

**MultiModemISI Hybrid Series**  
**Model ISIH-2S/2U**

88301151

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# MultiModemISI Hybrid Series

## Model ISIH-2S/2U

88301151, Revision B

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### Patents

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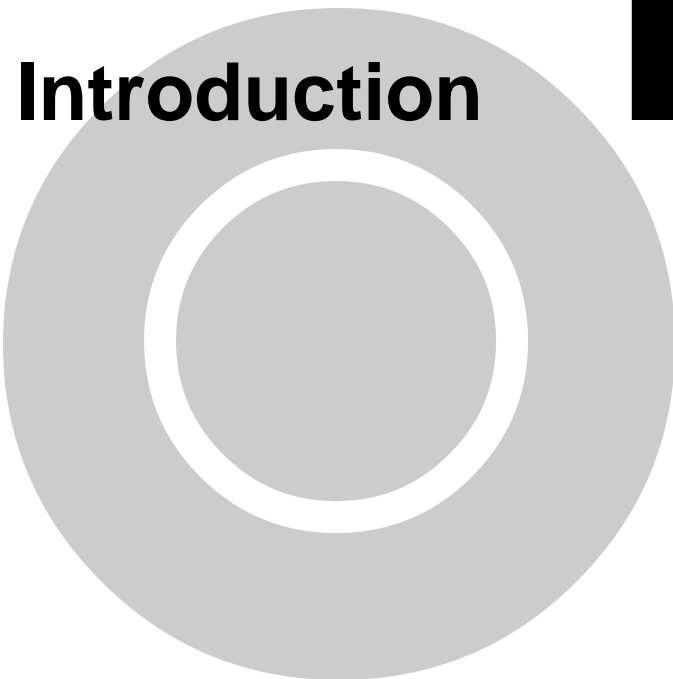
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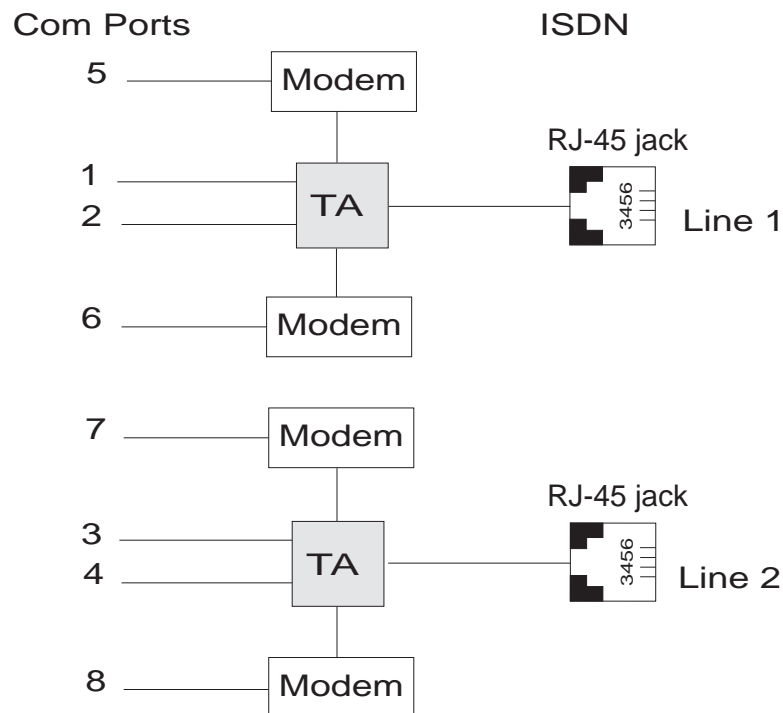
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# Introduction **1**



**W**elcome to Multi-Tech's new MultiModem Hybrid Series, model ISIHI-2S/2U, a multiport hybrid ISDN card for Remote Access Server (RAS) applications. Included on the ISIHI-2S/2U are four V.90/K56flex central site modems for incoming analog modem and fax calls, as well as two terminal adapters. Each terminal adapter appears as two ports to the server PC using the ISIHI-2S/2U. The terminal adapters identify incoming analog calls and route them to the central site modems. The card also supports dial-out applications via the modems or terminal adapters.

The ISIHI-2S/2U card features eight RAS ports using two Basic Rate Interface (BRI) ISDN lines. The eight ports allow a server to accept any combination of analog modem and digital ISDN calls, giving the user the flexibility to customize the settings of the terminal adapters and modems. Since the two BRI lines constitute only four Bearer channels, only four of the eight ports can be active at any one time. The two terminal adapters handle the four B-channels as four independent data connections (see diagram below).



From the perspective of the server PC, the ISIH-2S/2U is an 8-port serial card with eight devices permanently attached to the serial ports. The first four ports are the two terminal adapters, each of which appear as two ports. The remaining four ports are the four central site modems. The chart below summarizes the correlation of ports and devices.

Port Number	Device	ISDN Line Number
1	TA	1
2	TA	1
3	TA	2
4	TA	2
5	Modem	1
6	Modem	1
7	Modem	2
8	Modem	2

The ISIH-2S/2U server card is ideal for use in PC network environments because it provides an integrated hardware solution for remote access for both Windows NT and Novell-based LANs. To ensure smooth Novell network integration, the ISIH-2S/2U ships with a NetWare Loadable Module for NetWare Connect™ communication server that enables it to support state-of-the-art features such as remote dialing and modem pooling. The ISIH-2S/2U easily integrates into the Windows NT platform since it fully supports Microsoft's Remote Access Server software, which allows it to operate comfortably with popular network protocols such as TCP/IP and Net BIOS. The ISIH-2S/2U ships with drivers for other multiuser operating systems such as SCO®UNIX®.

This Owner's Manual will help you install, configure, test, and use the ISIH-2S/2U. The manual contains product specifications, installation instructions, and technical support information to assist you in the installation process. This manual is written for audiences with basic PC skills; therefore, step-by-step instructions for basic operations such as logging in and file editing are not included.

## Modem Description/Features

ISIHI-2S/2U modems include an Intel 20 MHz 80186 processor and 254K of RAM that work dynamically to allocate resources to the most active modems.

Simple to install, the ISIHI-2S/2U can be used to add multiport, Enhanced V.34 modem communications to a network host or server as easily as plugging in an expansion card, loading the driver software, and connecting the phone lines.

The ISIHI-2S/2U contains four modems, which meet the proposed Enhanced V.34 ITU standard for data signalling rates as high as 33.6/31.2 Kbps full-duplex mode. They support and are compatible with EIA extended Automode, adaptive line probing, automatic symbol rate and carrier frequency during startup, and retrain and rate renegotiation (in 2400 bps increments.)

The ISIHI-2S/2U features CCITT V.42 error correction and V.42bis data compression, providing 100% error-free data transmission. V.42 error correction incorporates MNP Classes 3 and 4 and LAP-M. You can select V.42bis data compression for 4-1 throughput or MNP Class 5 for 2-1 throughput.

ISIHI-2S/2U modems offer interactive automatic dialing as well as Command Mode option configuration. You can store up to ten command line/telephone numbers (up to 60 characters each) in the ISIHI-2S/2U's nonvolatile memory.

ISIHI-2S/2U modems offer pulse or tone dialing and recognize dial tones and busy signals for reliable call-progress detection. They detect AT&T calling card tones and are FCC-registered for connecting to telephone networks without Data Access Arrangements (DAAs).

They also feature Remote Configuration, which allows you to assist users at remote sites, saving you the time and trouble of site visits and preventing misinterpretation of configuration instructions.

The ISIHI-2S/2U meets the CCITT V.17 standard for sending and receiving faxes. When lined to a compatible fax machine or modem, ISIHI-2S/2U modems can transmit faxes at 14.4 Kbps. They meet the CCITT's Group 3 Designation for sending and receiving faxes at 9600 bps and Group 2 Designation for sending and receiving faxes at 1800 bps. The ISIHI-2S/2U also is downward-compatible to speeds as low as 300 bps, so you can send and receive faxes with virtually any fax machine in the world.



## Terminal Adapter Description/Features

ISIH-2S/2U terminal adapters have S/T ports to connect to the ISDN network and analog ports to connect to a telephone, modem, or fax machine. They ship with a software configuration utility for Windows® 95, Windows NT, and ConfigMenu (a built-in configuration utility for DOS and Windows 3.x operating systems). The TAs also accept AT commands, enabling them to use the same communications software as analog modems.

ISIH-2S/2U terminal adapters are compatible with EuroISDN switch protocol. They communicate using ISDN BRI (2B+D) service, which provides up to 128 Kbps data and voice communications. They automatically detect whether an incoming call is voice or data and handle it appropriately.

The ISIH-2S/2U terminal adapters communicate over public ISDN telephone lines. Features include the following:

- Compatibility with NET3, AT&T 5ESS, NT DMS-100, US National ISDN-1 switch protocols
- Automatically detect if incoming call is voice or data
- ISDN BRI (2B+D)
- AT command and S-Register controls and Result Code responses
- Use the same communications software as existing analog modems
- V.120, or PPP compatible
- Supports PPP (Point-to-Point Protocol) high speed ISDN connections
- Windows NT and Windows 95 software utility and a firmware utility for easy ISDN line configuration
- Flash PROM for easy firmware upgrades
- Automatic detection of the data protocol for answering incoming data calls
- Embedded protocol analyzer for troubleshooting the connection to the ISDN network

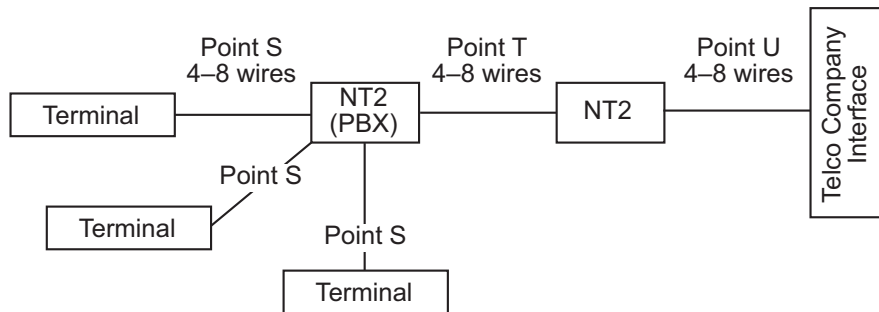
The ISDN TAs provide data communication using Basic Rate Interface (BRI). They provide two 64 Kbps *bearer* channels for voice or data and one 16 Kbps D channel for signaling information (2B+D) and are compatible with V.120 and PPP.

The TAs provides dial-up asynchronous communication capability with other personal computers, terminals, online computer services, or other types of computer systems.

**What is a S/T-Interface?** An ISDN Basic Rate (BRI) U-Loop consists of 2 conductors from the CO (telephone company central office) to the customer premises. Equipment on both sides of the U-loop is carefully designed to deal with the long length of the U-loop and the noisy environment it operates in. At the customer premises, the U-loop is terminated by an NT1 (network termination 1) device. An NT1 (network terminator 1) is a device that provides an interface between the two-wire twisted-pairs used by telephone companies in their ISDN BRI network and an end-user's four wire terminal equipment. The NT1 drives an S/T-bus that usually is 4 wires but in some cases may be 6 or 8 wires.

The name of the S/T bus comes from the letters used in the ISDN specifications to refer to two reference points, S and T. Point T refers to the connection between the NT1 device and customer supplied equipment. Terminals can connect directly to NT1 at point T, or there may be a PBX (private branch exchange, e.g., a customer-owned telephone exchange). When a PBX is present, point S refers to the connection between the PBX and the terminal.

Note that in ISDN terminology, *terminal* can mean any sort of end-user ISDN device, such as data terminals, telephones, FAX machines, etc. The following diagram reflects interface points in a typical ISDN network.



## Manual Organization

**Chapter 1: Introduction**—Introduces and describes the ISIHI-2S/2U. It describes features, provides manual organization, and lists technical specifications.

**Chapter 2: Hardware Installation**—Describes how to install the ISIHI-2S/2U card into the ISA bus of your personal computer system and how to configure card settings (I/O address DIP switch setting and jumper setting). This chapter also provides you with procedures for physically connecting the ISIHI-2S/2U to the ISDN BRI line.

**Chapter 3: Software/Driver Installation**—Provides detailed steps to install software/drivers to configure and operate the ISIHI-2S/2U via its firmware-based ConfigMenu utility or software-based ISDN TA Configuration Wizard.

**Chapter 4: Modem AT Commands, S-Registers, Result Codes**—Provides an introduction to the ISIHI-2S/2U's modems command mode fundamentals followed by a detailed explanation of each AT command with examples where applicable. This chapter also describes the modem's S-registers, which are used to store various modem options, and result codes that report the results of a command.

**Chapter 5: Terminal Adapter AT Commands, S-Registers, Result Codes**—Provides an introduction to the ISIHI-2S/2U's terminal adapters command mode fundamentals followed by a detailed explanation of each AT command with examples where applicable. This chapter also describes the TA's S-registers, which are used to store various modem options, and result codes that report the results of a command.

**Chapter 6: Troubleshooting Guide**—If you think your ISIHI-2S/2U is not working correctly, this chapter covers common problems and how to solve them.

**Chapter 7: Service, Warranty, and Technical/BBS**—Provides information on the ISIHI-2S/2U warranty, instructions for getting the ISIHI-2S/2U serviced at the factory,

and procedures for firmware upgrades via FlashROM. It also contains information on Multi-Tech's Bulletin Board Service (BBS), how to access technical support via the Internet, and information on Multi-Tech's Fax-Back Service.

