commands***

- Make sure you are in terminal mode in your data communications program; then type **AT** and press **Enter**. You should get an **OK** response. If not, reset your modem by sending it an **ATZ** or **AT&F** command in terminal mode. If using legacy software (software designed for an older operating system), make sure the initialization string includes **&F** as the first command to cancel any *leftover* commands that could interfere with the modem's operation. For more information on initialization strings, refer to Chapter 5.
- If you don't get an **OK**, the problem may still be in the communications software. Make sure you have properly configured the port in your communications software. Most legacy (prior to Windows 95) communications programs connect to the COM port when the software loads and remain connected until the program terminates. Some programs can disconnect without exiting the program. If this is the case, try issuing the software's connection command. If more than one communications program is open, they may conflict with each other. Make sure all other communications programs are closed and try to make the connection again.
- If using legacy software, the COM port setting may not match the COM port that Windows assigned. Compare the COM port setting in your software to the COM port reported in Windows. To view your modem COM port settings:
  - In Windows 95/98, select **Start | Settings | Control Panel | Modems**, and then **Diagnostics**.
  - In Windows NT, select **Start | Settings | Control Panel | Modems**. Click **Properties**.
  - In Windows 2000, click **Start | Settings | Control Panel | Modem and Phone Options | Properties**.
- Another expansion card (such as a sound card) may be using the same COM port, memory address, or interrupt request (IRQ) as your modem. See Chapter 3 for information on verifying the configuration for your operating system. Look for conflicts with other devices installed on your computer. Resources are assigned at power up by the computer's BIOS. If the resources assigned to the MultiModemZPX conflict with the resources of another device, the resources of the second device have to be changed. Select the port the conflicting device is on and change it to resolve the conflict. If you need to change switches or jumpers on the conflicting device, refer to the device's documentation.
- If you have another MultiModemZPX, install it and try to make a connection.

### ***The modem dials but cannot make a connection***

Several reasons why the MultiModemZPX fails to make a connection include:

- Lack of a physical connection to the telephone line.
- A wrong dial tone.
- A busy signal.
- A wrong number.
- No modem at the other end.
- A faulty modem, computer, or software at the other end.
- Incompatibility between modems.

Narrow the list of possibilities by using extended result codes. If you disabled the modem's extended result codes, enable them by entering **ATV1X4** in a terminal window and press **Enter**. When you dial again, the modem reports the call's progress.

- If the modem reports *NO DIALTONE*, check that the modem's telephone line cable is connected to both the modem's LINE jack (not the PHONE jack) and the telephone wall jack. If the cable looks secure, try replacing it.  
If that doesn't work, the problem may be in your building's telephone installation. To test the building installation, plug a telephone into your modem's telephone wall jack and listen for a dial tone. If you hear a dial tone, your modem may be installed behind a company phone system (PBX) with an internal dial tone that sounds different from the normal dial tone. In that case, the modem may not recognize the dial tone and may treat it as an error. Check with your in-house telephone switch (PBX) personnel or the PBX system manual to see if you can change the internal dial tone. If you can't, change your modem's initialization string to include **X3**, which makes the modem ignore dial tones.
- If the modem reports *BUSY*, the other number may be busy. Try again later. *BUSY* also may indicate that **9** was not added to the phone number (if required to dial **9** for an outside line). If you are required to dial **9** to get an outside line, the easiest way to dial it automatically using legacy software is to include it in the modem's dial prefix, e.g., **ATDT9**, (the comma inserts a pause before the number is dialed). If you have set up your connection through Dial-Up Networking or another communications program, find the dialing configuration dialog box that allows you to add a dial prefix. Enter **9** as the prefix when dialing.  
For example, in Windows 95/98, select **Start | Settings | Control Panel**, and then **Modems**. In the **Modems Properties** sheet, select the appropriate modem model (e.g., Multi-Tech MT5634ZPX), click **Dialing Properties** and type **9** in the local and long distance boxes in the *How I dial from this location* box.
- If the modem reports *NO ANSWER*, the other system has failed to answer, or you may have dialed a wrong number. Check the number.
- If the modem reports *NO CARRIER*, the phone was answered at the other end, but no modem connection was made. You may have dialed an incorrect number and a person answered instead of a computer. A *NO CARRIER* message may also indicate the modem you are calling is turned off or the software on the receiving end is faulty or incorrectly configured. Check the number and try again or try calling another system to make sure your modem is working. You may also try calling the modem's phone number from your telephone. If you hear harsh sounds, a modem is answering the call. If the modem is answering, the modems may be having problems negotiating due to modem incompatibilities or line noise. Try the call again connecting at a lower speed by setting register S37 to a lower rate (e.g., by typing **ATS37=11** in the terminal window and pressing **Enter**).

### ***The modem disconnects while online***

- If you have call waiting on the same phone line as your modem, it may interrupt your connection when someone tries to call you. If you have call waiting, disable it before each call. In most telephone areas in North America, you can disable call waiting by preceding the telephone number with **\*70** (check with your local telephone company). You can disable call waiting automatically by including the disabling code in the modem's dial prefix (e.g., **ATDT\*70**,—note the comma, which inserts a pause before the telephone number is dialed). For example, in Windows 95/98 software, select **Start | Settings | Control Panel**, and then **Modems**. In the **Modems Properties** sheet, select **Multi-Tech MT5634ZPX**, click **Dialing Properties**. Check *This location has call waiting* and select the correct code for your phone service.  
**Note:** *\*70 is used only in the United States.*
- If you have extension phones on the same line as your modem, you or someone else can interrupt the connection by picking up another phone. If this is a frequent problem, disconnect the extension phones before using the modem or install another phone line for the modem only.

- Check for loose connections between the modem and the telephone jack.
- You may have a poor connection because of line conditions, or the problem may have originated on the other end of the line. Try again.
- If you were online with a commercial online service, it may have hung up because of lack of activity on your part or because you exceeded your time limit for the day. Try increasing the length of time in minutes the modem will wait before disconnecting when no data is sent or received. The Inactivity Timer can be changed using AT Command `\Tn`, or register **S30**.

### ***The modem cannot connect when answering***

- Auto-answer may be disabled. Turn on auto-answer in your data communications program or send the command **ATS0=1** to your modem in terminal mode.

### ***File transfer appears slower than it should***

- If you are using a slow transfer protocol, such as Xmodem or Kermit, try Zmodem or Ymodem/G instead.
- Is your line noisy? If there is static on your line, the modem has to resend many blocks of data to ensure accuracy. You must have a clean line for maximum speed.
- If you are downloading a file compressed with MNP 5 hardware compression enabled, try disabling data compression. The transfer may be marginally slower with data compression enabled because hardware data compression cannot compress a file already compressed by an archiving program.

### ***Data is being lost***

- If you are using data compression, be sure the serial port baud rate is set to a minimum of four times the data rate.
- Make sure the flow control method you selected in your software matches the method selected in the modem (see AT commands **&Kn** and **\Qn**.)
- Try entering the **&V** (View Parameters) command, making a screen print of the diagnostics listing, and checking for parameters that may be unacceptable.

### ***Garbage characters display on the monitor***

- Your computer and the remote computer may be set to different word lengths, stop bits, or parities. If you are attempting to connect at 8-N-1, try changing to 7-E-1, or vice-versa, using your communications software.
- You may be experiencing line noise. Enable error correction if it is disabled. Or, hang up and call again; you may get a better connection.
- At speeds above 2400 bps, the remote modem may not use the same transmission or error correction standards as your modem. Try connecting at a slower speed or disabling error correction. (With no error correction, however, line noise can cause garbage characters.)
- Try entering the **&V** (View Parameters) command, making a screen print of the diagnostics listing, and checking for parameters that may be unacceptable.

### ***Fax and data software won't run at the same time***

- You can have Windows compliant data and fax communication applications open at the same time, but they cannot use the same modem at the same time. Make sure no other communications application is open when you try to dial out. If you are using legacy communications software with Windows, you may get a message that another application is occupying the device even when no call is in progress. Close any open legacy communications programs and try again.



## Chapter 7 - Warranty, Service, and Technical Support

## Multi-Tech Systems, Inc. Warranty & Repairs Policies

### Warranty

Multi-Tech Systems, Inc., (hereafter “MTS”) warrants that its products will be free from defects in material or workmanship for a period of two, five, or ten years (depending on model) from date of purchase, or if proof of purchase is not provided, two, five, or ten years (depending on model) from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by Customer or any party without MTS’s written authorization, or used in any manner inconsistent with MTS’s instructions.

MTS’s entire obligation under this warranty shall be limited (at MTS’s option) to repair or replacement of any products which prove to be defective within the warranty period or, at MTS’s option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS’s factory – transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PRICE FOR DEFECTIVE PRODUCTS.

### Repair Procedures for U.S. and Canadian Customers

In the event that service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota factory:

Multi-Tech Systems, Inc.

2205 Woodale Drive

Mounds View, MN 55112

Attn: Repairs, Serial # \_\_\_\_\_

A Returned Materials Authorization (RMA) is not required. Return shipping charges (surface) will be paid by MTS.

Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check or purchase order for repair charges.

For out of warranty repair charges, go to [www.multitech.com/documents/warranties](http://www.multitech.com/documents/warranties)

Extended two-year overnight replacement service agreements are available for selected products. Please call MTS at (888) 288-5470, extension 5308 or visit our web site at

<http://www.multitech.com/programs/orc/> for details on rates and coverage’s

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department at (800) 972-2439 or email [tsupport@multitech.com](mailto:tsupport@multitech.com). Please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at (800) 328-9717 or (763) 717-5631, or email [mtsrepair@multitech.com](mailto:mtsrepair@multitech.com).

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

### **Repair Procedures for International Customers (Outside U.S.A. and Canada)**

Your original point of purchase Reseller may offer the quickest and most economical repair option for your Multi-Tech product. You may also contact any Multi-Tech sales office for information about the nearest distributor or other repair service for your Multi-Tech product.

<http://www.multitech.com/COMPANY/offices/DEFAULT.ASP>

In the event that factory service is required, products may be shipped, freight prepaid to our Mounds View, Minnesota factory. Recommended international shipment methods are via Federal Express, UPS or DHL courier services, or by airmail parcel post; shipments made by any other method will be refused. A Returned Materials Authorization (RMA) is required for products shipped from outside the U.S.A. and Canada. Please contact us for return authorization and shipping instructions on any International shipments to the U.S.A. Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check drawn on a U.S. bank or your company's purchase order for repair charges. Repaired units shall be shipped freight collect, unless other arrangements are made in advance.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department nearest you or email [tsupport@multitech.com](mailto:tsupport@multitech.com). When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at

+(763) 717-5631 in the U.S.A., or email [mtsrepair@multitech.com](mailto:mtsrepair@multitech.com).