**Appendix A: Determining Current System Settings**

**Appendix B: Base I/O Switch Settings**

**Appendix C: Pin Assignments**

**Appendix D: ISIH-2S/2U Testing Utilities**

**Appendix E: Configuration Profiles**

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**Appendix G: ASCII Conversion Chart**

**Appendix H: Dial Pulses and Tones**

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**Appendix K: Modem Result Code Summary**

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**Appendix M: Terminal Adapter S-Register Summary**

**Appendix N: Terminal Adapter Result Code Summary**

**Appendix O: Regulatory Agency Information**

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## Technical Specifications

### Physical / Electrical / Environmental

<b>Dimensions:</b>	13.3" x 4.8" x .6" (33.3 cm x 12.2 cm x 1.5 cm)
<b>Baud Rates:</b>	200 to 115.2 Kbps per port
<b>Bus Type:</b>	ISA
<b>Environmental:</b>	Temperature: 0° to 50° C (32° to 120° F) Humidity range: 20–90% (noncondensing)
<b>Power:</b>	1.5 amps @ +5vDC
<b>Base I/O:</b>	One 16-byte address space per card
<b>Address:</b>	Valid options range from 100h to 3F0h (DIP-switch setting)
<b>Interrupt:</b>	One IRQ per card. Valid options
<b>Request:</b>	Include 2, 3, 4, 5, 7, 10, 11, 12, and 15
<b>Warranty:</b>	Two years

### Modem

<b>Data Rates (Modem)</b>	Four independent modems each operating as follows: Downloads at speeds to 56 Kbps when calling a fully digital V.90 or K56flex server or V.90 (actual connect speed depends on line conditions). Uploads and other connections at 33600, 3200, 28800, 26400, 24,000, 21600, 19200, 16800, 14400, 12000, 9600, 4800, 2400, 1200, or 0-300 bps
<b>Data Rates (Fax)</b>	14400, 9600, 4800, and 2400 bps
<b>Data Format (Modem)</b>	Serial, binary, asynchronous at all data rates
<b>Configuration</b>	Each of the card's modems is independently configurable
<b>Compatibility (Modem)</b>	ITU-T V.42bis, V.42, V.34, ITU-T V.32bis, V.32, V.25bis, V.21, V.22bis, V.22, V.23, V.17, Bell 212A* and 103/113*, K56flex
<b>Compatibility (Fax)</b>	ITU-T Group 3, T.4, T.30, V.21, V.27ter, V.29, V.17, and EIA TR29.2
<b>Error Correction</b>	ITU-T V.42 (MNP® Classes 3 and 4, and LAP-M)
<b>Data Compression</b>	ITU-T V.42bis (4:1 throughput) or MNP 5 (2:1 throughput)
<b>Speed Conversion</b>	Serial port data rates adjustable to 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps
<b>Flow Control</b>	XON/XOFF, CTS/RTS

<b>Mode of Operation</b>	Half or full duplex over dial-up lines, automatic or manual dialing, automatic or manual answer
<b>Intelligent Features</b>	Fully AT command compatible, auto dial, redial, repeat dial, pulse or tone dial, dial pauses, call status display, auto-parity and data rate selection, keyboard-controlled modem options, nonvolatile memory, on-screen displays of modem parameters, stored telephone numbers, and help menus
<b>AT Commands</b>	100% compatible with standard AT command set
<b>Command Buffer</b>	40 characters
<b>Automatic Dialing</b>	Standard AT command asynchronous dialing
<b>Modem Modulations</b>	FSK at 300 bps, PSK at 1200 bps, QAM at 2400, 4800, and 9600 bps (non-trellis), QAM with trellis-coded modulation (TCM) at 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 33600, plus K56flex speeds
<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.17TCM at 14400, 12000, 9600, and 7200 bps
<b>Carrier Frequencies ITU-T V.34</b>	1600, 1646, 1680, 1800, 1829, 1867, 1920, 1959, 2000 Hz
<b>Carrier Frequencies AT&amp;T V.32terbo/ITU-T V.32bis/V.32</b>	1800 Hz
<b>Carrier Frequencies V.22bis/V.22 or Bell 212A Standard (2400 &amp; 1200 bps)</b>	Transmit originate: 2400 Hz Transmit answer: 2400 Hz Receive originate: 1200 Hz Receive answer: 1200 Hz
<b>Carrier Frequencies Bell 103/113 (300 bps)</b>	Transmit originate: 1270 Hz mark, 1070 Hz space Receive originate: 2225 Hz mark, 2025 Hz space Transmit answer: 2225 Hz mark, 2025 Hz space Receive answer: 1270 Hz mark, 1070 Hz space
<b>Carrier Frequencies V.21</b>	Transmit originate: 980 Hz mark , 1180 Hz space Receive originate: 1650 Hz space, 1850 Hz mark Transmit answer: 1650 Hz mark, 1850 Hz mark Receive answer: 980 Hz mark, 1180 Hz space
<b>Fax Carrier Frequencies V.23</b>	Transmit originate: 390 Hz mark , 450 Hz space Receive originate: 1300 Hz space, 2100 Hz mark Transmit answer: 1300 Hz mark, 2100 Hz mark Receive answer: 390 Hz mark, 450 Hz space

**Fax Carrier Frequencies**

V.21CH2 (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>Transmit Level</b>	-13 dBm
<b>Frequency Stability</b>	+0.01%
<b>Receiver Sensitivity</b>	-43 dBm under worst case conditions
<b>AGC Dynamic Range</b>	43 dB
<b>Interface</b>	TIA / EIA RS-232/ITU-T V.24/V.28
<b>Diagnostics</b>	Power-on self-test, local analog loop, local digital loop, remote digital loop
<b>Firmware Upgrades</b>	Flash memory, available on Multi-Tech's BBS and website

**Terminal Adapter**

<b>Compatibility</b>	AT&T 5ESS, NT DMS-100, NTT INSnet64, US National ISDN-1, NET 3
<b>Network Interface</b>	4-wire S/T interface
<b>Protocols</b>	V.120, PPP compatible
<b>Data Rates</b>	300, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 56K, 57.6K, 64K, 115.2K , 230.4K, and 460.8 Kbps
<b>Async Data Format</b>	7 bit data + odd/even parity + 1 start/stop. 36 baud rate/parity settings via S-Register. Baud rates of 460.8 Kbps with even, space, mark, odd, or no parity.
<b>Data Connections</b>	Two ISDN B-channels, One ISDN D-channel
<b>Command Interface</b>	AT commands, S-Registers, Result Codes, ConfigMenu firmware configuration utility, Windows 95/NT software configuration utility, Windows 95 Dial-Up Networking (DUN)
<b>Hardware Connectors</b>	ISDN: RJ-45 female receptacle - 4 wire S/T Basic Rate Interface

# Hardware Installation **2**



## Introduction

This chapter describes how to install the ISIH-2S/2U card into the ISA bus on your personal computer. Hardware installation involves the following:

- Opening your PC
- Setting card configuration (determining I/O address DIP-switch setting and IRQ jumper setting)
- Installing the card into the PC

## Computer Requirements

- 386, 486, or Pentium®-based PC or compatible with ISA bus architecture
- Microsoft Windows 95, Windows NT 4.0, SCO Open Server version 5.0, Novell NetWare, or Linux
- At least one floppy drive
- 800 blocks of hard disk space for UNIX, 100K bytes for Windows NT, 34K bytes for Windows 95, and 50K bytes for Novell

## Shipping Contents

- ISIH-2S/2U card
- Two RJ-45 ISDN cords
- ISIH Driver Disk Set with ISDN TA Configuration Wizard
- Quick Start Guide

## Safety Warnings

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jacks are 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 that leak.
- Ports that are connected to other apparatus are defined as SELV. To ensure conformity to EN 41003, ensure that these ports are only connected to the same type on the other apparatus.



## Before You Start

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**Warning:** *Direct interconnection (or connection by way of other apparatus) of ports marked **SAFETY WARNING see instructions for use** with any other ports (whether similarly marked or not) may produce hazardous conditions on the network. Multi-Tech strongly urges you to consult a qualified engineer before attempting to make this type of connection.*

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- All installation must be done by a qualified service person.
- To reduce emissions, use blanking plates to cover empty slots in the your PC.
- Cable, wiring, and any other apparatus connected between the modem and the point of connection to any speech band circuit shall comply with the following:
  1. The overall characteristics of the apparatus shall be such as to introduce no material effect upon the electrical conditions presented to one another by the modem and the speech band circuit.
  2. The apparatus shall be comprised of only
    - a. apparatus approved for the purpose of connection between the modem and a speech band circuit; and
    - b. cable and wiring complying with a code of practice for the installation of equipment covered by this part of BS 6328 or such other requirements as may be applicable.

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**Note:** *Such apparatus may have been approved subject to limitations in its use.*

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**Note:** *If S/T-interface ISDN network connection cable is used, the ISDN phone cord should be connected between the ISDN network connection cable and NT1 device.*

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## Determine Current System Settings

When you install a device into your computer, the processor must have a means of routing information to and from the device, and the device must have a means of gaining the processor's attention. Input/Output (I/O) addresses route information to and from the device. Interrupt Requests (IRQs) gain the processor's attention. The ISIH-2S/2U card requires eight I/O addresses and one IRQ value that are not used by any other device in your system. When selecting a unique base I/O address, be sure the next address also is unused. To determine your system's current setting, refer to Appendix A and B.

If you are certain these settings are not already in use, continue with the installation. Each card ships with the IRQ set at 10 and the base I/O address set at 210 hex. Check your system's settings to see if these values can be used. If the defaults are already in use, select a unique IRQ and I/O address and record them below for future reference.

I/O address \_\_\_\_\_ IRQ \_\_\_\_\_

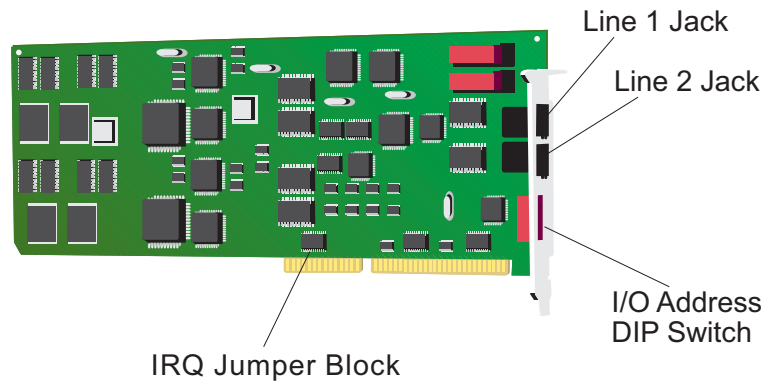
### Recommended Base I/O Address and IRQ Values

<i>ISIH-2S/2U</i>	<i>Base I/O Address</i>	<i>IRQ</i>
Initial 8 port board	210h	10
First 8 port upgrade	220h	11
Second 8 port upgrade	230h	12
Third 8 port upgrade	240h	15

## Installing the ISIH-2S/2U

Installing the ISIH-2S/2U includes setting the I/O address DIP switches and the IRQ jumper. You can skip this section if you select the default values. Default values are **I/O address: 210 hex** and **IRQ: 10**.

1. Before handling the ISIH-2S/2U, discharge any static in your body by touching a piece of grounded metal such as the computer chassis.
2. Carefully remove the ISIH-2S/2U from its antistatic bag, handling it only by the mounting bracket and edges. Do not touch the gold-plated connectors along the bottom edge. (You may want to save packaging for future use.)
3. Visually inspect the ISIH-2S/2U. If you have any concerns about its condition, call Technical Support at (612) 717-5863.



4. Make sure your computer and any peripheral equipment connected to it are turned off. Failure to do so can damage both the ISIH-2S/2U card and your PC. You can install the ISIH-2S/2U in a PC-AT, 386, 486, or Pentium equivalent ISA bus computer.
5. Remove the cover of your computer as instructed in your computer's documentation.
6. Locate the unused slot you will be using for your ISIH-2S/2U card and remove the slot cover according to instructions in your computer's documentation.
7. Check the settings of the I/O address switch and the IRQ jumper to ensure they are set properly for your installation.

8. The default for the ISiHI-2S/2U's base I/O address is 210 hex. The default value for the IRQ jumper is 10. Choose the IRQ value by covering the appropriate pins with the jumper plug (supplied). Refer to the figure below, if needed. If your system requires a different setting, or if you are installing multiple cards, refer to Appendix B for a table of valid address settings.



Record any changes you make to these settings for future reference and for software installation (Chapter 3).

I/O Address \_\_\_\_\_

IRQ \_\_\_\_\_

9. Install the ISiHI-2S/2U card in the selected expansion slot in the same manner as any other add-on card according to your computer's documentation.
10. Fasten the retaining bracket to the computer chassis and replace the cover.
11. Connect the ISiHI-2S/2U to your ISDN telephone wall jack with the provided modular telephone cable.

---

**Note:** *The ISiHI-2S/2U communicates over ISDN lines. If you don't have a standard modular wall jack near your computer, you should install one or have one installed by your telephone company. In the US, installation kits and adapters are available wherever telephones are sold.*

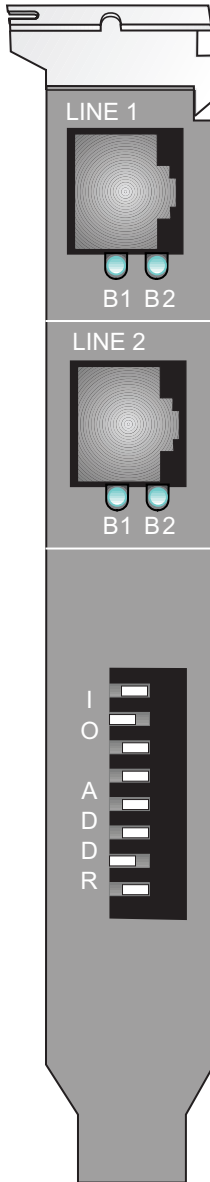
---

12. Turn on the power to the computer. Now you are ready to install the software/drivers.

## LED Indicators

The mounting bracket for both the ISIH-2S and the ISIH-2U is similar, except the LEDs are labeled differently. Each mounting bracket has two sets of LED indicators that indicate status and line activity. Below, and on the next page, are graphics for each bracket along with descriptions of the LED indicators.

### ISIH-2S LED Indicators



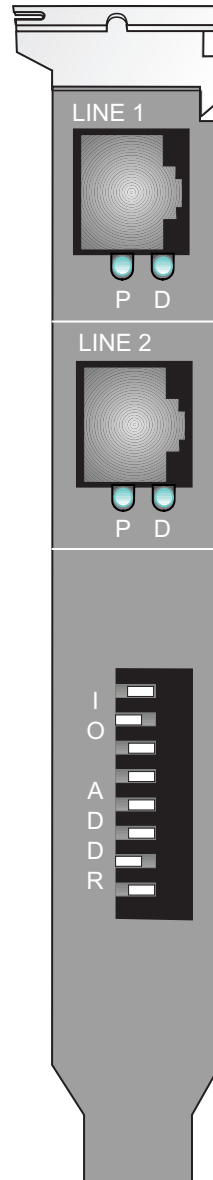
#### ***B1 LED Indicator***

- When lit, indicates active data or voice connection on B-channel 1.

#### ***B2 LED Indicator***

- When lit, indicates active data or voice connection on B-channel 2.

## ISIH-2U LED Indicators



### **P LED Indicator**

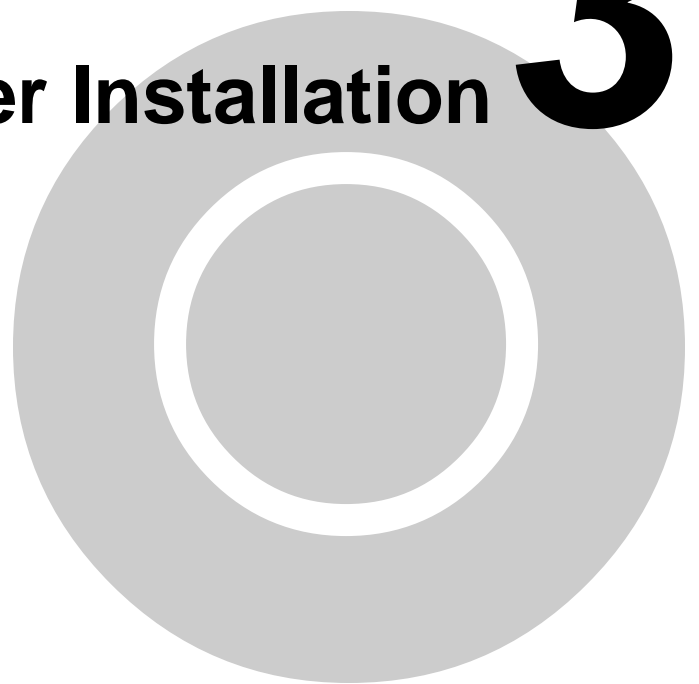
- Indicates U interface status connection.
- Controlled by NT-1, which converts S/T interface (4-wire ISDN) to U interface (2-wire ISDN).
- When U interface and S/T interface are NOT active, LED remains off.
- Flashes 8 times/second (8 Hz)—U interface is attempting to activate.
- Flashes once/second (1 Hz)—U interface is active; S/T interface is not fully active.
- Lit, not flashing—Both U and S/T interfaces are active.

### **D LED Indicator**

- Lights when the ISIH-2S/2U is turned on.
- Flashes until SPIDs are verified with the central office switch; then remains lit without flashing.
- Indicates data link layer status.



# Software/Driver Installation **3**



## Introduction

This chapter contains general instructions for software/driver installation the following operating systems:

- Windows NT
- Windows 95
- Novell
- SCO Open Server 5
- Linux

This guide assumes installers have a thorough knowledge of their operating system and the software installation process; therefore, it does not include every dialog box or option involved in installing and configuring the drivers.

The ISIH-2S/2U card ships with software/drivers for Windows NT, Windows 95, SCO Open Server 5, and NetWare Connect (Novell) operating systems. This chapter guides you through the installation of these drivers. The Multi-Tech Installation Script, used in the UNIX operating system, is located on page 58 of this chapter.

As with all software, you should make a backup copy of the diskette you received and use the copy for the installation. If you received a 3½" diskette, the capacity is 1.44 MB. Consult your system manual for instructions on disk copying. Also, if you have a numeric keypad, and you intend to use it for the installation process, make sure *Num Lock* is on.

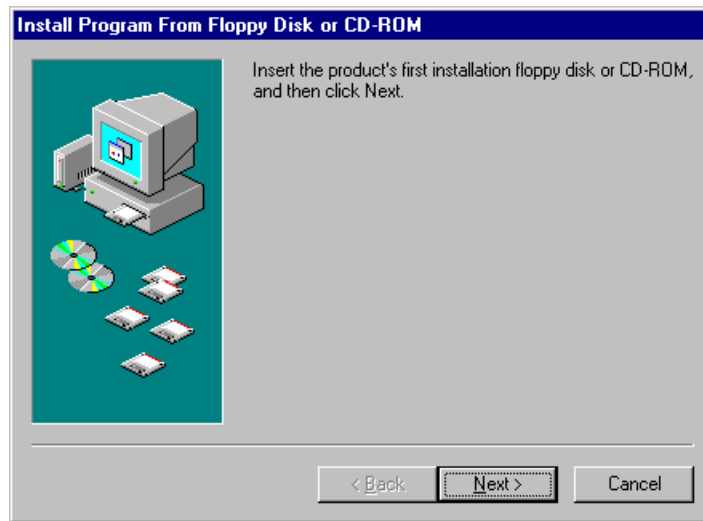
Installing a device driver consists of modifying your system. For this reason, only the *super user* (system administrator) is allowed to perform the installation. If you cannot login as the **root**, you must find the person in your organization who has this authorization (i.e., password). To begin the driver installation, login as **root**. Then proceed with the appropriate section.



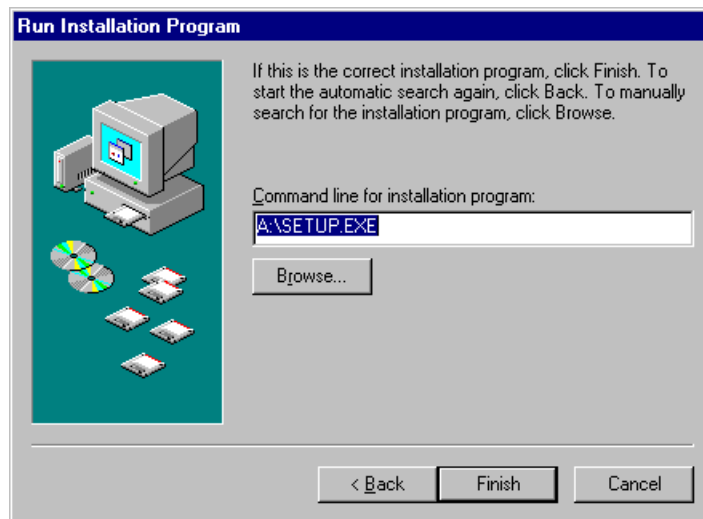
## Installing ISIH-2S/2U Drivers in Windows NT

1. Click **Start**, **Settings**, **Control Panel**, and then double-click the **Add/Remove Programs** icon.
2. The **Add/Remove Program Properties** dialog box appears. In the **Install/Uninstall** tab, click **Install**.
3. The **Install Program From Floppy Disk or CD-ROM** dialog box appears. If installing from diskette, insert the diskette labeled MultiModem ISI Driver for Windows NT in the disk drive. Then click **Next**.

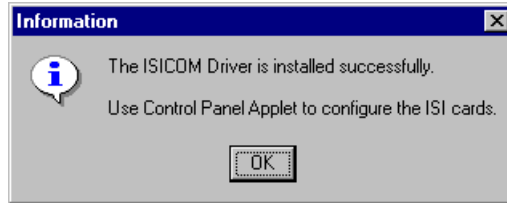
(If installing from a network location, connect to it. Note drive; you may need it later if you run Setup again.)



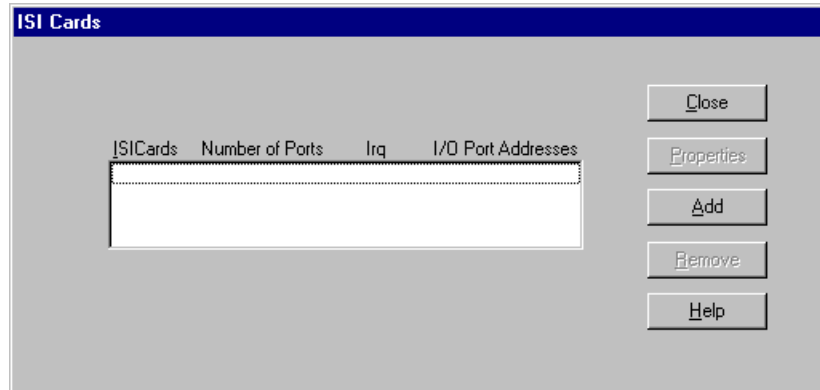
4. When the **Run Installation Program** dialog box appears, click **Finish** and the driver installs.



- When the **Information** dialog box below appears, click **OK**.

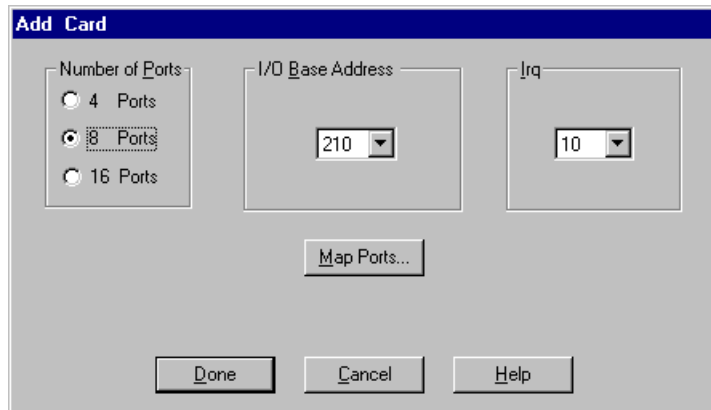


- The **ISI Cards** dialog box appears. Click **Add**.

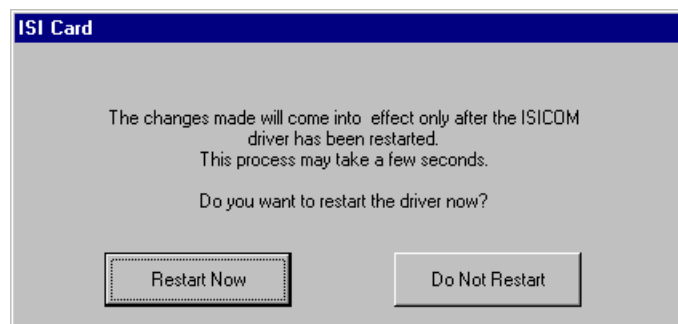


- The **Add Card** dialog box appears, displaying defaults—Ports: **8**, I/O Base: **210**, and IRQ: **10**. Click **Done** and then **Close**.

*Note: The ISIH-2S/2U contains 8 ports. Make sure the default is 8.*



- The **ISI Card** dialog box appears. Click **Restart Now** and then click **OK**.

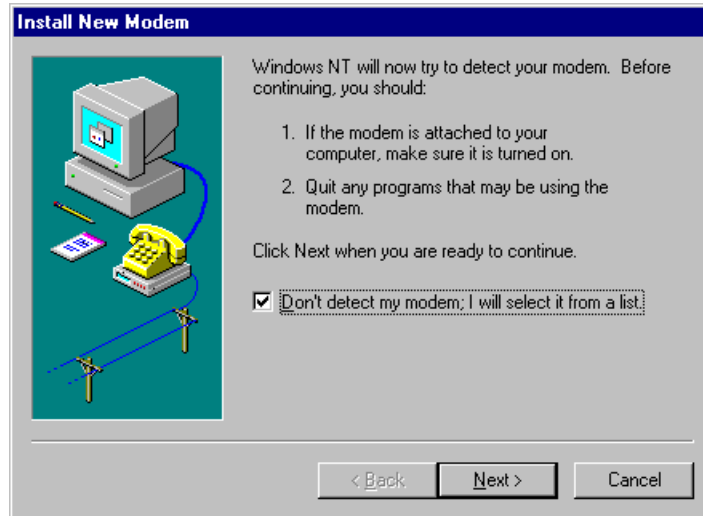


The ISI driver now is installed and you are ready to install the TAs and modems to the COM ports.

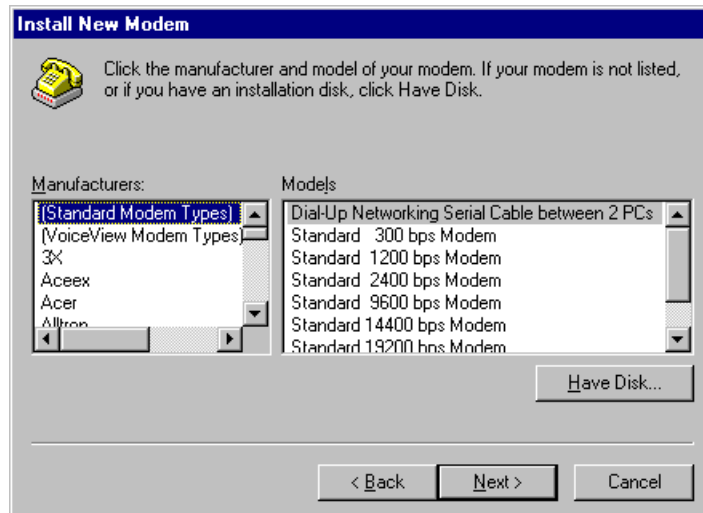
## Installing Terminal Adapters and Modems to COM Ports in Windows NT

### To install *terminal adapters*:

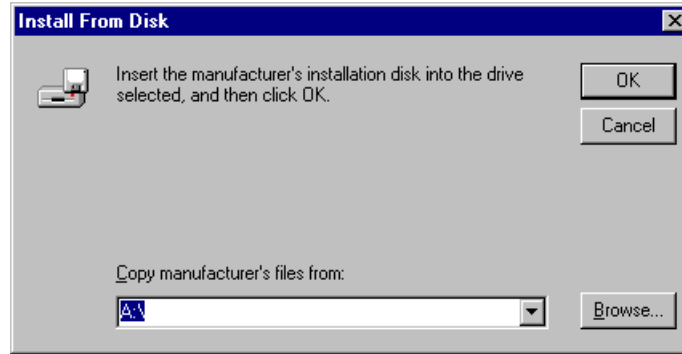
1. In the **Control Panel**, double-click the **Modems** icon.
2. The **Modem Properties** dialog box appears. Click **Add**.
3. The **Install New Modem** dialog box appears. Check the box marked **Don't detect my modem; I will select it from a list** and click **Next**.



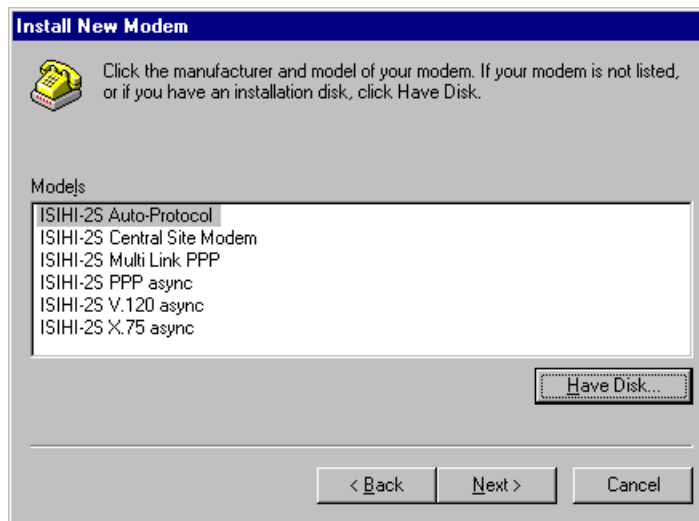
4. The **Install New Modem** dialog box appears. Click **Have Disk**.