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

### **Repair Procedures for International Distributors**

Procedures for International Distributors of Multi-Tech products are on the distributor web site.

<http://www.multitech.com/PARTNERS/login/>

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10-Sep-01

## Online Warranty Registration

If you have access to the World Wide Web, you can register your Multi-Tech product online at <http://www.multitech.com/register/>.

## Service

### U.S. and Canadian Customers

In the event that service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota, factory:

Multi-Tech Systems, Inc.  
2205 Wooddale Drive  
Mounds View, MN 55112

**Attn: Repairs, Serial # \_\_\_\_\_**

A Returned Materials Authorization (RMA) is not required. Return shipping charges (surface) will be paid by MTS. Please include inside the shipping box a description of the problem, a return shipping address (must have street address, not P.O. Box), a telephone number, and if the product is out of warranty, a check or purchase order for repair charges.

For out of warranty repair charges, go to <http://www.multitech.com/documents/warranties>.

Extended two-year overnight replacement agreements are available for selected products. Please call MTS at 888 288-5470, extension 5308, or visit our web site at <http://www.multitech.com/PROGRAMS/orc/> for details on rates and coverages.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department at 800 972-2439 or e-mail [tsupport@multitech.com](mailto:tsupport@multitech.com).

Please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at 800 328-9717 or +763 785-3500, or e-mail [mtsrepair@multitech.com](mailto:mtsrepair@multitech.com).

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

### International Customers (outside U.S.A. and Canada)

Your original point of purchase reseller may offer the quickest and most economical repair option for your Multi-Tech product. You may also contact any Multi-Tech sales office for information about the nearest distributor or other repair service for your Multi-Tech product: <http://www.multitech.com/COMPANY/offices/DEFAULT.ASP>.

In the event that factory service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota, factory. Recommended international shipment methods are via Federal Express, UPS or DHL courier services, or by airmail parcel post; shipments made by any other method will be refused. A Returned Materials Authorization (RMA) is required for products shipped from outside the U.S.A. and Canada. Please contact us for return authorization and shipping instructions on any international shipments to the U.S.A. Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check drawn on a U.S. bank or your company's purchase order for repair charges. Repaired units will be shipped freight collect, unless other arrangements are made in advance.

Please direct questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department nearest you, as listed at <http://www.multitech.com/COMPANY/offices/DEFAULT.ASP>, or e-mail [tsupport@multitech.com](mailto:tsupport@multitech.com). When calling the U.S., please direct questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at +763 717-5631 in the U.S.A., or e-mail [mtsrepair@multitech.com](mailto:mtsrepair@multitech.com).

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

## International Distributors

Procedures for international distributors of Multi-Tech products are on the Distributor Web site at <http://www.multitech.com/PARTNERS/login/>.

## Replacement Parts

SupplyNet, Inc., can supply you with replacement power supplies, cables and connectors for selected Multi-Tech products. You can place an order with SupplyNet via mail, phone, fax or the Internet at the following addresses:

Mail: SupplyNet, Inc.  
614 Corporate Way  
Valley Cottage, NY 10989  
Phone: 800 826-0279  
Fax: 914 267-2420  
Email: [info@thesupplynet.com](mailto:info@thesupplynet.com)  
Internet: <http://www.thesupplynet.com>

## Technical Support

Multi-Tech Systems has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, please call 800 972-2439 (USA and Canada) or 763 785-3500 (international and local). Please have modem information available. You can also contact Technical Support by e-mail at the following addresses:

<b>Country</b>	<b>Email</b>	<b>Telephone</b>
France:	<a href="mailto:support@multitech.fr">support@multitech.fr</a>	+(33) 1-64 61 09 81
India:	<a href="mailto:support@multitechindia.com">support@multitechindia.com</a>	+91 (124) 6340778
U.K.:	<a href="mailto:support@multitech.co.uk">support@multitech.co.uk</a>	+(44) 118 959 7774
U.S.A., Canada	<a href="mailto:tsupport@multitech.com">tsupport@multitech.com</a>	800 972-2439
Rest of world:	<a href="mailto:tsupport@multitech.com">tsupport@multitech.com</a>	+763 717-5863

Please note the status of the modem before contacting Technical Support. Status information can include the state of the LED indicators, screen messages, diagnostic test results, problems with a specific application, etc.

## Internet Sites

Multi-Tech is a commercial provider on the Internet. Multi-Tech has a Web site at <http://www.multitech.com> and an ftp site at <ftp://ftp.multitech.com>



## Appendixes

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## Appendix A - Regulatory Compliance

### FCC Part 68 Telecom Analog/Modem

1. This equipment complies with part 68 of the Federal Communications Commission Rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number. This information must be provided to the telephone company.
2. As indicated below, the suitable jack (Universal Service Order Code connecting arrangement) for this equipment is shown. If applicable, the facility interface codes (FIC) and service order codes (SOC) are shown.
3. A FCC compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.
4. The ringer equivalence number (REN) is used to determine the quantity of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the device not ringing in response to an incoming call. In most , but not all areas, the sum of the REN's should not exceed (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total REN's, contact the local telephone company.
5. If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.
6. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.
7. If trouble is experienced with this equipment (the model of which is indicated below) please contact MultiTech Systems, Inc. at the address shown below for details of how to have repairs made. If the equipment is causing harm to the network, the telephone company may request you to remove the equipment from the network until the problem is resolved.
8. No repairs are to be made by you. Repairs are to be made only by MultiTech Systems or its licensees. Unauthorized repairs void registration and warranty.
9. This equipment should not be used on party lines or coin lines.
10. If so required, this equipment is hearing-aid compatible.

<b>Manufacturer:</b>	<b>MultiTech Systems Inc.</b>
<b>Trade Name:</b>	<b>MultiModemZPX</b>
<b>Model Number</b>	<b>MT5634ZPX</b>
<b>FCC Registration Number:</b>	<b>AU7USA-32234-M5-E</b>
<b>Ringer Equivalence:</b>	<b>0.4B</b>
<b>Modular Jack (USOC):</b>	<b>RJ-11C</b>
<b>Service Center in USA:</b>	<b>Multi-Tech Systems Inc. 2205 Woodale Drive Mounds View, MN 55112 (800) 328-9717 (763) 785-3500 (763) 785-9874 FAX</b>

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## Fax Branding Statement

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device, including fax machines, to send any message unless such message clearly contains the following information:

- Date and time the message is sent
- Identification of the business, or other entity, or other individual sending the message
- Telephone number of the sending machine or such business, other entity, or individual

This information is to appear in a margin at the top or bottom of each transmitted page on the first page of the transmission. (Adding this information in the margin is referred to as *fax branding*.)

Since any number of fax software packages can be used with this product, the user must refer to the fax software manual for setup details. Typically, the fax branding information must be entered via the configuration menu of the software.

### Canadian Limitations Notice

**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 of 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 five.

**Notice:** The Industry Canada label identifies certificated equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. 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 made by an authorized Canadian maintenance facility 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.

## Class B Statement

### FCC Part 15

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference that may cause undesired operation.

**Warning:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Industry Canada

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

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

## European Low Voltage Directive

When correctly installed and maintained, the modem will present no hazard to the user. When correctly installed the modem will be connected to the PSTN or a PW and to a Data Terminal Equipment (DTE), whose modem connections comply with ITU-T recommendation V.28. The DTE connections are therefore taken to be safe voltages (less than  $\pm 30$  volts).

Ports which are capable of connecting to other apparatus are defined as SELV. To ensure conformity with EN41003, ensure that these ports are only connected to ports of the same type on other apparatus.

## Protection Against Contact with TNV Circuit (Internal PC Cards)

The protective cover is fastened to the modem card by means that will only allow a tool to remove the cover.

**Warning:** Removal of the protective cover will affect product safety and user safety requirements.



## EMC, Safety and R&TTE Directive Compliance

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility.

and

Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits:

and

Council Directive 1999/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

## International Modem Restrictions

Some dialing and answering defaults and restrictions may vary for international modems. Changing settings may cause a modem to become non-compliant with the national telecom requirements in specific countries. Also note that some software packages may have features or lack restrictions that may cause the modem to become non-compliant.

## New Zealand Telecom Warning Notice

- (1) The grant of a Telepermit for any item of terminal equipment indicates only that Telecom has accepted that the item complies with minimum conditions for connection to its network. It indicates no endorsement of the product by Telecom, nor does it provide any sort of warranty. Above all, it provides no assurance that any item will work correctly in all respects with another item of Telepermitted equipment of a different make or model, nor does it imply that any product is compatible with all of Telecom's network services.

This equipment is not capable under all operating conditions of correct operation at the higher speed which it is designated. 33.6 kbps and 56 kbps connections are likely to be restricted to lower bit rates when connected to some PSTN implementations. Telecom will accept no responsibility should difficulties arise in such circumstances.

- (2) Immediately disconnect this equipment should it become physically damaged, and arrange for its disposal or repair.
- (3) This modem shall not be used in any manner which could constitute a nuisance to other Telecom customers.

- (4) *This device is equipped with pulse dialing, while the Telecom standard is DTMF tone dialing. There is no guarantee that Telecom lines will always continue to support pulse dialing.*

Use of pulse dialing, when this equipment is connected to the same line as other equipment, may give rise to 'bell tinkle' or noise and may also cause a false answer condition. Should such problems occur, the user should NOT contact the Telecom Faults Service.

The preferred method of dialing is to use DTMF tones, as this is faster than pulse (decadic) dialing and is readily available on almost all New Zealand telephone exchanges.

- (5) Warning Notice: No '111' or other calls can be made from this device during a mains power failure.
- (6) This equipment may not provide for the effective hand-over of a call to another device connected to the same line.
- (7) Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. The associated equipment shall be set to operate within the following limits for compliance with Telecom's Specifications:

For repeat calls to the same number:

There shall be no more than 10 call attempts to the same number within any 30 minute period for any single manual call initiation, and

The equipment shall go on-hook for a period of not less than 30 seconds between the end of one attempt and the beginning of the next attempt"

For automatic calls to different numbers:

The equipment shall be set to ensure that automatic calls to different numbers are spaced such

that there is no less than 5 seconds between the end of one call attempt and the beginning of another.