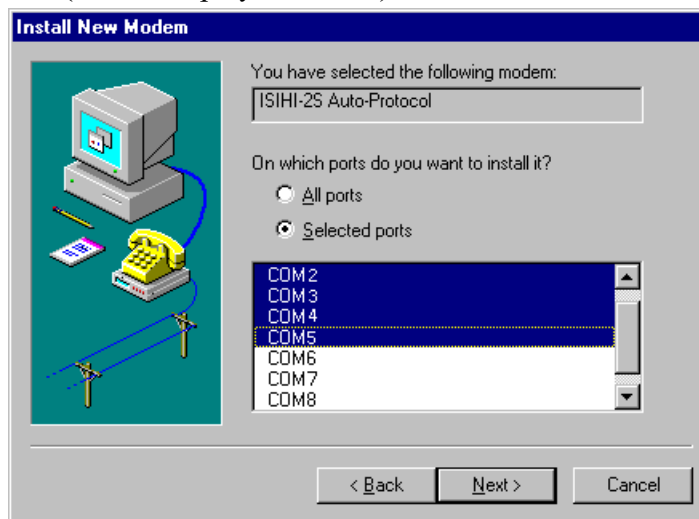
5. The **Install From Disk** dialog box appears. Click **OK** (diskette is still in drive).



6. The **Install New Modem** dialog box appears. From the **Models** list, select a protocol (depending on your application) for the terminal adapters. Then click **Next**.



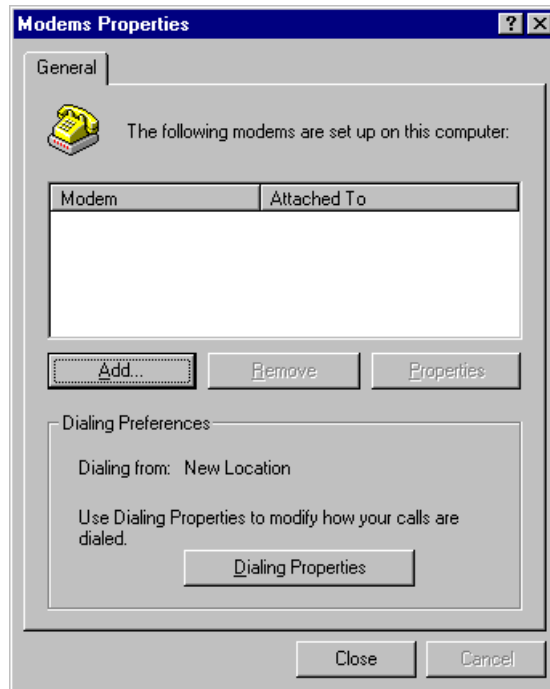
7. The **Install New Modem** dialog box appears. Select the ports that correspond to the first four ports of the ISIH-2S/2U. Note that any ports that existed prior to installing the ISIH-2S/2U appear first in the list of available COM ports. Click **Next**. The terminal adapters (screen displays *modems*) install to the selected COM ports.



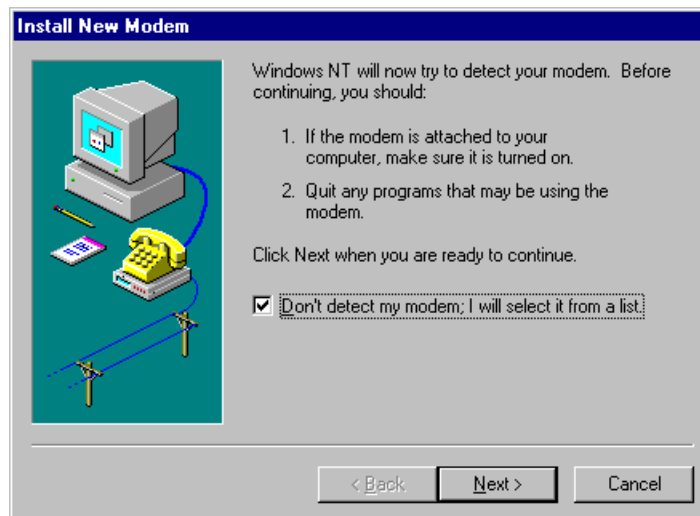
8. After the TAs install, click **Finish** to return to the **General** tab to view COM port assignments (and make changes if necessary). Now you are ready to install modems.

**To install modems:**

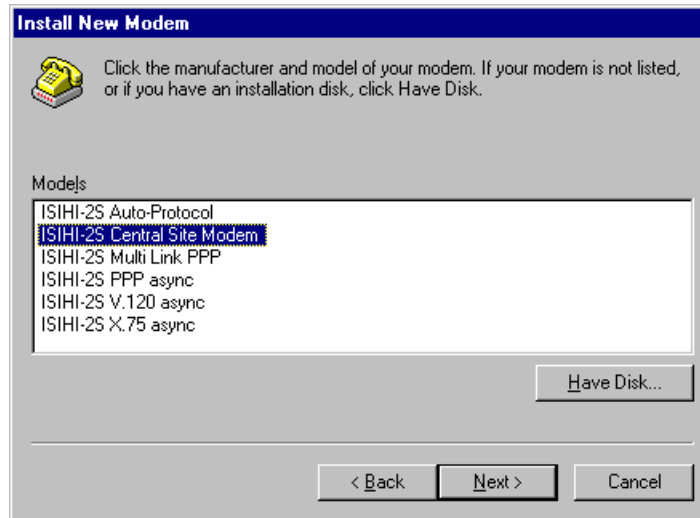
1. In the **General** tab, click **Add**.



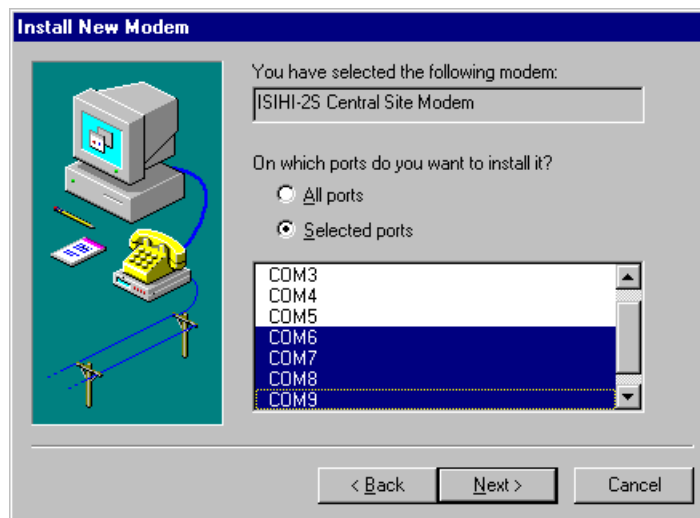
2. The **Install New Modem** dialog box appears. Check the box marked **Don't detect my modem; I will select it from a list**. Then click **Next**.



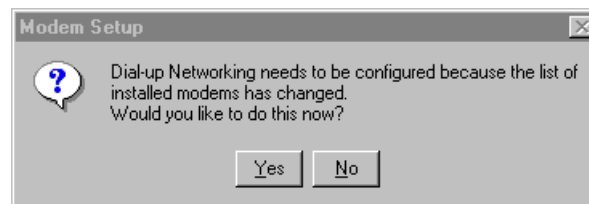
- The **Install New Modem** dialog box appears. From the **Models** list, select **Central Site Modems** for the modems. Then click **Next**.



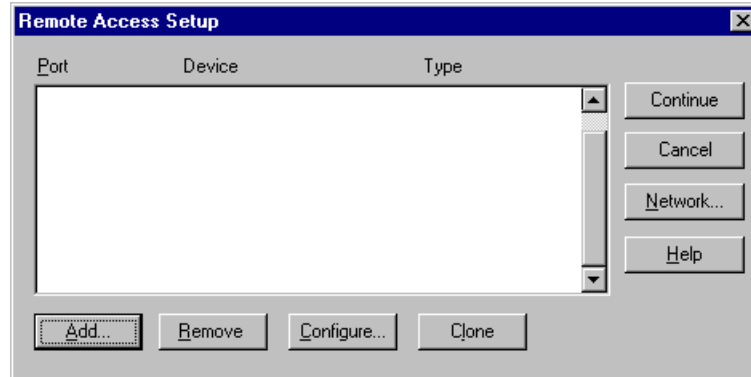
- Select the ports that correspond to the last four ports of the ISiHI-2S/2U card. Then click **Next**. The modems install to the selected COM ports.



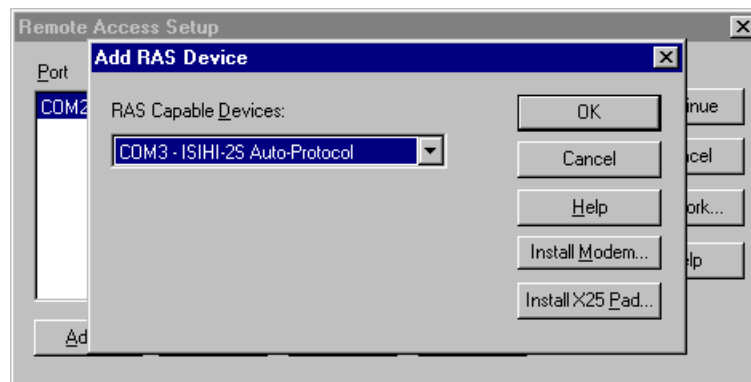
- After the modems install, click **Finish** to return to the **General** tab where to view COM port assignments (and make changes if necessary).
- Close the **Modem Properties** dialog box. The message below appears asking if you want to configure dial-up networking. Click **Yes**.



7. The **Remote Access Setup** dialog box appears. Click **Add**.

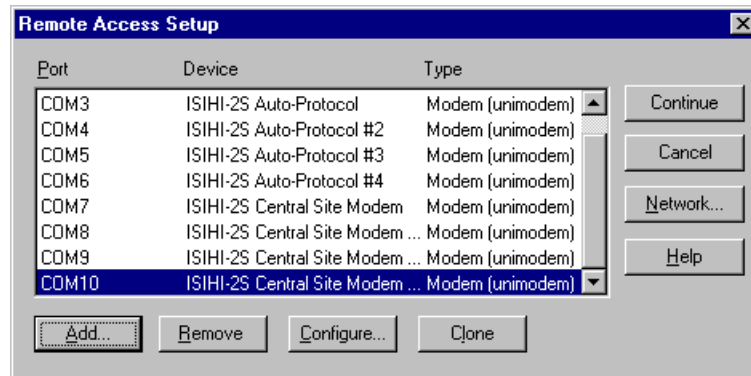


8. Each COM port appears in a separate **Add RAS Device** dialog box. To add the highlighted device, click **OK**.

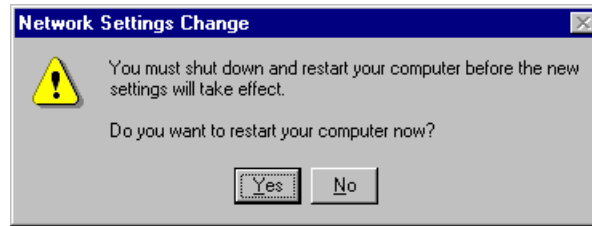


9. The **Remote Access Setup** dialog box displays again. Repeat steps 7 and 8 until all devices are added.

10. When all devices are added, click **Continue**.



11. When the message below appears, click **Yes**.



The **ISI Cards** icon appears in the **Control Panel** and you now are ready to configure the terminal adapter. Go to page “Configuring the Terminal Adapter” on page 47.

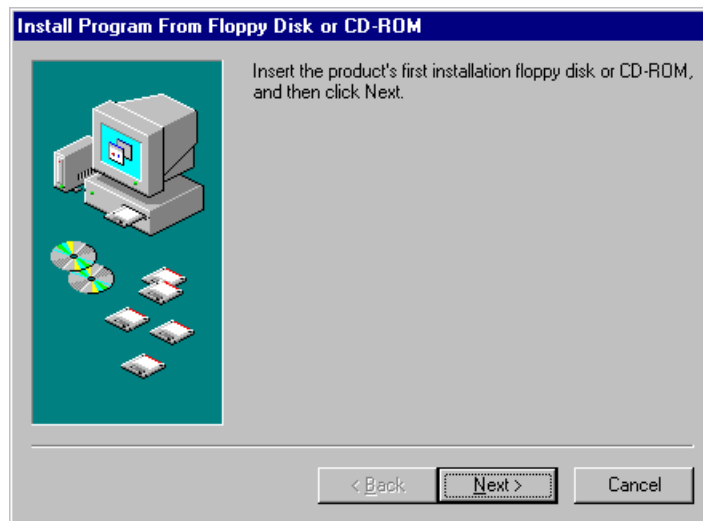
## Removing the Driver

1. Click **Settings, Control Panel**; then double-click **Add/Remove Programs**.
2. From the list box, select **ISICOM Driver**.
3. Click **Add/Remove** and follow dialog box instructions.

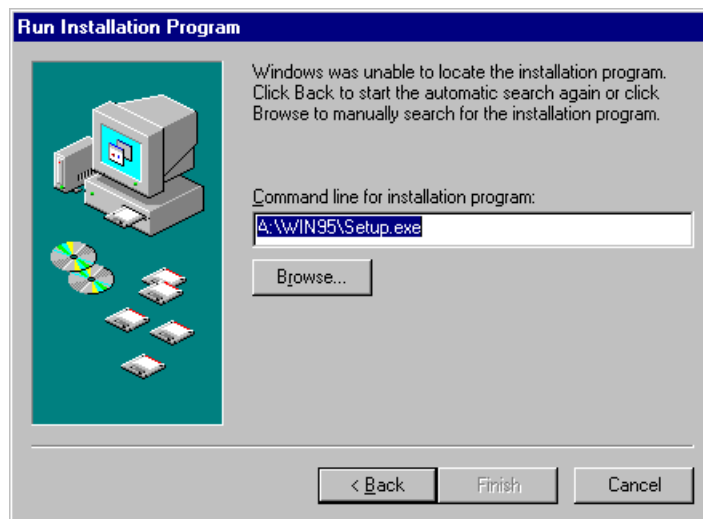


## Installing ISIH-2S/2U Drivers in Windows 95

1. Click **Start, Settings, Control Panel**, and then double-click the **Add/Remove Programs** icon.
2. The **Add/Remove Program Properties** dialog box appears. In the **Install/Uninstall** tab, click **Install**.
3. The **Install Program From Floppy Disk or CD-ROM** dialog box appears. If installing from diskette, insert the diskette labeled MultiModemISI Driver for Windows 95 & Netware AIO in the disk drive. Then click **Next**.  
(If installing from a network location, connect to it. Note drive; you may need it later if you run Setup again.)



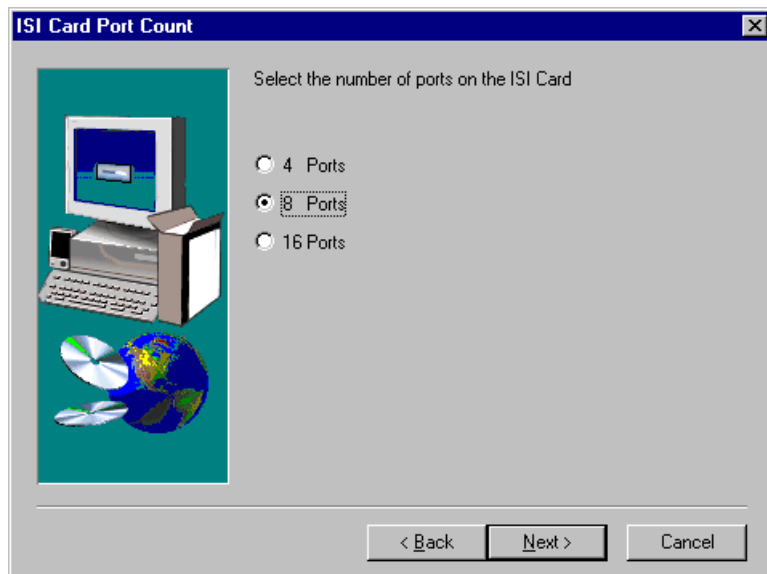
4. The **Run Installation Program** dialog box appears. In the command line, enter **A:\WIN95\Setup.exe**. Click **Finish** and the driver installs.



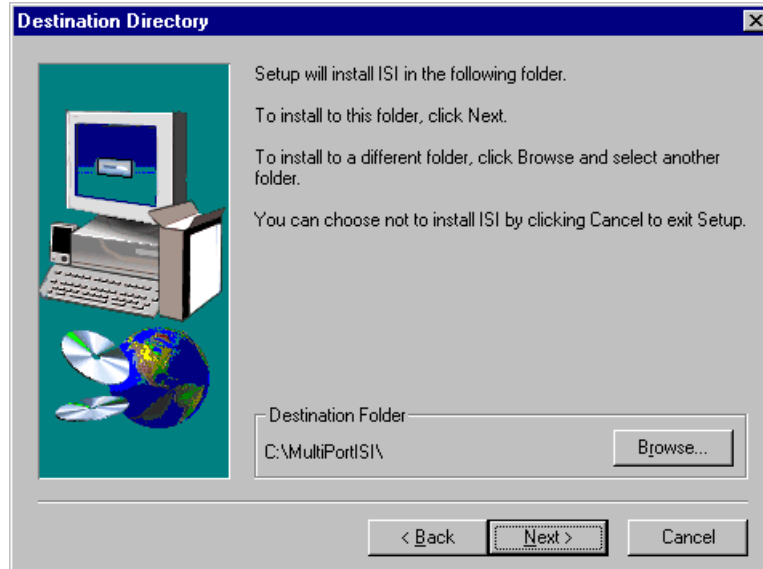
5. The **Welcome** dialog box appears. Click **Next**.



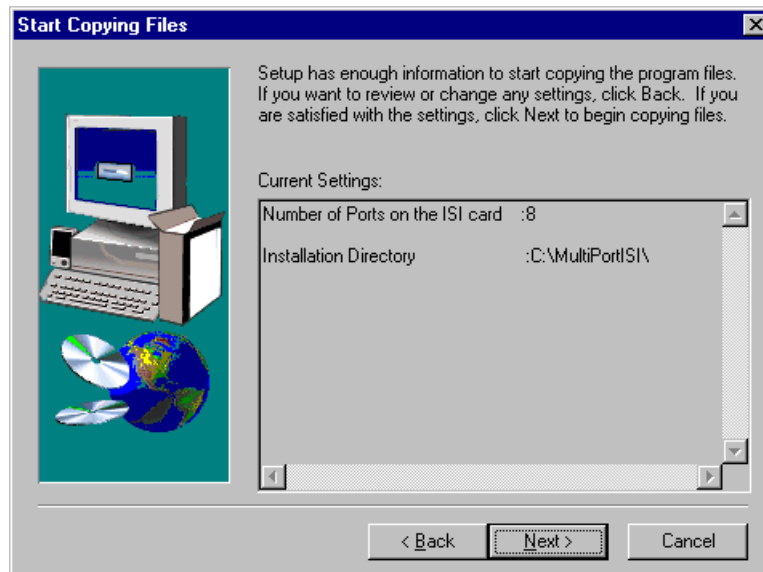
6. The **ISI Card Port Count** dialog box appears. Make sure the **8 Ports** option is selected; then click **Next**.



7. The **Destination Directory** dialog box appears. Click **Next**.



8. The **Start Copying Files** dialog box appears. Click **Next**.



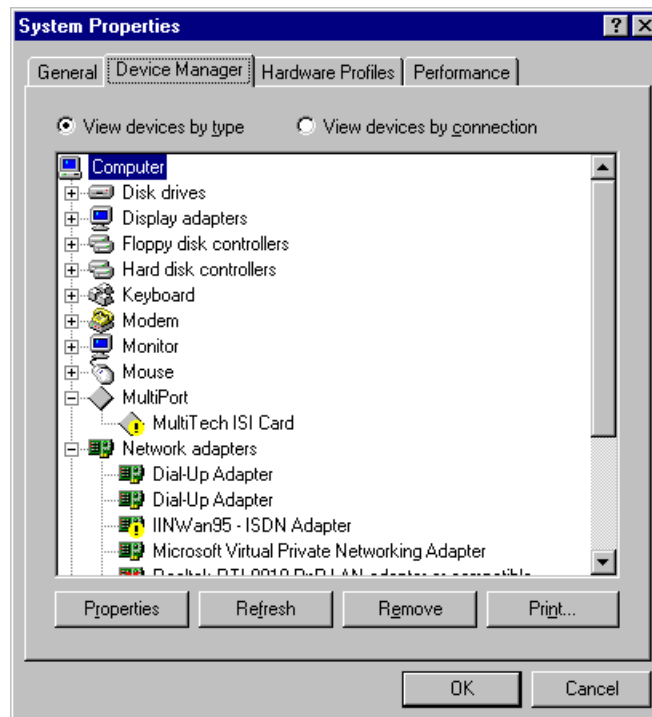
9. The **ISI Driver Setup** dialog box appears. Click **OK**.



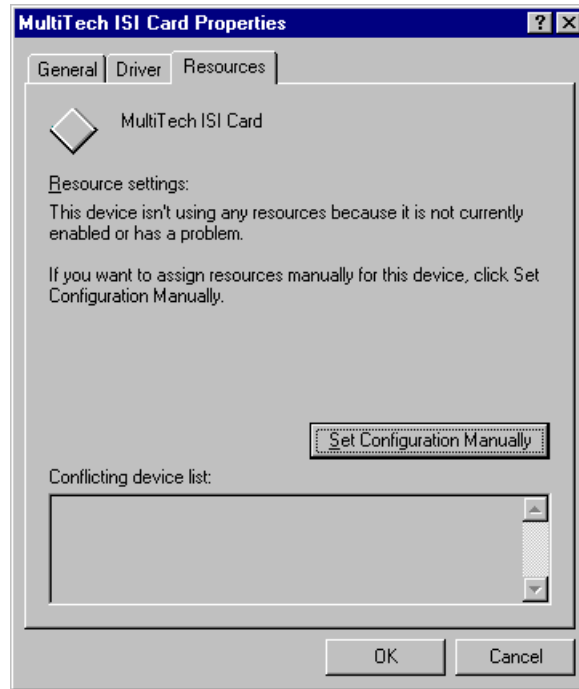
10. The **ISI Driver Setup** dialog box appears instructing you to set the base address and IRQ for the card. Click **OK**.



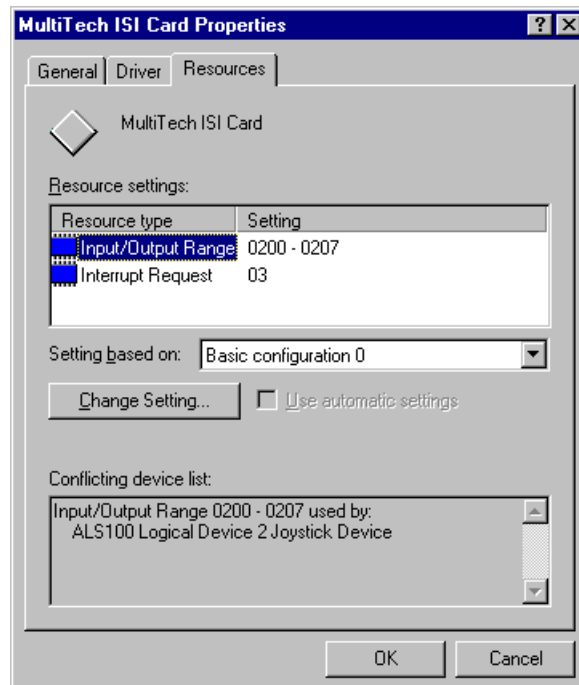
11. The **Systems Properties** dialog box appears. To change settings, in the **Device Manager**, double-click **MultiTech ISI Card** located under **MultiPort**.



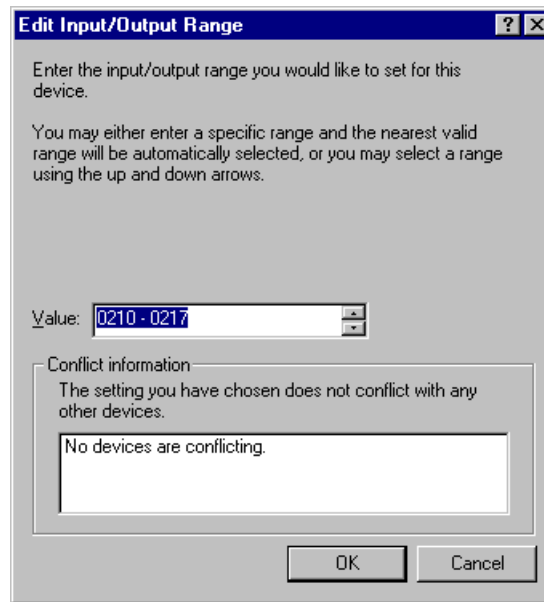
12. The **MultiTech ISI Card Properties** dialog box appears. Click **Resources**. Then click **Set Configuration Manually**.



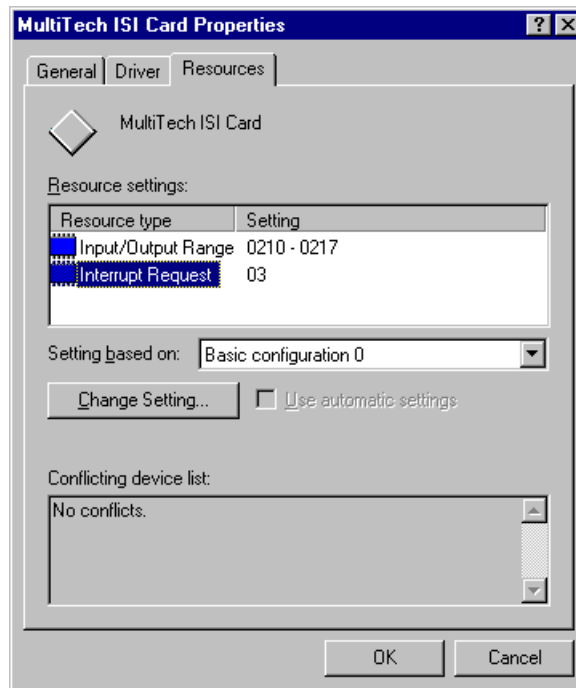
13. In the **Resources settings**: list, select **Input/Output Range**; then click **Change Setting**.



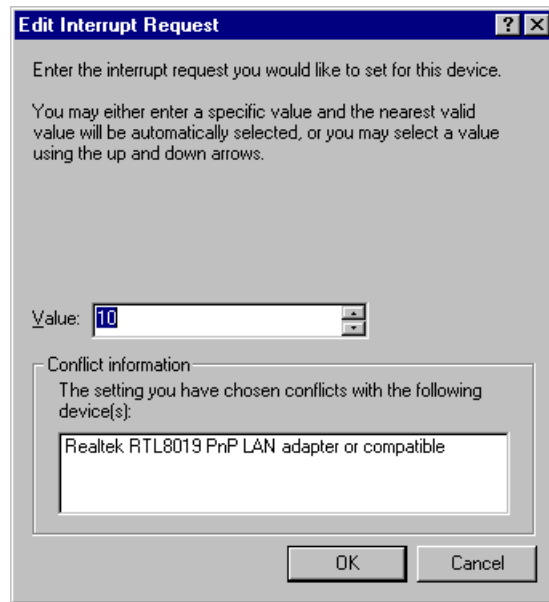
14. The **Edit Input/Output Range** dialog box appears. Click the arrows (up or down) to select the value that matches the ISIH-2S/2U card's I/O address. (If you used the default I/O address, this value is 210. Otherwise, refer to the settings you recorded on page 18.) When finished, click **OK** to return to the **Resources settings:** list.



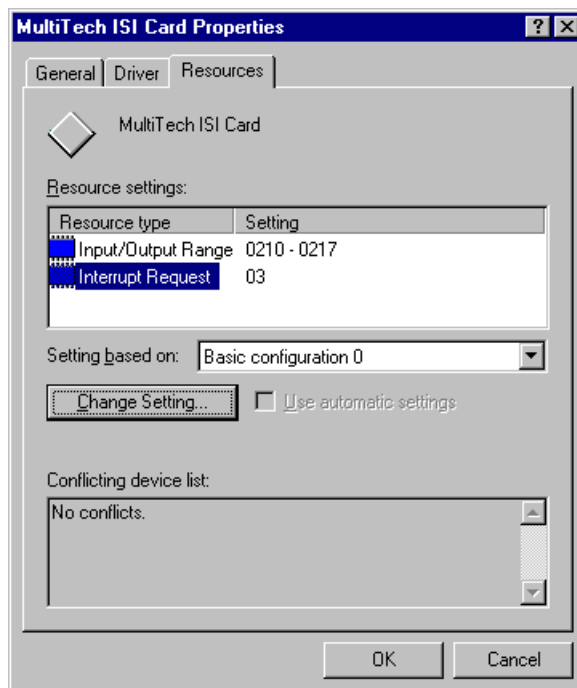
15. In the **Resources settings:** list, select **Interrupt Request**; then click **Change Setting**.



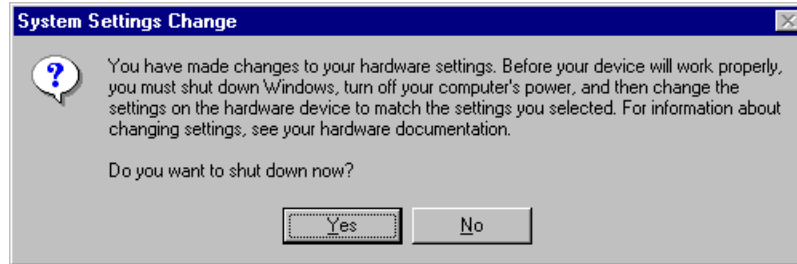
16. The **Edit Interrupt Request** dialog box appears. Select the value that matches the ISIH-2S/2U card's IRQ. (If you selected the default IRQ, this value is 10. Otherwise, refer to the settings you recorded on page 18.) Then click **OK** to return to the **Resources settings:** list.