For automatically answered incoming calls:

The equipment shall be set to ensure that calls are answered between 3 and 30 seconds of receipt of ringing.

- (8) For correct operation, total of the RN's of all devices connected to a single line at any time should not exceed 5.

## Appendix B - Updating Your Modem's Firmware

### *Introduction*

Your modem is controlled by semi-permanent software, called firmware, which is stored in flash memory. Firmware is nonvolatile; that is, it remains stored in memory when the modem is turned off. However, either the manufacturer or the user can change the firmware as bugs are fixed or new features are added.

Multi-Tech System's *Flash Wizard* utility can be used in the Windows operating system to update (flash) your modem's firmware.

The *Flash Wizard* utility is available on the MT5634ZPX System CD or can be downloaded from Multi-Tech's ftp site.

### *Upgrade Overview*

The upgrade (flash) procedure for the Windows operating system consists of the following steps:

1. Identify the modem's model number and firmware version.
2. Identify the current version of the firmware.
3. Download the upgrade (.HEX) file for your modem.
4. Extract the firmware upgrade (.HEX) file.
5. Install The Flash Wizard .
6. Document your stored parameters.
7. Upgrade the modem's firmware using the .HEX file and the Flash Wizard.
8. Restore your parameters.

### *Step 1: Identify the Modem Firmware*

You must know the model number and firmware version of your Multi-Tech modem to know whether you should update it.

1. Run your favorite terminal program. If you are using Windows 95, Windows 98, Windows NT, or Windows 2000, you can use HyperTerminal.
2. In the program's terminal window, type **AT&F**. Even if you cannot see the **AT&F** command on your screen, be sure to type it completely, and then press **Enter**. The modem should respond **OK**.
3. After the modem responds **OK**, type **ATI** and press **Enter**. Record your results. The model number and firmware version should appear.

### *Step 2: Identify the Current Firmware Version*

Identify the current version of the firmware available for your modem on the Multi-Tech web site. If your modem already has the current firmware, there is no need to update it.

1. Using your favorite Web browser, go to Multi-Tech System's support web page. Follow the links to the modem firmware page.
2. Locate your modem model number.

3. Compare the firmware version number for your modem as found in *Step 1: Identify the Modem Firmware*, to the latest firmware version as listed on the web site. If your modem is at the current version, it does not need to be updated.
4. If the current firmware version is greater than the firmware version number found in *Step 1: Identify the Modem Firmware*, your modem has an older firmware version. Continue with *Step 3: Download the Upgrade File*.

### **Step 3: Download the Upgrade File**

At Multi-Tech's Support web page, follow the links to the modem firmware page. Locate the entry for your modem model and click on the upgrade file name to begin downloading the file to a temporary directory on your hard disk.

### **Step 4: Install the Flash Wizard**

Install the Flash Wizard upgrade utility from the MT5634ZPX System CD.

1. Insert the MT5634ZPX System CD into your computer's CD-ROM drive.
2. When the Autorun menu appears, click **Utilities**.
3. From the **Select Utility Program** dialog box, **select** Flash Wizard. Click **OK**.
4. The **Welcome** dialog box displays.
5. Before continuing with the firmware update, exit all Windows programs. Click **Cancel** to quit Setup if you need to close other Windows programs. Close any programs that are running and restart the update Wizard. When you are ready to proceed, click **Next>** to continue.
6. The **Choose Destination Location** dialog box displays. You may click **Browse** and select another folder if you do not want to use the default installation path. Remember the location of the destination folder; you'll need to copy the firmware .Hex file to the same location before using the *Flash Wizard* to update your modem. Destination Folder \_\_\_\_\_  
Click **Next>**.
7. When the program finishes copying files to your computer, the **Setup Complete** dialog box displays indicating that you must restart your computer before using the program.
8. Select **Yes**, then **Finish** to restart your system.

*Note: You must restart your computer to finish the Flash Wizard installation*

### **Step 5: Extract the Upgrade Files**

1. When the system restarts, move the upgrade file (downloaded from the web site) to the Flash Wizard utility directory on your computer's hard drive.
2. In Windows, double-click the self-extracting update file. The extracted files include the .HEX file used to update your modem.

### **Step 6: Document Your Stored Parameters**

Before you flash your modem it is important that you record the parameters that are currently stored in your modem so you can reprogram it after flashing.

1. Run your favorite terminal program.
2. In the program's terminal window, type **AT&V** and press **Enter** to list your modem's current parameters.
3. Record your parameters by saving the screens and sending them to your printer.
4. Close the terminal program.

### **Step 7: Upgrade the Modem's Firmware**

**CAUTION:** If you are using Windows NT, you must disable Windows RAS and Microsoft Fax Service before upgrading the modem's firmware.

To disable RAS and your Fax service (Windows NT Only):

Click **Start | Settings | Control Panel**, then double-click **Services**. Select **Remote Access Server** and click **Startup....** Select **Manual** as the *Start Up Type* and click **OK**.

If you are using a Fax service in NT, change its *Start Up Type* to **Manual**.

### **Using the Flash Wizard**

1. Use Windows Explorer to copy the new .Hex file (which you downloaded from the Multi-Tech web site) to the folder in which the *Flash Wizard* program was installed.
2. Click **Start | Programs | Flash Wizard** to start the firmware update process. The program begins by identifying devices attached to your computer.
3. The Wizard displays a list of installed devices able to be flashed with the update. You may update more than one device in a single procedure. Select the device(s) you'd like to update and click **Next>** to continue.
4. Next, the **Firmware Update Wizard** displays current firmware version information. The top portion of the window provides port, version and country identification for the firmware currently installed on your device(s). The *Hex File* list box displays the firmware versions available for updating your modem.
  - a. If your modem's firmware version number matches or is *higher* than the version number listed in the Hex File list, click **Cancel** to end the update process.
  - b. If your modem's firmware version number is *lower* than the firmware version shown in the Hex File list, continue with the update process. Select the port for the device you are updating. Use the list box to select the latest .Hex file version number for your country and click **Next>**.
5. The **Firmware Update Wizard** displays a progress indicator and begins updating your devices with the new firmware version. When the Wizard finishes the update, the progress indicator status changes to *Programming Complete*, and the **Finish>** button becomes active. Click **Finish>** to complete the update.
6. When the update completes, the **Firmware Update Wizard** displays indicating the device has been successfully updated. Click **Next>** to close the Wizard.
7. You must restart your computer to make the firmware changes effective for your modem.

**Note:** If you are using Windows NT, be certain to enable RAS and your fax program when the operating system restarts.

### **Step 8: Restore Your Parameters**

Your modem has been updated. You can now open your terminal program to reprogram your modem parameters or to confirm the update by typing **ATI** in the terminal window.

## Appendix C - Global Wizard Configuration Utility

If you are using the Global build of the MT5634ZPX modem, before using the device, or if you operate your modem from a different country than it was originally set up in, you must configure it for country-specific operation. If you are using Windows 95, 98, or 2000, you may quickly and easily configure your modem for country-specific operation using Multi-Tech Systems *Global Wizard* configuration utility.

If you are using a non-Windows operating system, or if you prefer to configure your Windows based modem for country-specific operation using AT commands, follow the configuration procedures in the AT Command Reference Guide.

### Global Wizard

1. Insert the MT5634ZPX System CD into your CD-ROM drive. The **MT5634ZPX AutoRun** dialog box displays:
2. **Click** the “Initial Setup & Country Selection” icon.
3. Select either **Run GlobalWizrd** or **Install GlobalWizard**.

**Run GlobalWizard** allows you to configure your modem by running Multi-Tech’s *Global Wizard* configuration utility from the CD. If you select this option, continue with Step 4.

If you plan to use your computer from different countries, you may want to select **Install GlobalWizard** to install the configuration utility to your hard drive and add the *Global Wizard* to your Start Menu.

Once you’ve installed Global Wizard to your hard drive, you may use the Global Wizard by selecting **Start | Programs | Global Wizard**.

4. The **Global Wizard** dialog box displays, prompting you to begin the configuration process.



Click **Next>**.

5. Wait while the wizard searches for your modem (this process may take a couple of minutes).



- The **Global Wizard** dialog box indicates the modem has been identified.



click **Next>**.

- An informational message appears indicating that the country list provided within the Global Wizard application does not indicate that the modem you are using is approved for use in that country\*. Refer to Multi-Tech System's web site at [www.multitech.com](http://www.multitech.com) for the most up-to-date country approval information.



Click **OK** to continue.

- The **Global Wizard** prompts you to select the country to configure the modem for.



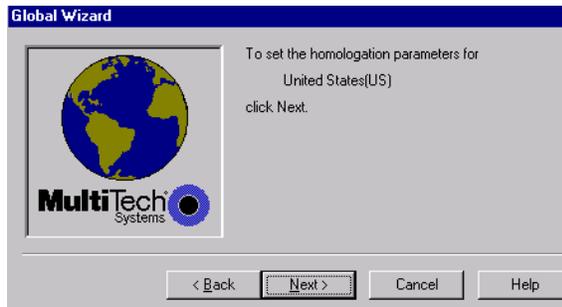
- Scroll through the country list and highlight the country from which you'll operate the modem.

- The **Global Wizard** dialog box displays the country which you have selected.



Click **Next>**.

11. The **Global Wizard** dialog box indicates it will set the homologation parameters for the country you have selected.



If the correct country is displayed, click **Next>** to continue; otherwise, click the **<Back** button and make the appropriate country selection.

12. The **Global Wizard** dialog box displays asking you to wait while it sets the homologation parameters for the selected country.



13. The **Global Wizard** indicates the homologation parameters have been successfully set for the country you selected.



Click **Finish** to exit the Global Wizard.

# Appendix D - ASCII Conversion Chart

CTRL	CODEHEX	DEC										
@	NUL	00	0	SP	20	32	@	40	64	`	60	96
A	SOH	01	1	!	21	33	A	41	65	a	61	97
B	STX	02	2	"	22	34	B	42	66	b	62	98
C	ETX	03	3	#	23	35	C	43	67	c	63	99
D	EOT	04	4	\$	24	36	D	44	68	d	64	100
E	ENQ	05	5	%	25	37	E	45	69	e	65	101
F	ACK	06	6	&	26	38	F	46	70	f	66	102
G	BEL	07	7	'	27	39	G	47	71	g	67	103
H	BS	08	8	(	28	40	H	48	72	h	68	104
I	HT	09	9	)	29	41	I	49	73	i	69	105
J	LF	0A	10	*	2A	42	J	4A	74	j	6A	106
K	VT	0B	11	+	2B	43	K	4B	75	k	6B	107
L	FF	0C	12	,	2C	44	L	4C	76	l	6C	108
M	CR	0D	13	-	2D	45	M	4D	77	m	6D	109
N	SO	0E	14	.	2E	46	N	4E	78	n	6E	110
O	SI	0F	15	/	2F	47	O	4F	79	o	6F	111
P	DLE	10	16	0	30	48	P	50	80	p	70	112
Q	DC1	11	17	1	31	49	Q	51	81	q	71	113
R	DC2	12	18	2	32	50	R	52	82	r	72	114
S	DC3	13	19	3	33	51	S	53	83	s	73	115
T	DC4	14	20	4	34	52	T	54	84	t	74	116
U	NAK	15	21	5	35	53	U	55	85	u	75	117
V	SYN	16	22	6	36	54	V	56	86	v	76	118
W	ETB	17	23	7	37	55	W	57	87	w	77	119
X	CAN	18	24	8	38	56	X	58	88	x	78	120
Y	EM	19	25	9	39	57	Y	59	89	y	79	121
Z	SUB	1A	26	:	3A	58	Z	5A	90	z	7A	122
[	ESC	1B	27	;	3B	59	[	5B	91	{	7B	123
\	FS	1C	28	<	3C	60	\	5C	92		7C	124
]	GS	1D	29	=	3D	61	]	5D	93	}	7D	125
^	RS	1E	30	>	3E	62	^	5E	94	~	7E	126
_	US	1F	31	?	3F	63	_	5F	95	DEL	7F	127

NUL	Null, or all zeros	VT	Vertical Tab	SYN	Sync.
SOH	Start of Header	FF	Form Feed	ETB	End Transmission Block
STX	Start of Text	CR	Carriage Return	CAN	Cancel
ETX	End of Text	SO	Shift Out	EM	End of Medium
EOT	End of Transmission	SI	Shift In	SUB	Substitute
ENQ	Enquiry	DLE	Data Link Escape	ESC	Escape
ACK	Acknowledge	DC1	Device Control 1	S	File Separator
BEL	Bell or Alarm	DC2	Device Control 2	GS	Group Separator
BS	Backspace	DC3	Device Control 3	RS	Record Separator
HT	Horizontal Tab	DC4	Device Control 4	US	Unit Separator
LF	Line Feed	NAK	Negative Acknowledge	DEL	Delete



## Glossary

## A

**Analog signal:** A waveform which has amplitude, frequency and phase, and which takes on a range of values between its maximum and minimum points.

**Analog Transmission:** One of two types of telecommunications which uses an analog signal as a carrier of voice, data, video, etc. An analog signal becomes a carrier when it is modulated by altering its phase, amplitude and frequency to correspond with the source signal. Compare with digital transmission.

**Application Program Interface (API):** A software module created to allow dissimilar, or incompatible applications programs to transfer information over a communications link. APIs may be simple or complex; they are commonly required to link PC applications with mainframe programs.

**ASCII (American Standard Code for Information Interchange) (pronounced "askey"):** A binary code for data that is used in communications and in many computers and terminals. The code is used to represent numbers, letters, punctuation and control characters. The basic ASCII code is a 7-bit character set which defines 128 possible characters. The extended ASCII file provides 255 characters.

**Asynchronous Transfer Mode (ATM):** A very high-speed method of transmission that uses fixed-size cells of 53 bytes to transfer information over fiber; also known as cell relay.

**AT Commands:** A standard set of commands used to configure various modem parameters, establish connections and disconnect. The "AT" is used to get the "attention" of the modem before the actual command is issued.

**Availability:** The measure of the time during which a circuit is ready for use; the complement of circuit "outage" (100% minus % outage = % available).

## B

**Babble:** unexpected bus activity that persists beyond a specified point in a frame.

**Backbone:** 1. A set of nodes and their interconnecting links providing the primary data path across a network. 2. In a local area network multiple-bridge ring configuration, a high-speed link to which the rings are connected by means of bridges. A backbone may be configured as a bus or as a ring. 3. In a wide area network, a high-speed link to which nodes or data switching exchanges (DSEs) are connected. 4. A common distribution core that provides all electrical power, gases, chemicals, and other services to the sectors of an automated wafer processing system.

**Background:** An activity that takes place in the PC while you are running another application. In other words, the active user interface does not correspond to the 'background' task.

**Bandwidth:** the amount of data transmitted per unit of time, typically bits per second (bps) or bytes per second (Bps).

**Bell Operating Companies (BOC):** The family of corporations created during the divestiture of AT&T. BOCs are independent companies which service a specific region of the US. Also called Regional Bell Operating Companies (RBOCs).

**Bell Pub 41450:** The Bell publication defining requirements for data format conversion, line conditioning, and termination for direct DDS connection.

**Bell Pub 62310:** The Bell publication defining requirements for data format conversion, line conditioning, and termination for direct DDS connection.

**Binary Synchronous Communication (BSC):** A form of telecommunication line control that uses a standard set of transmission control characters and control character sequences, for binary synchronous transmission of binary-coded data between stations.

**Bit (Binary digit):** A bit is the basis of the binary number system. It can take the value of 1 or 0. Bits are generally recognized as the electrical charge generated or stored by a computer that represent some portion of usable information.

**Bps (bits per second):** A unit to measure the speed at which data bits can be transmitted or received. Bps differs from baud when more than one bit is represented by a single cycle of the carrier.

**Bridges:** 1. A functional unit that interconnects two local area networks that use the same logical link protocol but may use different medium access control protocols. 2. A functional unit that interconnects multiple LANs (locally or remotely) that use the same logical link control protocol but that can use different medium access control protocols. A bridge forwards a frame to another bridge based on the medium access control (MAC) address. 3. In the connection of local loops, channels, or rings, the equipment and techniques used to match circuits and to facilitate accurate data transmission.

**Buffer:** A temporary storage register or Random Access Memory (RAM) used in all aspects of data communications which prevents data from being lost due to differences in transmission speed. Keyboards, serial ports, muxes and printers are a few examples of the devices that contain buffers.

**Bus:** A common channel between hardware devices either internally between components in a computer, or externally between stations in a communications network.

**Bus Enumeration:** Detecting and identifying Universal Serial Bus devices.

**Byte:** The unit of information a computer can handle at one time. The most common understanding is that a byte consists of 8 binary digits (bits), because that's what computers can handle. A byte holds the equivalent of a single character (such as the letter A).

## C

**Call Setup Time:** The time to establish a circuit-switched call between two points. Includes dialing, wait time, and CO/long distance service movement time.

**Capabilities:** Those attributes of a Universal Serial Bus device that are administrable by the host.

**Carrier Group Alarm (CGA):** A T1 service alarm generated by a channel bank when an OOF condition occurs for a predefined length of time (usually 300mS to 2.5 seconds). The CGA causes the calls using a trunk to be dropped and for trunk conditioning to be applied.

**Carrier signal:** An analog signal with known frequency, amplitude and phase characteristics used as a transport facility for useful information. By knowing the original characteristics, a receiver can interpret any changes as modulations, and thereby recover the information.

**CCITT (Consultative Committee for International Telephone and Telegraph):** An advisory committee created and controlled by the United Nations and headquartered in Geneva whose purpose is to develop and to publish recommendations for worldwide standardization of telecommunications devices. CCITT has developed modem standards that are adapted primarily by PTT (post, telephone and telegraph) organizations that operate phone networks of countries outside of the U.S. See also ITU.

**Central Office (CO):** The lowest, or most basic level of switching in the PSTN (public switched telephone network). A business PABX or any residential phone connects to the PSTN at a central office.

**Centrex:** A multi-line service offered by operating telcos which provides, from the telco CO, functions and features comparable to those of a PBX for large business users. See also "Private Branch Exchange", "Exchange".

**Channel:** A data communications path between two computer devices. Can refer to a physical medium (e.g., UTP or coax), or to a specific carrier frequency.

**Channel Bank:** A device that acts as a converter, taking the digital signal from the T1 line into a phone system and converting it to the analog signals used by the phone system. A channel bank acts as a multiplexer, placing many slow-speed voice or data transactions on a single high-speed link.

**Characteristics:** Those qualities of a Universal Serial Bus device that are unchangeable; for example, the device class is a device characteristic.

**Circuit-switched Network:** A technology used by the PSTN that allocates a pair of conductors for the exclusive use of one communication path. Circuit switching allows multiple conversations on one talk path only if the end-users multiplex the signals prior to transmission.

**Circuit Switching:** The temporary connection of two or more communications channels using a fixed, non-shareable path through the network. Users have full use of the circuit until the connection is terminated.

**Clear Channel:** A transmission path where the full bandwidth is used (i.e., no bandwidth needed for signaling, carrier framing or control bits). A 64 Kbps digital circuit usually has 8 Kbps used for signaling. ISDN has two 64 Kbps circuits, and a 16 Kbps packet service of which part is used for signaling on the 64K channels.

**Client-Server:** In TCP/IP, the model of interaction in distributed data processing in which a program at one site sends a request to a program at another site and awaits a response. The requesting program is called a client; the answering program is called a server.

**Cluster Controller:** A device that can control the input/output operations of more than one device connected to it. A cluster controller may be controlled by a program stored and executed in the unit, or it may be entirely controlled by hardware.

**Committed Burst Size:** The maximum number of bits that the frame relay network agrees to transfer during any measurement interval.

**Committed Information Rate (CIR):** An agreement a customer makes to use a certain minimum data transmission rate (in bps). The CIR is part of the frame relay service monthly billing, along with actual usage, that users pay to their frame relay service provider.

**Compression:** 1. The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks. 2. In SNA, the replacement of a string of up to 64-repeated characters by an encoded control byte to reduce the length of the data stream to the LU-LU session partner. The encoded control byte is followed by the character that was repeated (unless that character is the prime compression character). 3. In Data Facility Hierarchical Storage Manager, the process of moving data instead of allocated space during migration and recall in order to release unused space. 4. Contrast with decompression.

**COMx Port:** A serial communications port on a PC.

**Congestion:** A network condition where there is too much data traffic. The ITU I.233 standard defines congestion management in terms of speed and burstiness.