17. The **MultiTech ISI Card Properties** dialog box appears. If the settings are correct, click **OK**.



18. When the **System Settings Change** dialog box appears, click **Yes**.



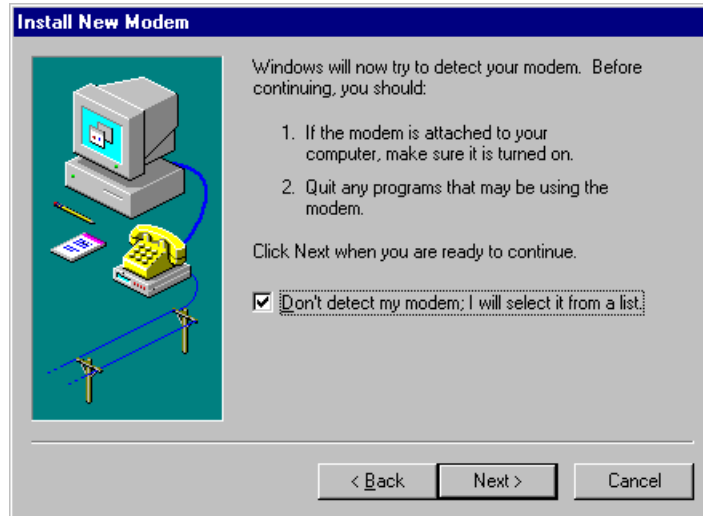
Drivers now are installed. After rebooting, you are ready to install the TAs and modems to the COM ports.



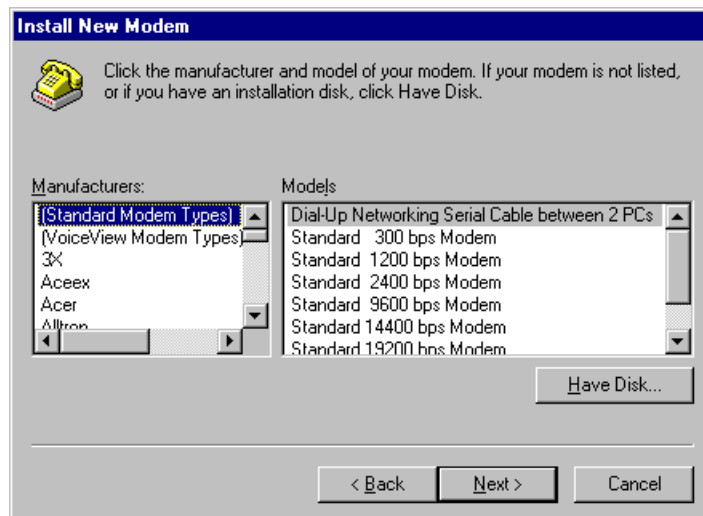
## Installing Terminal Adapters and Modems to COM Ports in Windows 95

### To install *terminal adapters*:

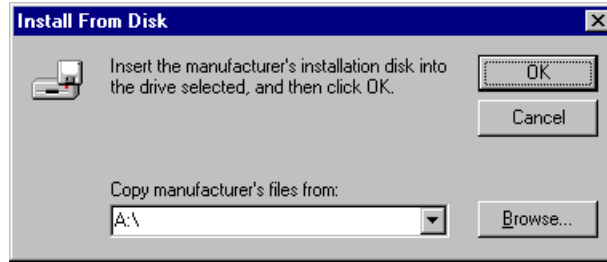
1. Click **Start, Settings, Control Panel**, and then double-click the **Modems** icon.
2. The **Install New Modem** dialog box appears again. Check the box marked **Don't detect my modem; I will select it from a list**. Then click **Next**.



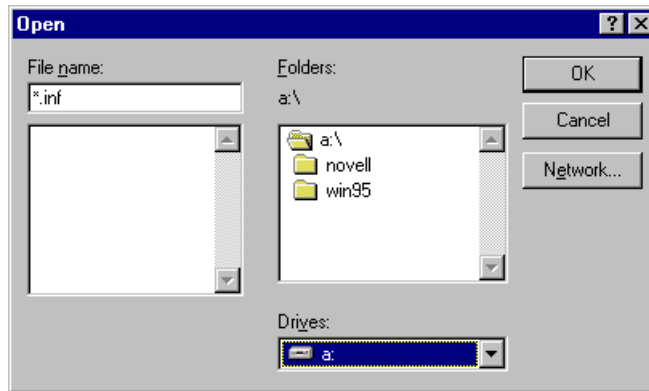
3. The **Install New Modem** dialog box appears. Insert the diskette labeled MultiModem ISI Driver for Windows 95 & Netware AIO and click **Have Disk**.



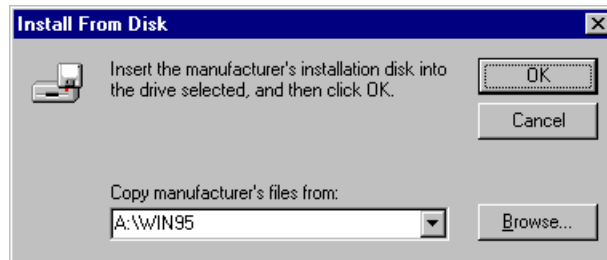
- The **Install From Disk** dialog box appears. Click **Browse**.



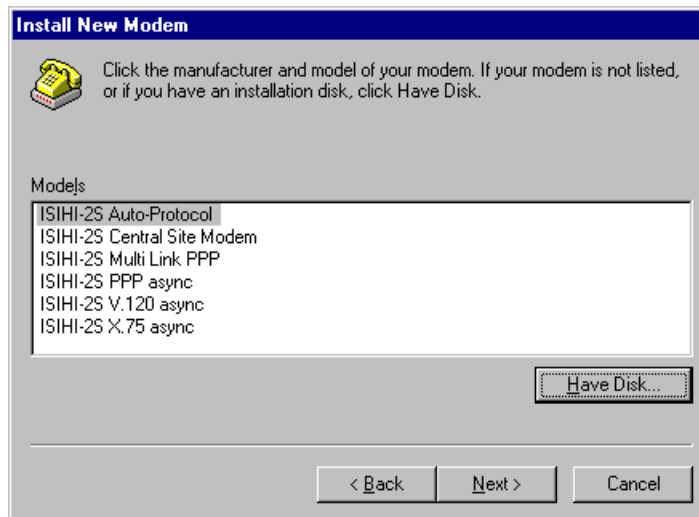
- The **Open** dialog box appears. Double-click the **win95** folder and **isihimdm.inf** appears in the **Filename:** text box. Click **Next**.



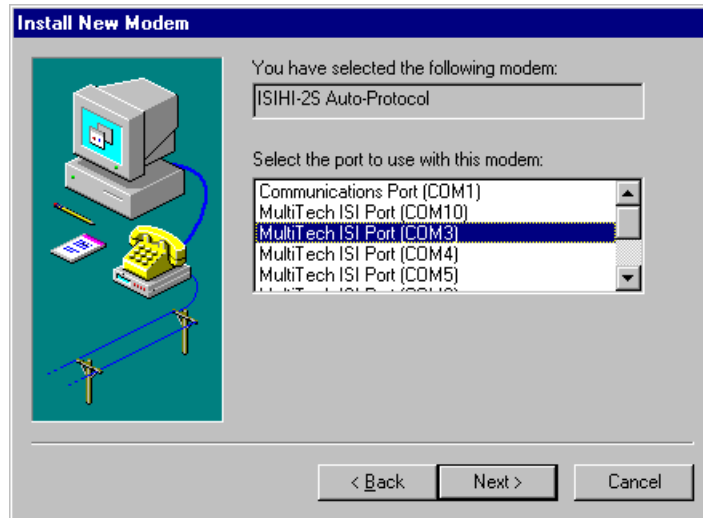
- The **Install From Disk** dialog box now appears with **WIN95** in the text box. Click **OK**.



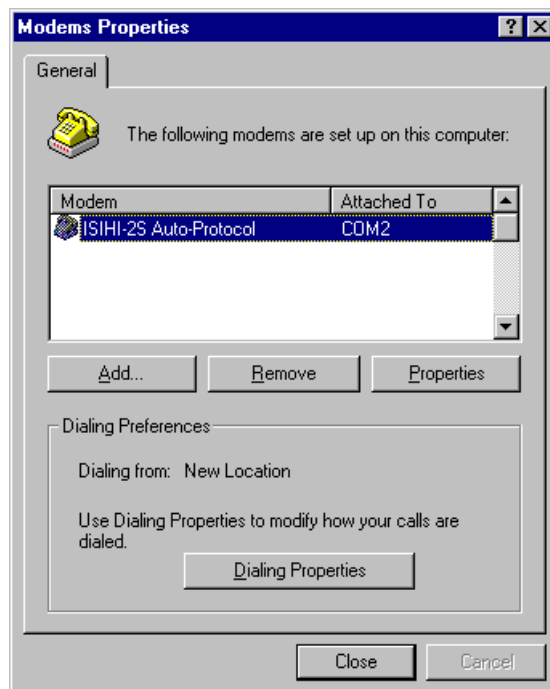
- The **Install New Modem** dialog box appears. Select a protocol (depending on your application) from the **Models** list; then click **Next**.



8. In the next dialog box, select the desired COM port and click **Next**. The terminal adapter (screen displays *modem*) installs to the selected COM port.



9. After the terminal adapters install, click **Finish** to return to the **General** tab to view COM port assignments (and make changes if necessary).



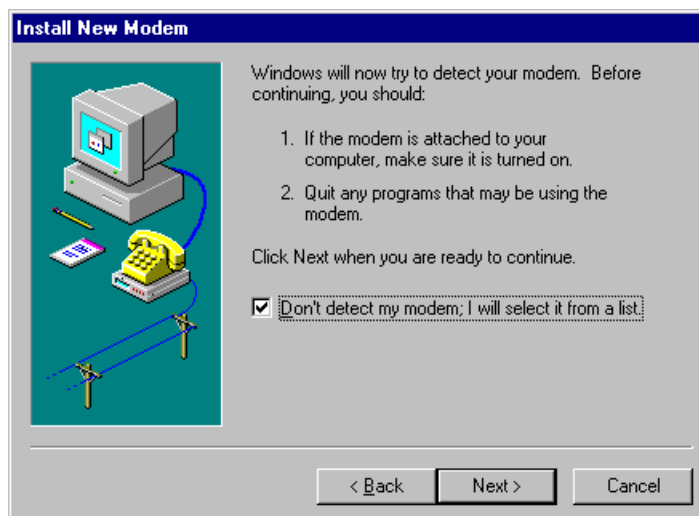
10. Click **Add** and repeat installation steps 2–9 to install terminal adapters to the first four ports of the ISIH-2S/2U.  
After the terminal adapters install, you now are ready to install the modems.

**To install modems:**

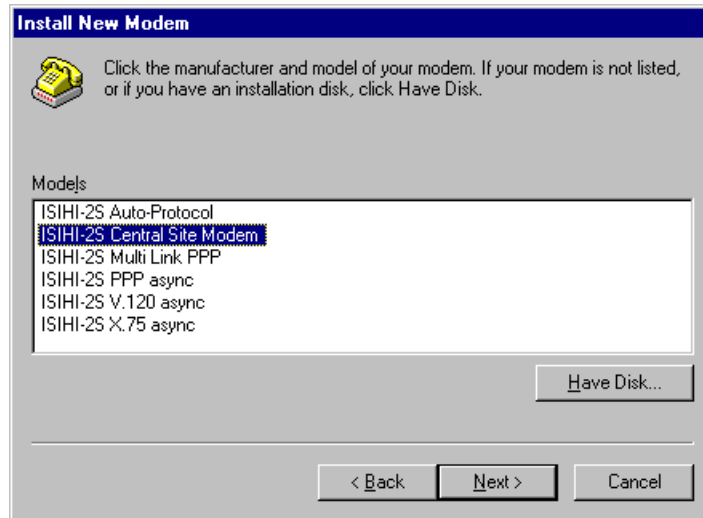
1. In the **General** tab, click **Add**.



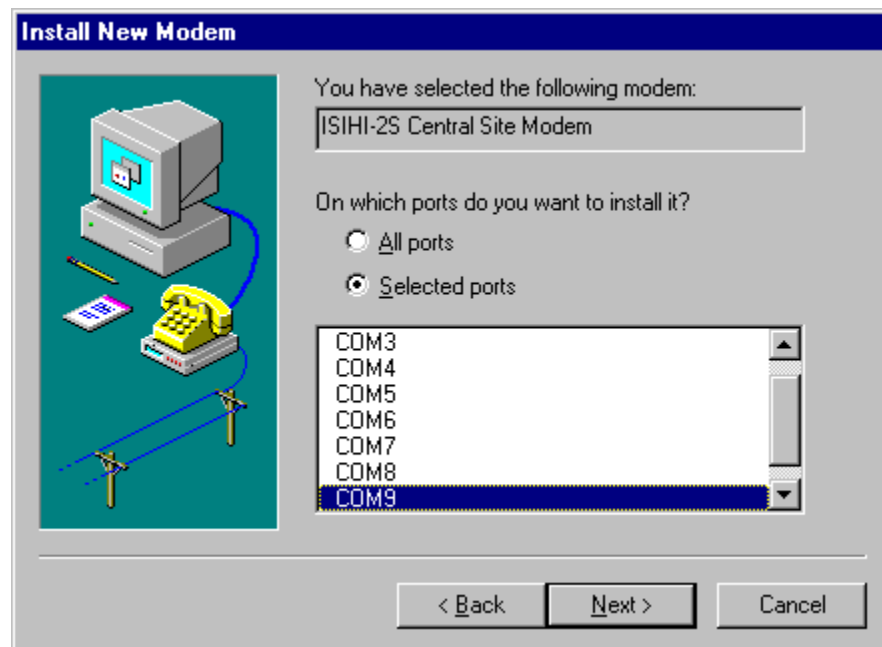
2. The **Install New Modem** dialog box appears. Check the box marked **Don't detect my modem; I will select it from a list**. Then click **Next**.



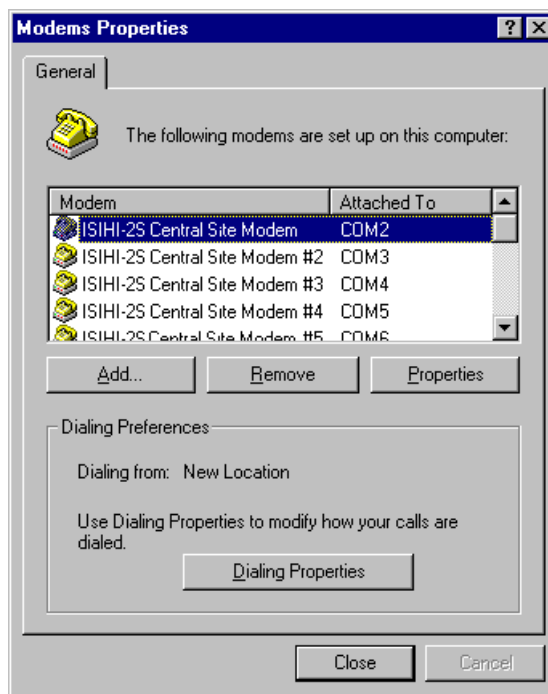
- The **Install New Modem** dialog box appears. From the **Models** list, select **Central Site Modems** for the *modems*. Then click **Next**.