**Congestion notification:** The function in frame relay that ensures that user data transmitted at a rate higher than the CIR are allowed to slow down to the rate of the available network bandwidth.

**Consecutive Severely Errored Seconds (CSES):** An error condition that occurs when from 3 to 9 SES (Severely Errored Seconds) are logged consecutively.

**Customer Premise Equipment (CPE):** The generic term for data comm and/or terminal equipment that resides at the user site and is owned by the user with the following exclusions: Over voltage protection equipment, inside wiring, coin operated or pay telephones, "company-official" equipment, mobile telephone equipment, "911" equipment, equipment necessary for the provision of communications for national defense, or multiplexing equipment used to deliver multiple channels to the customer.

## D

**Data Communications Equipment (DCE):** Any device which serves as the portal of entry from the user equipment to a telecommunications facility. A modem is a DCE for the telephone network (PSTN) that is commonly on site at the user's premises. Packet Switched Networks have another level of DCE which is most often located at a central office.

**Data Link Connection Identifier (DLCI):** One of the six components of a frame relay frame. Its purpose is to distinguish separate virtual circuits across each access connection. Data coming into a frame relay node is thus allowed to be sent across the interface to the specified "address". The DLCI is confirmed and relayed to its destination, or if the specification is in error, the frame is discarded.

**Dataphone Digital Service (DDS):** A private line digital service that offers 2400, 4800, 9600 and 56 Kbps data rates on an inter-LATA basis by AT&T and on an intra-LATA basis by the BOCs.

**Data Service Unit (DSU):** A device that provides a digital data service interface directly to the data terminal equipment. The DSU provides loop equalization, remote and local testing capabilities, and a standard EIA/CCITT interface.

**Dedicated Line:** A communication line that is not switched. The term leased line is more common.

**Default:** This is a preset value or option in software packages, or in hardware configuration, that is used unless you specify otherwise.

**Default Address:** an address defined by the Universal Serial Bus Specification and used by a Universal Serial Bus device when it is first powered or reset. The default address is 00h.

**Default Pipe:** the message pipe created by Universal Serial Bus system software to pass control and status information between the host and a Universal Serial Bus device's Endpoint 0.

**Device:** a logical or physical entity that performs a function. The actual entity described depends on the context of the reference. At the lowest level, device may refer to a single hardware component, as in a memory device. At a higher level, it may refer to a collection of hardware components that perform a particular function, such as a Universal Serial Bus interface device. At an even higher level, device may refer to the function performed by an entity attached to the Universal Serial Bus; for example, a data/FAX modem device. Devices may be physical, electrical, addressable, and logical. When used as a non-specific reference, a Universal Serial Bus device is either a hub or a function.

**Device Address:** the address of a device on the Universal Serial Bus. The Device Address is the Default Address when the Universal Serial Bus device is first powered or reset. Hubs and functions are assigned a unique Device Address by Universal Serial Bus software.

**Device driver:** Software that controls how a computer communicates with a device, such as a printer or mouse.

**Digital Cross-connect System (DCS):** The CO device which splits and redistributes the T1 bandwidth. the DCS takes time slots from various T1 lines and alters them to provide the needed connectivity. DCS connections are made with software at an administrator's workstation.

**Digital Data:** Information represented by discrete values or conditions (contrast "Analog Data").

**Digital Loopback:** A technique used for testing the circuitry of a communications device. Can be initiated locally, or remotely (via a telecommunications device). The tested device decodes and encodes a received test message, then echoes the message back. The results are compared with the original message to determine if corruption occurred en route.

**Digital PBX:** A Private Branch Exchange that operates internally on digital signals. See also "Exchange".

**Digital Service, level 0 (DS0):** The world-wide standard speed (64 Kbps) for digital voice conversation using PCM (pulse coded modulation).

**Digital Service, level 1 (DS1):** The 1.544M bps voice standard (derived from an older Bell System standard) for digitized voice transmission in North America. The 1.544M bps consists of 24 digitally-encoded 64 Kbps voice channels (north America) and 2.048M bps (30 channels) elsewhere.

**Digital Signal:** A discrete or discontinuous signal (e.g., a sequence of voltage pulses). Digital devices, such as terminals and computers, transmit data as a series of electrical pulses which have discrete jumps rather than gradual changes.

**Digital Signaling Rates (DSn):** A hierarchical system for transmission rates, where "DS0" is 64 Kbps (equivalent to ISDN B channel), and DS1 is 1.5 Mbps (equivalent to ISDN PRI).

**Digital Transmission:** A method of electronic information transmission common between computers and other digital devices. Analog signals are waveforms: a combination of many possible voltages. A computer's digital signal may be only "high" or "low" at any given time. Therefore, digital signals may be "cleaned up" (noise and distortion removed) and amplified during transmission.

**Digitize:** To convert an analog signal to a digital signal.

**DIP switch (pronounced "dip switch"):** A set of tiny toggle switches, built into a DIP (dual in-line package), used for setting configurable parameters on a PCB (printed circuit board).

**Downstream:** The direction of data flow from the host or away from the host. A downstream port is the port on a hub electrically farthest from the host that generates downstream data traffic from the hub. Downstream ports receive upstream data traffic.

**Driver:** When referring to hardware, an I/O pad that drives an external load. When referring to software, a program responsible for interfacing to a hardware device; that is, a device driver.

**Drop and Insert:** The process where a portion of information carried in a transmission system is demodulated ("Dropped") at an intermediate point and different information is included ("Inserted") for subsequent transmission.

**DTE (Data Terminal Equipment):** A term used to include any device in a network which generates, stores or displays user information. DTE is a telecommunications term which usually refers to PCs, terminals, printers, etc.

**DTMF (Dual-Tone MultiFrequency):** A generic push-button concept made popular by AT&T TouchTone.

**DWORD:** Double word. A data element that is 2 words, 4 bytes, or 32 bits in size.

**Dynamic Insertion and Removal:** the ability to attach and remove devices while the host is in operation.

## E

**E&M:** A telephony trunking system used for either switch-to-switch, or switch-to-network, or computer/telephone system-to-switch connection.

**EIA:** The Electronics Industries Association is a trade organization in Washington, DC that sets standards for use of its member companies. (See RS-232, RS-422, RS530.)

**Encapsulation:** A technique used by network-layer protocols in which a layer adds header information to the protocol data unit from the preceding layer. Also used in "enveloping" one protocol inside another for transmission. For example, IP inside IPX.

**End User:** The user of a host.

**Endpoint:** See Device Endpoint.

**Endpoint Address:** The combination of a Device Address and an Endpoint Number on a Universal Serial Bus device.

**Endpoint Number:** A unique pipe endpoint on a Universal Serial Bus device.

**Ethernet:** A 10-megabit baseband local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by using collision detection and transmission. Ethernet uses carrier sense multiple access with collision detection (CSMA/CD).

**Excess Zeros:** A T1 error condition that is logged when more than 15 consecutive 0s or fewer than one 1 bit in 16 bits occurs.

**Exchange:** A unit (public or private) that can consist of one or more central offices established to serve a specified area. An exchange typically has a single rate of charges (tariffs) that has previously been approved by a regulatory group.

**Exchange Area:** A geographical area with a single uniform set of charges (tariffs), approved by a regulatory group, for telephone services. Calls between any two points within an exchange area are local calls. See also "Digital PBX", "PBX".

**Exchange Termination (ET):** The carrier's local exchange switch. Contrast with "Loop Termination - LT".

**Explicit Congestion Management:** The method used in frame relay to notify the terminal equipment that the network is overly busy. The use of FECN and BECN is called explicit congestion management. Some end-to-end protocols use FECN or BECN, but usually not both options together. With this method, a congestion condition is identified and fixed before it becomes critical. Contrast with "implicit congestion".

**Extended Super Frame (ESF):** One of two popular formats for framing bits on a T1 line. ESF framing has a 24-frame super-frame, where robbed bit signaling is inserted in the LSB (bit 8 of the DS-0 byte) of frames 6, 12, 18 and 24. ESF has more T1 error measurement capabilities than D4 framing. Both ESF and B8ZS are typically offered to provide clear channel service.

## F

**Failed Seconds:** A test parameter where the circuit is unavailable for one full second.

**Failed Signal:** A T1 test parameter logged when there are more than 9 SES (Severely Errored Seconds).

**Fax (facsimile):** Refers to the bit-mapped rendition of a graphics-oriented document (fax) or to the electronic transmission of the image over telephone lines (faxing). Fax transmission differs from data transmission in that the former is a bit-mapped approximation of a graphical document and, therefore, cannot be accurately interpreted according to any character code.

**Firmware:** A category of memory chips that hold their content without electrical power, they include ROM, PROM, EPROM and EEPROM technologies. Firmware becomes "hard software" when holding program code.

**Foreground:** The application program currently running on and in control of the PC screen and keyboard. The area of the screen that occupies the active window. Compare with "background".

**Fractional T1 (FT1):** A digital data transmission rate between 56 Kbps (DS0 rate) and 1.544M bps (the full T1 rate - in North America). FT1 is typically provided on 4-wire (two copper pairs) UTP. Often used for video conferencing, imaging and LAN interconnection due to its low cost and relatively high speed. FT1 rates are offered in 64 Kbps multiples, usually up to 768 Kbps.

**Frequency:** A characteristic of an electrical or electronic signal which describes the periodic recurrence of cycles. Frequency is inversely proportional to the wavelength or pulse width of the signal (i.e., long wavelength signals have low frequencies and short wavelength signals yield high frequencies).

**Foreign Exchange (FX):** A CO trunk with access to a distant CO, allowing ease of access and flat-rate calls anywhere in the foreign exchange area.

**Foreign Exchange Office (FXO):** Provides local telephone service from a CO outside of ("foreign" to) the subscriber's exchange area. In simple form, a user can pick up the phone in one city and receive a tone in the foreign city. Connecting a POTS telephone to a computer telephony system via a T1 link requires a channel bank configured for the FX connection. To generate a call from the POTS set to the computer telephony system, a FXO connection must be configured.

**Foreign Exchange Station (FXS):** See FX, FXO. To generate a call from the computer telephony system to the POTS set, an FXS connection must be configured.

**Forward Explicit Congestion Notification (FECN):** A bit that tells you that a certain frame on a particular logical connection has encountered heavy traffic. The bit provides notification that congestion-avoidance procedures should be initiated in the same direction of the received frame. See also BECN (Backward Explicit Congestion Notification).

**Function:** A Universal Serial Bus device that provides a capability to the host. For example, an ISDN connection, a digital microphone, or speakers.

## G

**Gateway:** 1. A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures. 2. A network that connects hosts.

**Graphical User Interface (GUI):** A type of computer interface consisting of a visual metaphor of a real-world scene, often of a desktop. Within that scene are icons, representing actual objects, that the user can access and manipulate with a pointing device.

## H

**Handshaking:** A process that two modems go through at the time of call setup to establish synchronization over the data communications link. It is a synchronization and negotiation process accomplished by the exchange of predefined, mutually recognized control codes.

**Hexadecimal:** A base 16 numbering system used to represent binary values. Hex uses the numbers 0-9 and the letters A-F; usually notated by an "h" (e.g., "4CF h", read "four charley fox, hex"). The result is that one hex digit represents a 4-bit value.

**High-level Data Link Control (HDLC):** An ISO standard, bit-oriented data communications protocol that provides nearly error-free data transfers.

**Host:** The host computer system where the Universal Serial Bus host controller is installed. This includes the host hardware platform (CPU, bus, etc.) and the operating system in use.

**Host Controller:** The host's Universal Serial Bus interface. A hardware device that provides the interface to the Host Controller Driver (HCD) and the USB bus.

**Host Controller Driver (HCD):** Software that provides an interface to the USB Driver and the Host Controller. (The interface to the Host Controller is defined by the OHCI spec.

## I

**Implicit congestion management:** A method of informing the terminal that the network is busy. This method relies on the end-system protocol to detect and fix the congestion problem. (TCP/IP is an example of a protocol using only implicit congestion management.) See also "explicit congestion management".

**In-band:** Refers to the type of signalling over the conversion path on an ISDN call. Contrast "out-of-band".

**Insufficient Ones:** A T1 error condition that is logged when fewer than one 1 in 16 0s or less than 12.5 % average 1s density is received.

**Inter Exchange Carrier (IEC):** The long distance company (LE) who's central office provides the point of reference for T1 access. Any common carrier authorized by the FCC to carry customer transmissions between LATAs.

**Internet:** Refers to the computer network of many millions of university, government and private users around the world. Each user has a unique Internet Address.

**Internet Address (IP Address):** A unique 32-bit address for a specific TCP/IP host on a network. Normally printed in dotted decimal format (e.g., 129.128.44.227).

**Internet Protocol (IP):** A protocol used to route data from its source to its destination in an Internet environment. The Internet Protocol was designed to connect local area networks. Although there are many protocols that do this, IP refers to the global system of interconnecting computers. It is a highly distributed protocol (each machine only worries about sending data to the next step in the route).

**Internetwork Packet Exchange (IPX):** A NetWare communications protocol used to route messages from one node to another. IPX packets include network addresses and can be routed from one network to another. An IPX packet can occasionally get lost when crossing networks, thus IPX does not guarantee delivery of a complete message. Either the application has to provide that control, or NetWare's SPX protocol must be used.

**Interoperable:** Devices from different vendors that can exchange information using a standard's base protocol.

**Interrupt Request:** A hardware signal that allows a device to request attention from a host. The host typically invokes an interrupt service routine to handle the condition which caused the request.

**I/O Addresses:** Locations within the I/O address space of your computer used by a device, such as an expansion card, a serial port, or an internal modem. The address is used for communication between software and a device.

**IRQ Level (Interrupt Request Level):** The notification a processor receives when another portion of the computer's hardware requires its attention. IRQs are numbered so that the device issuing the IRQ can be identified, and so IRQs can be prioritized.

**Isochronous data:** Information delivered in a continuous stream at a steady rate.

**ISA (Industry Standards Architecture) (pronounced "ice a"):** The classic 8 or 16-bit architecture introduced with IBM's PC-AT computer.

**ISDN (Integrated Services Digital Network):** An International telecommunications standard for transmitting voice, video and data over a digital communications line. ISDN is a world-wide telecommunications service that uses digital transmission and switching technology to support voice and digital data communications. Frame relay was partially based on ISDN's data link layer protocol (LAPD). Frame relay can be used to transmit across ISDN services offering circuit-switched connection at 64 Kbps and higher speeds. Contrast Public Switched Telephone Network (PSTN).

**ITU-TSS (formerly CCITT):** International Telecommunications Union-Telecommunications Sector; the United Nations organization that prepares standards ("Recommendations") for resolving communications issues and problems.

## J

No Entries.

## K

**Key Telephone System (KTS):** Phone devices with multiple buttons that let you select incoming or outgoing CO phone lines directly. Similar in operation to a PBX, except with a KTS you don't have to dial a "9" to call outside the building.

**Key Service Unit (KSU):** A small device containing the switching electronics for a business key telephone system (KTS).

**Key Set:** A phone set with several buttons for call holding, line pickup, intercom, autodialing, etc. Also called a touchtone phone (Ericsson) and a KTS (Key Telephone Set).

## L

**LAPB:** Link Access Procedure Balanced; based on the X.25 Layer 2 specification. A full-duplex, point-to-point, bit-synchronous protocol commonly used as a data link control protocol to interface X.25 DTEs. LAPB is the link initialization procedure that establishes and maintains communications between the DTE and the DCE.

**LAPD:** Link Access Protocol for the D-Channel; based on the ISDN Q.921 specification. A full-duplex point-to-point bit-synchronous link-level protocol for ISDN connections; different from LAPB in its framing sequence. Transmission is in units called "frames", and a frame may contain one or more X.25 packets.

**Line Coding:** The representation of 1s and 0s on a T1 line. The two methods of line coding commonly used, B8ZS and AMI, differ in the restrictions placed on user data. T1 line coding ensures that sufficient timing information is sent with the digital signal to ensure recovery of all the bits at the far end. Timing information on the T1 line is included in the form of 1s in the data stream; a long string of 0s in the data stream could cause problems recovering the data.

**Line Termination (LT):** The electronics at the ISDN network side of the user/network interface that complements the NT1 at the user side. The LT and the NT1 together provide the high-speed digital line signals required for BRI access.

**Listed Directory Number (LDN):** The main number assigned by the telco; the number listed in the phone directory and also provided by Directory Assistance. Some devices can have more than one LDN, such as ISDN devices that have one LDN for voice and another LDN for data.

**Local Area Network (LAN):** 1. A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. 2. A LAN does not use store-and-forward techniques. 3. A network in which a set of devices are connected to one another for a communication and that can be connected to a larger network.

**Local Access and Transport Area (LATA):** A post-divestiture geographical area generally equivalent to a Standard Metropolitan Statistical Area. At divestiture, the territory served by the Bell system was divided into approximately 161 LATAs. The Bell Operating Companies (BOCs) provide Intra-LATA services.

**Local Exchange Carrier (LEC):** The local phone company which provides local (i.e., not long distance) transmission services. AKA "telco". LECs provide T1 or FT1 access to LDCs (unless the T1 circuit is completely intra-LATA). Inter-LATA T1 circuits are made up of a combination of Access and Long Haul facilities.

**Local Management Interface (LMI):** A specification for frame relay equipment that defines status information exchange.

**Local Loop:** A transmission path, typically twisted-pair wire, between an individual subscriber and the nearest public telecommunications network switching center. The wires provide ISDN service, but require an NT1 at the user end and an LT at the network end. (AKA, "loop" or "subscriber loop".)

**Logical Link Control (LLC2):** In a local area network, the protocol that governs the exchange of transmission frames between data stations independently of how the transmission medium is shared. The LLC2 protocol was developed by the IEEE 802 committee and is common to all LAN standards.

**Logical Unit (LU):** A type of network accessible unit that enables end users to gain access to network resources and communicate with each other.

**Long Haul:** The T1 element that connects to the Access portion of the long distance company's (LDC's) central office. The LDC is commonly called the point of presence (POP). Each LDC has a number of POPs, located throughout the country. The LDC is also called an IEC (Inter Exchange Carrier).

**Long Haul Communications:** The type of phone call reaching outside of a local exchange (LE).

## M

**Management Information Base (MIB):** A database of network management information used by the Common Management Information Protocol (CMIP) and the Simple Network Management Protocol (SNMP).

**Megacom:** An AT&T service with a normal WATS line (typically T1) between the customer premise and the AT&T serving class 4 CO are the customer's responsibility.

**MegaLink:** BellSouth's leased T1 service.

**Message:** Associated with such terms as packet, frame, and segment. 1. In information theory, an ordered series of characters intended to convey information. 2. An assembly of characters and sometimes control codes that is transferred as an entry from an originator to one or more recipients.

**Message Pipe:** A pipe that transfers data using a request/data/status paradigm. The data has an imposed structure which allows requests to be reliably identified and communicated.

**Modem:** A communications device that enables a computer to transmit information over a phone line. It converts the computer's digital signals into analog signals to send over a phone line and converts them back to digital signals at the receiving end. Modems can be internal and fit into an expansion slot, or external and connect to a serial port.

**Multiplexer (Mux):** 1. A device that takes several input signals and combines them into a single output signal in such a manner that each of the input signals can be recovered. 2. A device capable of interleaving the events of two or more activities or capable of distributing the events of an interleaved sequence to the respective activities. 3. Putting multiple signals on a single channel.

**Multiprotocol:** A device that can interoperate with devices utilizing different network protocols.

**Multithreading:** The ability of a software system to be able to handle more than one transaction concurrently. This is contrasted to the case where a single transaction is accepted and completely processed before the next transaction processing is started.

## N

**Network:** A group of computers connected by cables or other means and using software that enables them to share equipment, such as printers and disk drives to exchange information.

**Node:** Any point within a network which has been assigned an address.

## O

**OHCI (OpenHCI):** Open Host Controller Interface Specification for USB. All transfers on the USB are initiated by the host system's host controller. The host controller is responsible for controlling traffic on the USB and can be appropriately programmed to transfer data to and from USB devices. This is typically a PCI device that can be programmed to run a given schedule of transfers on the USB and bus master the results into memory for processing by the host software. There are currently two standards for host controllers: OpenHCI (OHCI or Open Host Controller Interface) and UHCI (Universal Host Controller Interface). Both these standards define register level interfaces of the host controller to PCI bus. Bandwidth allocation over the USB is software managed and is done by the programming of the host controller.

**Object-Oriented:** A method for structuring programs as hierarchically organized classes describing the data and operations of objects that may interact with other objects.

**Office Channel Unit - Data Port (OCU-DP):** The CO channel bank used as the interface between the customer's DSU and the channel bank.