- The **Install New Modem** dialog box appears. Select the desired COM port and click **Next**. The modem installs to the COM port.



5. After the modem installs to the port, click **Finish** to return to the **General** tab to view COM port assignments (and make changes if necessary).



6. Click **Add** and repeat installation steps 2–5 to install modems to the last four ports of the ISIHI-2S/2U. Now you are ready to configure the terminal adapters.

## Removing the Driver

1. Click **Settings, Control Panel**, and then double-click **Add/Remove Programs**.
2. From the list box, select **ISICOM Driver**.
3. Click **Add/Remove** and follow dialog box instructions.

## Configuring the Terminal Adapter

### Introduction

North American users must configure the terminal adapter to match network switch type, the service profile identifier (SPID), and the directory number (DN). For international users, the terminal adapter ships already configured for NET3, which should work on most phone lines in Europe. However, you may want to customize settings, regardless of your location. (See “Optional Settings” on the following page.)

You can configure the terminal adapters with ISDN TA Configuration utility, ConfigMenu, or with AT commands. Instructions for all three are provided in this section.

- **ISDN TA Configuration Utility**—recommended for computers with Windows 95 and Windows NT, version 4.0, operating systems.
- **ConfigMenu**—recommended for computers with DOS or Windows 3.x and a VT100/ANSI compatible terminal or data communication program that includes VT100/ANSI terminal emulation.
- **AT Commands**—allow you to fine tune TA operation with AT commands and S-registers. Enter these commands in your data communication program’s terminal mode. AT commands are described in detail in the Chapter 4.

### North American Users

Before you connect the ISIH-2S/2U to your network terminator, you must configure it to match the following:

- **Network Switch Type** \_\_\_\_\_  
Select the network switch type your ISDN service uses at its local central office. You can set the TA to NET3, AT&T 5ESS, NT DMS-100, or US National ISDN-1. In the US the TA defaults to NI 1. In Europe, the TA defaults to NET3. If you don’t know the switch type, get the information from the local phone company.  
AT command: **!CO=**
- **SPIDs and DNs** \_\_\_\_\_  
The TA must be configured with the Service Profile Identifier (SPID). The SPID, assigned by the local phone company, is for the specific BRI line where TA is attached. The SPID field is empty prior to configuration. AT command: **AT!C6=** and **AT\*!C6**  
  
The Directory Number (DN) is the phone number another user would call to contact this TA once it is attached to the ISDN. AT commands: **AT!N1=** and **AT\*!N1=**

---

**Note:** *SPIDs only apply for North American switch types.*

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### International Users

The terminal adapters ship already configured for NET3, which should work for most telephone lines in Europe. If you want to customize settings, refer to the “Optional Configurations” on the following page.

## Optional Settings

- *Data TEI* \_\_\_\_\_  
The Data TEI is the TEI (terminal endpoint identifier) assigned to the data channel. You can select Auto TEI, a fixed TEI, or Disable. A TEI is a number used by the central office switch to uniquely identify each device that is connected to the network. When it uses dynamic TEI assignments (Auto TEI), the central office switch assigns a TEI each time the TA connects to the network. However, the ISDN service provider may assign a fixed TEI at subscription time, in which case you must configure the TA with the fixed TEI number. You also can disable the channel, which may be useful when multiple TAs are attached to a network terminator bus. AT command: **!D3=**
- *Voice TEI* \_\_\_\_\_  
The Voice TEI is the TEI assigned to the voice channel. You have the same choices as for Data TEI: Auto TEI, fixed TEI number, or Disable. AT command: **\*!D3=**
- *Persistent DTR Dialing* \_\_\_\_\_  
A high DTR (Data Terminal Ready) signal on the serial port indicates that your computer or terminal is ready to communicate with your TA. DTR normally goes high when a communication program starts or is ready to dial. Persistent DTR dialing enables the TA to automatically redial the number stored in memory location 0 whenever DTR is high, and the serial port does not have an active call. You can enable or disable this feature. AT command: **\$D**
- *Auto Answer Data Calls* \_\_\_\_\_ *Rings to Answer* \_\_\_\_\_  
Select Auto Answer if you want the TA to automatically answer all incoming data calls (option does not affect analog port). The Rings to Answer number (range: 1–255) selects number of rings the TA waits before answering an incoming call. Default: 1 ring. AT command: **S0=**
- *Dialing Method* \_\_\_\_\_  
Select either the Enbloc or the Overlap dialing method for use when establishing a data call. Your ISDN provider determines the dialing method. The enbloc method is used for most ISDN dialing; however, you can select the overlap method if you are working with a private network. AT command: **%A97=**
- *Data Protocol* \_\_\_\_\_  
The data protocol, also known as the B-channel protocol and the rate adaption protocol, is the language spoken over each 64 Kbps channel between two ISDN devices. The devices on both ends of the ISDN link must use identical protocols. AT command: **!Z**  
  - V.120 Protocol*—provides rates up to 64000 bps on each B channel.
  - PPP Protocol*—provides rates up to 64 Kbps per channel.
- *Stored Numbers* \_\_\_\_\_  
The TA can optionally store as many as 10 phone numbers, up to 20 characters each. AT command: **&Z=**
- *Dialing Stored Numbers* \_\_\_\_\_  
The TA can dial a number previously stored in directory number *n* using the **&Zn=x** command. AT command: e.g., **DS3**



## ISDN TA Configuration Utility

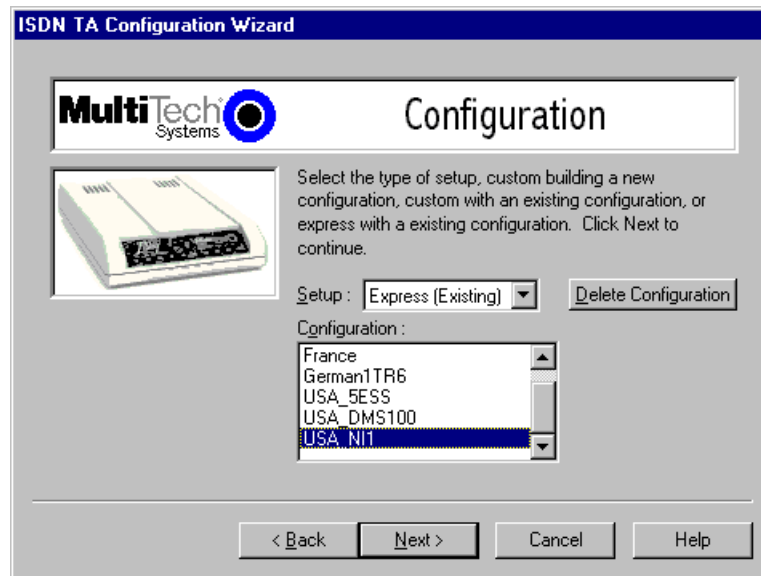
1. Before you start, disconnect the ISIHI-2S/2U by removing the RJ-45 cable from the ISDN jack.
2. Make sure Windows NT Remote Access Service (RAS), or any other application that is using the modem, is shut down. To shut down RAS, click **Start, Programs**, and then **Administrative Tools (Common)**. Then click **Remote Access Admin** and click **Server**, which will indicate whether or not RAS is running. If it is running, click **Stop Remote Access Service**.
3. Insert the diskette labeled Config Utility (ISDNTA). Click **Start, Programs**, and then the ISDN TA Configuration Utility icon.
4. The **Welcome** dialog box appears. Click **Next**.



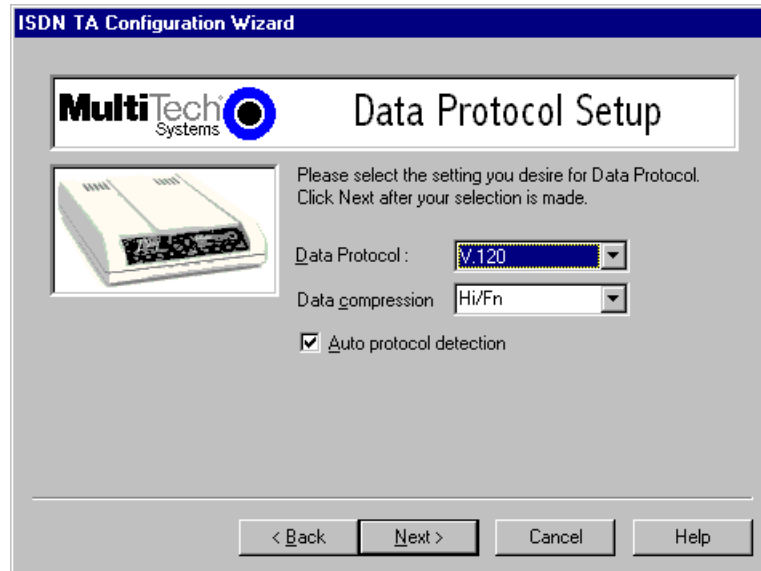
5. The **Searching for TA** dialog box appears. Click **Next**.



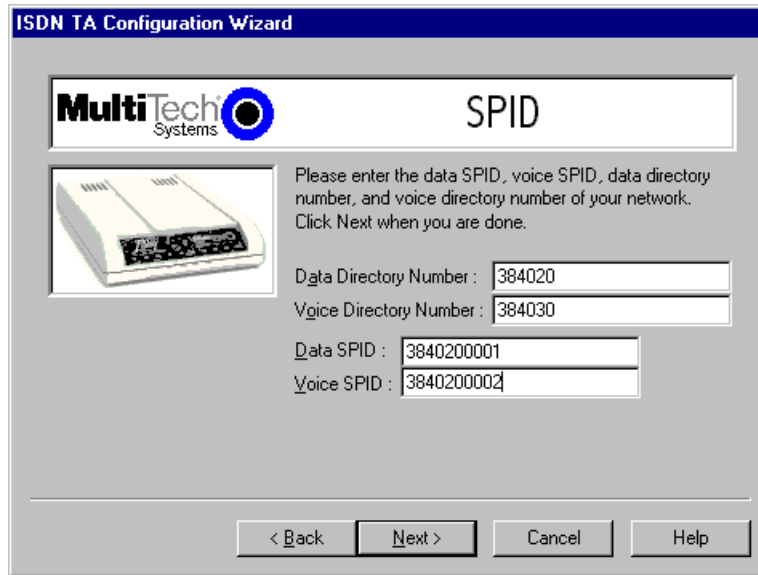
- The **Configuration** dialog box appears. Refer to your network configuration notes in *Before You Start* as you enter information to configure both TAs. If you have questions about choices, click **Help**. After entering information in each dialog box, click **Next**.



- The **Data Protocol Setup** dialog box appears. Referring to you network configuration notes, enter the appropriate information; then click **Next**.

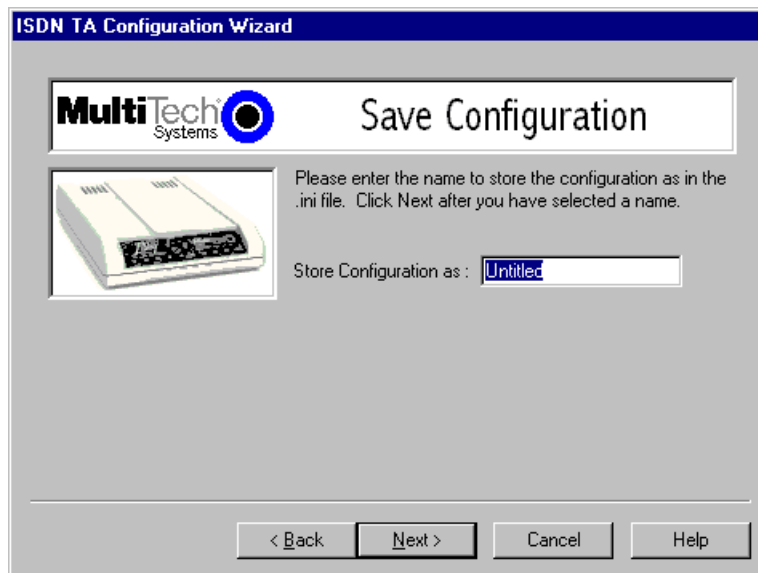


- The **SPID** dialog box appears (North America only). Referring to your network configuration notes, enter the appropriate information; then click **Next**.



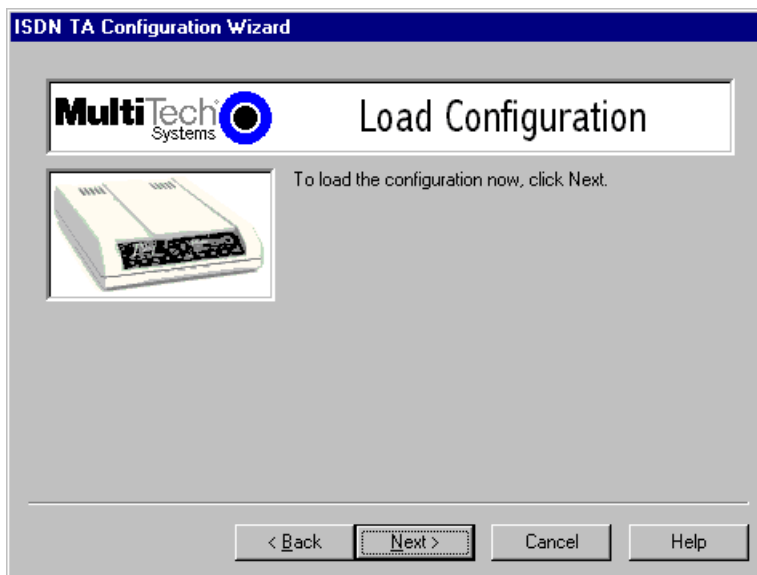
The screenshot shows the "ISDN TA Configuration Wizard" dialog box. The title bar reads "ISDN TA Configuration Wizard". The window contains the MultiTech Systems logo and the title "SPID". Below the logo is an image of a white ISDN terminal adapter. To the right of the image, the text reads: "Please enter the data SPID, voice SPID, data directory number, and voice directory number of your network. Click Next when you are done." There are four input fields: "Data Directory Number" with the value "384020", "Voice Directory Number" with the value "384030", "Data SPID" with the value "3840200001", and "Voice SPID" with the value "3840200002". At the bottom of the dialog box are four buttons: "< Back", "Next >", "Cancel", and "Help".