**Off-hook:** The condition of a device which has accessed a phone line (with or without using the line). In modem use, this is equivalent to a phone handset being picked up. Dialing and transmission are allowed, but incoming calls are not answered. Contrast "on-hook".

**Off Premise Extension (OPX):** An extension or phone that terminates in a location other than that of the PBX. Commonly used to provide a corporate member with an extension of the PBX at home.

**Ones Density:** The measure of the number of logical 1s on a T1 line compared to a given total number of bits on that line; used for timing information in data recovery in AMI and B8ZS.

**On-Hook:** The condition of a device which has not accessed a phone line. In modem use, this is equivalent to a telephone handset that has not been picked up. In other words, it can receive an incoming call. Contrast "off-hook".

**Open Shortest Path First (OSPF):** A hierarchical Interior Gateway Protocol (IGP) routing algorithm for IP that is a proposed standard for the Internet. OSPF incorporates least-cost routing, equal-cost routing, and load balancing.

**Outage:** The measure of the time during which a circuit is not available for use due to service interrupt. Outage is the complement of circuit "availability" (100% minus % available = % outage).

**Out-of-band:** Signaling that is separated from the channel carrying the information (e.g., the voice/data/video signal is separate from the carrier signal). Dialing and various other "supervisory" signals are included in the signaling element. Contrast "In-band" signaling.

**Out of Frame (OOF):** A T1 alarm condition that is logged on the loss of 2, 3 or 4 of 5 consecutive FT framing bits.

## P

**Packet:** 1. In data communication, a sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole. The data, control signals and, possibly, error control information are arranged in a specific format. 2. Synonymous with data frame. 3. In TCP/IP, the unit of data passed across the interface between the Internet layer and the link layer. A packet includes an IP header and data. A packet can be a complete IP datagram or a fragment of an IP diagram. 4. In X.25, a data transmission information unit. A group of data and control characters, transferred as a unit, determined by the process of transmission. Commonly used data field lengths in packets are 128 or 256 bytes. 5. The field structure and format defined in the CCITT X.25 recommendation.

**Packet Assembler/Disassembler (PAD):** Used by devices to communicate over X.25 networks by building or stripping X.25 information on or from a packet.

**Packet Data:** The information format ("packetized") used for packet-mode calls.

**Packet Mode:** Refers to the switching of chunks of information for different users using statistical multiplexing to send them over the same transmission facility.

**Parity bit:** An extra bit attached to each byte of synchronous data used to detect errors in transmission.

**Permanent Virtual Circuit (PVC):** A connection between two endpoints dedicated to a single user. In ISDN, PVCs are established by network administration and are held for as long as the user subscribes to the service.

**Physical Unit (PU):** The component that manages and monitors the resources (such as attached links and adjacent link stations) associated with a node, as requested by an SSCP via an SSCP-PU session. An SSCP activates a session with the physical unit in order to indirectly manage, through the PU, resources of the node such as attached links. This term applies to type 2.0, type 4, and type 5 nodes only.

**Pipe:** A logical abstraction representing the association between an endpoint on a device and software on the host. A pipe has several attributes; for example, a pipe may transfer data as streams (Stream Pipe) or messages (Message Pipe).

**Plug and Play (PnP):** A technology for configuring I/O devices to use non-conflicting resources in a host. Resources managed by Plug and Play include I/O address ranges, memory address ranges, IRQs, and DMA channels.

**Point of Presence (POP):** The central office's end points of the long distance carriers.

**Point-to-Point Protocol (PPP):** A protocol that lets a PC user access TCP/IP (Internet memeber) using an ISDN terminal adapter or a high-speed modem over a standard phone line.

**Polling:** Asking multiple devices, one at a time, if they have any data to transmit.

**Port:** Point of access to or from a system or circuit. For Universal Serial Bus, the point where a Universal Serial Bus device is attached.

**Primary Rate Interface (PRI):** Used on ISDN. In North America, and Japan, PRI is one 64Kbps D channel and 23 B channels. Elsewhere, it is one D channel and 30 B channels.

**Primitive:** An abstract representation of interaction across the access points indicating that information is being passed between the service user and the service provider. The OSI Reference Model defines four types of primitives: Request, Indication, Response and Confirm.

**Private Branch Exchange (PBX):** A phone exchange located on the customer's premises. The PBX provides a circuit switching facility for phone extension lines within the building, and access to the public phone network. See also "Exchange".

**PROM (Programmable Read Only Memory - pronounced "prom"):** A permanent memory chip that can be programmed or filled by the customer after by the manufacturer has set initial values. Contrast with ROM.

**Protocol:** 1. A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. 2. In Open Systems Interconnection architecture, a set of semantic and syntactic rules that determine the behavior of entities in the same layer in performing communication functions. 3. In SNA, the meanings of and the sequencing rules for requests and responses used for managing the network, transferring data, and synchronizing the states of network components. 4. Synonymous with line control discipline.

**PSTN (Public Switched Telephone Network):** A worldwide public voice telephone network that is used as a telecommunications medium for the transmission of voice, data and other information.

**Public Data Network (PDN):** A packet-switched network that is available to the public for individual ("subscriber") use. Typically, controlled by a government or a national monopoly.

**Public Switched Telephone Network (PSTN):** The group of circuit-switching voice carriers, which are commonly used as analog data communications services.

**Pulse Code Modulation (PCM):** 1. In data communication, variation of a digital signal to represent information; for example, by means of pulse amplitude modulation (PAM), pulse duration modulation (PDM), or pulse position modulation (PPM). 2. Transmissions of analog information in digital form through sampling and encoding the samples with a fixed number of bits.

**Pulse dialing:** One of two methods of dialing a telephone, usually associated with rotary-dial phones. Compare with "tone dialing".

## Q

**Quantizing:** The process of analog-to-digital conversion by assigning a range, from the contiguous analog values, to a discrete number.

## R

**Random Access Memory (RAM):** A computer's primary workspace. All data must be stored in RAM (even for a short while), before software can use the processor to manipulate the data. Before a PC can do anything useful it must move programs from disk to RAM. When you turn it off, all information in RAM is lost.

**Rate Enforcement:** The concept in frame relay where frames sent faster than the CIR are to be carried only if the bandwidth is available, otherwise they are to be discarded. (The frame relay network assumes that anything exceeding the CIR is of low priority.) Rate enforcement makes sure that the network will not get so congested that it isn't able to meet the agreed on CIR.

**Recognized Private Operating Agency (RPOA):** A corporation, private or government-controlled, that provides telecommunications services. RPOAs, such as AT&T, participate as non-voting members in the CCITT.

**Red Alarm:** A T1 error condition generated when a local failure (e.g., loss of synchronization) exists for 2.5 seconds, causing a Carrier Group Alarm (CGA). See also "Blue Alarm" and "Yellow Alarm".

**Request for Comment (RFC):** A set of papers in which Internet standards (published and proposed), along with generally-accepted ideas, proposals, research results, etc. are published.

**RJ-11:** An industry standard interface used for connecting a telephone to a modular wall outlet; comes in 4-and 6-wire packages.

**RJ-45:** An 8-wire modular connector for voice and data circuits.

**Root Hub:** A Universal Serial Bus hub directly attached to the host controller. This hub is attached to the host; tier 0.

**Root Port:** The upstream port on a hub.

**Router:** A device that connects two networks using the same networking protocol. It operates at the Network Layer (Layer 3) of the OSI model for forwarding decisions.

**Routing Information Protocol (RIP):** A distance vector-based protocol that provides a measure of distance, or hops, from a transmitting workstation to a receiving workstation.

**RS-232C:** An EIA standard for a serial interface between computers and peripheral devices (modem, mouse, etc.). It uses a 25-pin DB-25, or a 9-pin DB-9 connector. The RS-232 standard defines the purposes, electrical characteristics and timing of the signals for each of the 25 lines.

**RS-422:** The EIA standard for a balanced interface with no accompanying physical connector. RS-422 products can use screw terminals, DB9, various DB25, and DB37 connectors.

**RS-530:** The EIA standard for the mechanical/electrical interface between DCEs and DTEs transmitting synchronous or asynchronous serial binary data. RS-530 provides for high data rates with the same connector used for RS-232; however, it is incompatible with RS-232.

## S

**Serial Port:** The connector on a PC used to attach serial devices (those that need to receive data one bit after another), such as a mouse, a printer or a modem. This consists of a 9- or 25-pin connector that sends data in sequence (bit by bit). Serial ports are referred to as "COMx" ports, where x is 1 to 4 (i.e., COM1 through COM4). A serial port contains a conversion chip called a "UART" which translates between internal parallel and external serial formats.

**Service:** The requirements offered by an RPOA to its customers to satisfy specific telecommunications needs.

**Severely Errored Seconds (SES):** Refers to a typical T1 error event where an error burst occurs (a short term, high bit-error rate that is self-clearing). Per the ITU-T (CCITT) G.821: any second in which the BER is less than  $1 \times 10^{-3}$ .

**Signaling:** The process of establishing, maintaining, accounting for, and terminating a connection between two endpoints (e.g., the user premises and the telco CO). Central office signals to the user premises can include ringing, dial tone, speech signals, etc. Signals from the user's telephone can include off-hook, dialing, speech to far-end party, and on-hook signals. In-band signaling techniques include pulse and tone dialing. With common channel signaling, information is carried out-of-band.

**Simple Network Management Protocol (SNMP):** TCP/IP protocol that allows network management.

**Simultaneous Voice Data (SVD):** A technology for letting a user send data via a modem, and use a handset to talk to another user at the same time over the same connection. The alternative, making a second call, can be expensive or even impossible. The uses for SVD are telecommuting, videoconferencing, distant learning, tech support, etc.

**Stop Bit:** One of the variables used for timing in asynchronous data transmission. Depending on the devices, each character may be trailed by 1, 1.5, or 2 stop bits.

**Switched Virtual Circuit (SVC):** A data transmission type where the connection is maintained only until the call is cleared.

**Switched Line:** In communications, a physical channel established by dynamically connecting one or more discrete segments. This connection lasts for the duration of the call, after which each segment can be used as part of a different channel. Contrast with leased line.

**Switched Network:** A network in which a temporary connection is established from one point via one or more segments.

**Synchronous Data Link Control (SDLC):** A discipline conforming to subsets of the Advanced Data Communications Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Organization for Standardization, for managing synchronous, code-transparent, serial-by-bit information transfer over a link connection. Transmission exchanges may be duplex, or half-duplex over switched or nonswitched links. The configuration of the link connection may be point-to-point, multipoint, or loop.

**Synchronous Transmission:** The transmission of data which involves sending a group of characters in a packet. This is a common method of transmission between computers on a network or between modems. One or more synchronous characters are transmitted to confirm clocking before each packet of data is transmitted. Compare to Asynchronous Transmission.

**Systems Network Architecture (SNA):** The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through, and controlling the configuration and operation of, networks.

## T

**TCP/IP:** A set of communication protocols that support peer-to-peer connectivity functions for both local and wide area networks.

**T Carrier:** The generic name for a digitally multiplexed carrier system. In the North American digital hierarchy, a T is used to designate a DS (digital signal) level hierarchy. Examples: T1 (DS1) is a 1.544 M bps 24-channel designation. In Europe, T1 is called E1. The T Carrier system was originally designed for transmitting digitized voice signals, but has since been adapted for digital data applications.

**T1:** A digital transmission link capable of 1.544M bps. T1 uses two pairs of normal UTP, and can handle 24 voice conversations, each digitized at 64 Kbps. T1 is a standard for digital transmission in the U.S., Canada, Japan and Hong Kong. T1 is the access method for high-speed services such as ATM, frame relay, and SMDS. See also T Carrier, T1 line and FT1.

**T1 Channel Tests:** A set of diagnostics that vary by carrier, used to verify a T1 channel operation. Can include Tone, Noise Level, Impulse Noise Level, Echo Cancelers, Gain, and Crosstalk testing.

**T1 Framing:** To digitize and encode analog voice signals requires 8000 samples per second (twice the highest voice frequency of 4000 Hz). Encoding in an 8-bit word provides the basic T1 block of 64 Kbps for voice transmission. This "Level 0 Signal, as its called, is represented by "DS-0", or Digital Signal at Level 0. 24 of these voice channels are combined into a serial bit stream (using TDM), on a frame-by-frame basis. A frame is a sample of all 24 channels; so adding in a framing bit gives a block of 193 bits ( $24 \times 8 + 1 = 193$ ). Frames are transmitted at 8000 per second (the required sample rate), creating a 1.544M ( $8000 \times 193 = 1.544M$ ) transmission rate.

**T1 Line:** A digital communications facility that functions as a 24-channel pathway for data or voice transmission. A T1 line is composed of two separate elements: the Access element and the Long Haul element.

**T1 Mux:** A device used to carry many sources of data on a T1 line. The T1 mux assigns each data source to distinct DS0 time slots within the T1 signal. Wide bandwidth signals take more than one time slot. Normal voice traffic or 56/64 Kbps data channels take one time slot. The T1 mux may use an internal or external T1 DSU; a "channel bank" device typically uses an external T1 CSU.

**Transmission Control Protocol / Internet Program (TCP/IP):** A multi-layer set of protocols developed by the US Department of Defense to link dissimilar computers across dissimilar and unreliable LANs.

**Terminal:** The screen and keyboard device used in a mainframe environment for interactive data entry. Terminals have no "box", which is to say they have no file storage or processing capabilities.

**Terminal Adapter (TA):** An ISDN DTE device for connecting a non-ISDN terminal device to the ISDN network. Similar to a protocol converter or an interface converter, a TA connects a non-ISDN device between the R and S interfaces. Typically a PC card.

**Tie line:** A dedicated circuit linking two points without having to dial a phone number (i.e., the line may be accessed by lifting the telephone handset or by pushing a button).

**Time-Division Multiplexing (TDM):** Division of a transmission facility into two or more channels by allotting the common channel to several different information channels, one at a time.

**Time Slot:** One of 24 channels within a T1 line. Each channel has a 64 Kbps maximum bandwidth. "Time slot" implies the time division multiplexing organization of the T1 signal.

**Toll Call:** A call to a location outside of your local service area (i.e., a long distance call).

**Tone dialing:** One of two methods of dialing a telephone, usually associated with Touch-Tone® (push button) phones. Compare with pulse dialing.

**Topology:** Physical layout of network components (cables, stations, gateways, and hubs). Three basic interconnection topologies are star, ring, and bus networks.

**Transmission Control Protocol (TCP):** A communications protocol used in Internet and in any network that follows the US Department of Defense standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It assumes that the Internet protocol is the underlying protocol.

**Transport Layer:** Layer 4 of the Open Systems Interconnection (OSI) model; provides reliable, end-to-end delivery of data, and detects transmission sequential errors.

**Transport Protocol Data Unit (TPDU):** A transport header, which is added to every message, contains destination and source addressing information that allows the end-to-end routing of messages in multi-layer NAC networks of high complexity. They are automatically added to messages as they enter the network and can be stripped off before being passed to the host or another device that does not support TPDU's.

**Trunk:** Transmission links that interconnect switching offices.

**TSR (terminate and stay resident):** A software program that remains active and in memory after its user interface is closed. Similar to a daemon in UNIX environments.

**Tunneling:** Encapsulation data in an IP packet for transport across the Internet.

**Twisted pair wiring:** A type of cabling with one or more pairs of insulated wires wrapped around each other. An inexpensive wiring method used for LAN and telephone applications, also called UTP wiring.

**Type A:** The upstream (USB Type A) connector. A Type A Connector is for those devices on which the external cable is permanently attached. Connectors for USB come in two designs: the 'A' and 'B' types. Upstream connections (computer, hub input, etc.) are made using the 'A' type connector, downstream connections (peripherals, hub outputs) are made using the 'B' type connector. The USB spec defines two types of connectors to protect the bus from illegal topologies (e.g., connecting one downstream port back to another, etc.) and to prevent end-user confusion. This allows end users to easily attach the correct connectors to peripherals and ports. Type A Plug and receptacle are to be used for those devices on which the external cable is permanently attached to devices such as Keyboard, mouse and hubs. Series B Plug and receptacle are to be used for those devices that require an external detachable cable such as printers, scanners and modems.

**Type B:** The uplink (USB Type B) connector. A Type B Connector is for detachable external cables. Allows for double ended cable assemblies. Connectors for USB come in two designs: the 'A' and 'B' types. Upstream connections (computer, hub input, etc.) are made using the 'A' type connector, downstream connections (peripherals, hub outputs) are made using the 'B' type connector. The USB spec defines two types of connectors to protect the bus from illegal topologies (e.g., connecting one downstream port back to another, etc.) and to prevent end-user confusion. This allows end users to easily attach the correct connectors to peripherals and ports. Type A Plug and receptacle are to be used for those devices on which the external cable is permanently attached to devices such as Keyboard, mouse and hubs. Series B Plug and receptacle are to be used for those devices that require an external detachable cable such as printers, scanners and modems.

## U

**UART (Universal Asynchronous Receiver/Transmitter) (pronounced "you art"):** A chip that transmits and receives data on the serial port. It converts bytes into serial bits for transmission, and vice versa, and generates and strips the start and stop bits appended to each character.

**UHCI (Universal Host Controller Interface):** The USB Universal Host Controller Interface. All transfers on the USB are initiated by the host system's host controller. The host controller is responsible for controlling traffic on the USB and can be appropriately programmed to transfer data to and from USB devices. This is typically a PCI device that can be programmed to run a given schedule of transfers on the USB and bus master the results into memory for processing by the host software. There are currently two standards for host controllers: OpenHCI (OHCI or Open Host Controller Interface) and UHCI (Universal Host Controller Interface). Both these standards define register level interfaces of the host controller to PCI bus. Bandwidth allocation over the USB is software managed and is done by the programming of the host controller.

**UNIX:** An operating system developed by Bell Laboratories that features multiprogramming in a multi-user environment.

**Universal Serial Bus:** A collection of Universal Serial Bus devices and the software and hardware that allow them to connect the capabilities provided by functions to the host.

**Universal Serial Bus Device:** Includes hubs and functions. See device.

**Universal Serial Bus Driver:** The host resident software entity responsible for providing common services to clients that are manipulating one or more functions on one or more Host Controllers.

**Universal Serial Bus Interface:** The hardware interface between the Universal Serial Bus cable and a Universal Serial Bus device. This includes the protocol engine required for all Universal Serial Bus devices to be able to receive and send packets.

**Unshielded Twisted Pair (UTP):** Telephone-type wiring. Transmission media for 10Base-T.

**Upstream:** The direction of data flow towards the host. An upstream port is the port on a device electrically closest to the host that generates upstream data traffic from the hub. Upstream ports receive downstream data traffic.

**USB:** See Universal Serial Bus.

**USB D:** See Universal Serial Bus Driver.

**USB Performance categories:** Low Speed (Interactive Devices at 10-100 Kb/s); Medium Speed (Phone, Audio, Compressed Video at 500Kb/s - 10Mbps); High Speed (Video, Disk at 25-500 Mb/s)

## V

**V.25bis:** An ITU-T standard for synchronous communications between a mainframe or host and a modem using HDLC or other character-oriented protocol.

**V.54:** The ITU-T standard for local and remote loopback tests in modems, DCEs and DTEs. The four basic tests are:

- local digital loopback (tests DTE send and receive circuits),
- local analog loopback (tests local modem operation),
- remote analog loopback (tests comm link to the remote modem), and
- remote digital loopback (tests remote modem operation).

**Virtual Circuit:** A logical connection. Used in packet switching wherein a logical connection is established between two devices at the start of transmission. All information packets follow the same route and arrive in sequence (but do not necessarily carry a complete address).

## W

**Wide Area Network (WAN):** 1. A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network, and that may use or provide public communication facilities. 2. A data communications network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks, and national telephone networks. Contrast with local area network (LAN).

**Wide Area Telecommunications Service (WATS):** A low-cost toll service offered by most long distance and local phone companies. Incoming (800 call service, or IN-WATS) and outgoing WATS are subscribed to separately, but over the same line.

## X

**X.25:** ITU-T's definition of a three-level packet-switching protocol to be used between packet-mode DTEs and network DCEs. X.25 corresponds with layer 3 of the 7-layer OSI model.

## Y

**Yellow Alarm:** An error indication sent by the T1 device when it has not gotten a receive signal, or cannot synchronize on the receive signal received. Contrast "Red Alarm" and "Blue Alarm".

## Z

**Zero Byte Time Slot Interchange (ZBTSI):** A method for allowing 64 Kbps unrestricted user data (allowing all 0s in the user data). An alternative to (but not as popular as) B8ZS.



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