- In the **Save Configuration** dialog box, enter a name to store the configuration. Then click **Next**.

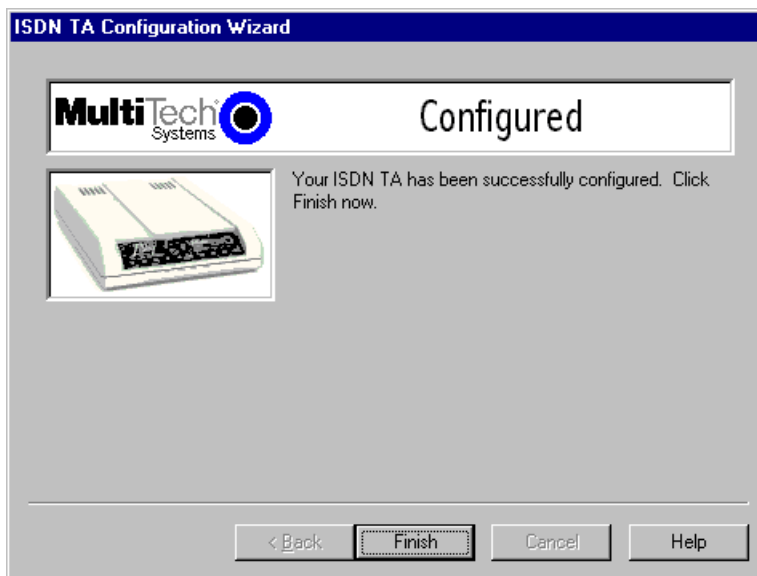


The screenshot shows the "ISDN TA Configuration Wizard" dialog box. The title bar reads "ISDN TA Configuration Wizard". The window contains the MultiTech Systems logo and the title "Save Configuration". Below the logo is an image of a white ISDN terminal adapter. To the right of the image, the text reads: "Please enter the name to store the configuration as in the .ini file. Click Next after you have selected a name." There is one input field labeled "Store Configuration as :" with the value "Untitled". At the bottom of the dialog box are four buttons: "< Back", "Next >", "Cancel", and "Help".

10. To load the configuration, click **Next** in the **Load Configuration** dialog box.



11. Then click **Finish** in the **Configured** dialog box.



The first TA now is configured.

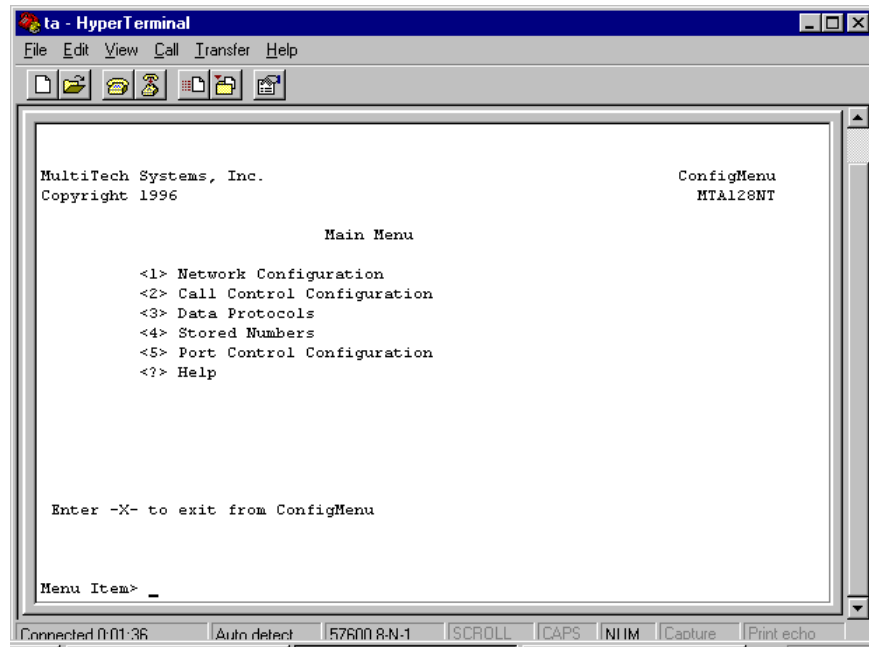
12. Click **Back** to return to the **Configuration** dialog box and repeat steps 5 through 10 to configure the remaining TA(s). If you install multiple ISIH-2S/2U cards in the same PC, you must configure two TAs per card installed. For example, if you install four ISIH-2S/2U cards in one PC, you have to configure eight TAs (two per card).
13. After all TAs are configured, close the ISDN TA Configuration utility and connect to the network again.

## ConfigMenu Configuration Utility

Use the ConfigMenu configuration utility with computers using DOS or Windows 3.x operating systems. ConfigMenu is installed in the TAs as part of the firmware.

To use ConfigMenu:

1. Start a data communication program and select the COM port where the TA is connected.
2. In the communication program dialog box, type **AT@Config** and press ENTER. ConfigMenu's **Main Menu** appears (see screen below).



3. To select menu item, type its number and press ENTER. A submenu then appears where you can make selections. At the lowest level, you can change a configuration option by selecting a number or typing a value and pressing ENTER.
4. When you finish, close ConfigMenu.
5. Use the **&W** command to save your new configuration and to load it automatically when the TA is turned on.

### ConfigMenu Menus

**Network Configuration Menu**—configures network parameters such as switch type, data and voice TEIs, and data and voice MSNs. When you finish, select Save Network Configuration to save your work.

**Call Control Configuration Menu**—changes how the TA originates and answers calls. Options include Auto Answer, Rings to Answer, Dialing Method, and Persistent DTR Dialing.

**Data Protocols Menu**—changes the rate adaption protocol used by the TA.

**Stored Numbers Menu**—stores up to ten phone numbers ( maximum of 20 characters each). Stored number 0 is the phone number that will be dialed if persistent DTR dialing is enabled.

**Port Control Configuration Menu**—configures TA’s serial port, including how TA responds to control signals on the serial interface.

**Help Menu**—provides assistance in navigating through the TA menu system or viewing the ISIH-2S/2U’s firmware version numbers.

## AT Commands

You can configure the terminal adapters using AT commands, just as you would configure an analog modem. Use this method if you prefer to work with AT commands or if you have a special requirement not addressed by either of the configuration utilities.

To configure the TAs with AT commands:

1. Disconnect the ISIH-2S/2U from the network (remove RJ-45 cables from ISDN jacks).
2. Start a data communication program and select the first and third COM ports to be configured.
3. Referring to your notes made in “Before You Start,” enter AT commands in the terminal window of the data communications program.
4. When you finish, use the **&W** command to save your new configuration and to select it to load automatically when the ISIH-2S/2U is turned on.
5. Close the data communications program and reconnect the TA to the network terminator.

For more information on AT commands, refer to AT Commands in Chapter 4.

## NetWare Connect (Novell) Driver Installation

Multi-Tech Systems provides AIO drivers for the ISIH-2S/2U, so it can function with Novell compatible asynchronous applications (e.g., NetWare Connect). The AIO driver is simply an NLM (NetWare Loadable Module) that runs on the file server. Drivers must be loaded on the file server where the board is installed. Drivers can be loaded from the file server's console prompt or incorporated for autoloading in the AUTOEXEC.NCF file.

To install the Multi-Tech AIO driver, copy the file AIOISIX.NLM to the system directory of the file server from a workstation on the network. To copy, use this command:

```
COPY A:\AIOISIX.NLM F:\SYSTEM
```

To load the driver, go to the system or PC console (where the ISIH-2S/2U is installed) and enter the following at the prompt:

```
LOAD AIOISIX [port=W] [int=X] [name=Y] [note=Z]
```

**W** is the hexadecimal I/O port address for the ISIH-2S/2U. The ISIH-2S/2U occupies the next 15 I/O addresses on the bus. That is, if you specify the address 210 hex, then the ISIH-2S/2U occupies addresses from 210 hex to A hex (total of 16 addresses).

**X** is the interrupt (IRQ) vector number for the ISIH-2S/2U. The ISIH-2S/2U can be set for IRQ vectors 10, 11, 12 & 15.

**Y** sets the ISIH-2S/2U board name.

**Z** overrides the default node ID number for the ISIH-2S/2U.

---

***Note:** All these parameters are optional. If none are supplied, the AIO driver assumes the default I/O address and IRQ values and tries to load the driver.*

---

To install the ISIH scripts, copy **aiomdms.mdc** to **f:\system\aiodirectory**. Click **Yes** to overwrite the existing aiomdms.mdc file.

### IRQ Jumpers

Setting IRQs consists of installing the IRQ jumper on the two pins that indicate the interrupt vector. For example, IRQ10 is chosen in the configuration below.

2	3	4	5	7	10	11	12	15
:	:	:	:	:	[:]	:	:	:

## Error Messages

1. *\*Error: An ISIH-2S/2U does not seem to appear at address X\**  
The driver could not find the ISI residing at the address X. Make sure there is no other device in your system at the same I/O address and that the ISI is seated properly in the system slot.
2. *\*Error: ISIH-2S/2U rejected the load header\**  
*\*Error: ISIH-2S/2U got out of sync\**  
*\*Error: ISIH-2S/2U verify failed at address X\**  
*\*Error: Expected X received Y\**  
*\*Error: Verify got out of sync\**

The file server is not able to communicate with the ISIH-2S/2U. Make sure no other device is residing in the system at the same I/O address you chose for the ISIH-2S/2U. Power down the server and make sure the ISIH-2S/2U is seated properly in the system slot. Power up the file server and try to load the AIO driver again. If the problem persists, contact the Multi-Tech Technical Support team.

## Troubleshooting

**Problem:** I loaded the driver at the file server console, then I started NetWare Connect and connected a modem to a port on an ISIH-2S/2U. When I try to communicate with the modem, I see the DTR of the modem being raised, but the modem does not respond to my AT commands.

**Solution:** There might be an IRQ conflict between an ISIH-2S/2U and some other hardware in your system. Even though that particular device (for example, a mouse) is not activated under NetWare, that device will still control the IRQ. Refer to your system's documentation to find out how to disable that device.

## Configuring Ports for NetWare Connect

To set up NetWare Connect ports, enter LOAD NWCCON at the NetWare console prompt. LOAD NWCCON opens the NetWare Connect Configuration Utility. Select the appropriate menu options (modem type, speed, flow control, etc.)

## Removing the Driver (Novell)

Remove file AIOISIX.NLM from the system directory and make the appropriate changes to the *Autoexec.ncf* file.



## SCO Open Server 5 Driver Installation

The installation utility provided by SCO is called *custom*. This section provides a brief guide for opening the utility and installing the driver. The instructions below should be used only on SCO Open Server 5 systems. When you have completed the steps below, go to Multi-Tech Installation Script, which immediately follows this section.

1. If installing the driver from your default floppy drive, type *custom* and press ENTER to open the custom utility. If using a nondefault drive, you must inform your system of the disk drive from where you are doing the installation and the size and capacity of the diskette(s).
2. Select **Software** and press ENTER.
3. The main menu displays a list of options. Press ENTER to select the highlighted item (default): **Install**.
4. Select **From comsco** and press ENTER.
5. Make sure the driver diskette is in the floppy diskette drive and then press ENTER to select the highlighted item (default): **Floppy Disk Drive 0**. The following message appears: **Examining media. Please wait ...**
6. The system recognizes you are installing the Multi-Tech Serial Card Driver and prompts you to select the type of installation.
7. Select **Full Installation** and press ENTER to continue. These messages appear:  
**Extracting Files...**  
**Executing Multi-Tech Serial Card Driver Init Script...**
8. When installation finishes, this prompt appears:  
**Do you wish to continue ( y / n / q ) : ?**  
Type **Y**, press ENTER, and proceed with the *Multi-Tech Installation Script*.

## The Multi-Tech Installation Script

This section guides you through the Multi-Tech Installation Script for SCO and UNIXWare systems. The script requests information such as how many boards you want to install, what I/O address and IRQ values (interrupt requests) you have selected, and how many pseudo devices you want to create for Multi\_View utility. This information extracts the necessary drivers, which will be linked with your system's kernel.

1. The first screen requests the number of ISIH-2S/2U cards you are installing. If you have more than one ISIH-2S/2U, use the chart on page 18 of this guide—**Recommended Base I/O Address and IRQ Values**—to enter the appropriate values for each card. Enter the number of cards and press ENTER.

2. The second screen requests the number of ports. Enter 8 and press ENTER.

3. The third screen requests the base I/O address you selected for the first card you are installing. It is important to verify that the address you select for each ISI does not overlap with existing devices or with another ISI. **The ISI card uses the base I/O address and the next fifteen addresses.**

---

*Note: If the I/O address you select conflicts with an existing device in your system, you must remove the ISI driver and reinstall it.*

---

Enter the base I/O address and press ENTER. For additional information, refer to the online manual.

4. The fourth screen requests the IRQ value for this card. Verify that the IRQ you select for each ISI does not overlap with existing devices or with another ISI. Type the desired IRQ value and press ENTER.

---

*Note: If you entered a number greater than 1 at the first screen, the previous three screens reappear in sequence for each card you install. After you enter the necessary information, installation continues.*

---

5. The fifth screen requests you enter the number of pseudo devices to create for Multi\_View Utility. Enter the value and press ENTER.

---

*Note: You must enter a minimum of 8 for each board installed.*

---

6. The /dev directory holds device-information files used by the kernel to access the hardware. When you add an ISI card, you must give the ISI ports unique names, so they do not conflict with existing ports or other devices known to your system. If you use an existing device name to identify your new ISI ports, the existing device is deleted when the ISI port using its name is created.

The default base name for ISIH-2S/2U ports is **ttyl**. The default base name for printer ports is **prnl**. If this is acceptable, type **Y** and press ENTER.

To change the base name, type **N** and provide a prefix of less than five characters. The base name you select will be used for all ports on each card you install.

The following describes the format used in naming ISI ports:

Default device name and format: **ttyl**

**ttyl**      **basename**

This prefix is applied to all ISI ports on all boards. Base names contain 1–4 characters.

**b**      **board number**

Values of 1 through 4, depending on the number of ISIs installed.

**x**      **port letter**

Values of A–H for ISI ports. (SCO UNIX values A-H indicate modem ports.)

Device base name selected: \_\_\_\_\_

7. After you select a device base name, you are prompted for a printer base name. This prefix identifies each port that supports a terminal with a printer attached to its auxiliary port (for transparent printing). Select a unique base name or accept the default of **prnl** (printer parameters are outlined in the Multi\_Setup Utility section in this guide).

Printer base name selected: \_\_\_\_\_

8. The Multi\_View utility initializes the multiple-page capability of terminals with multiple pages of memory. You are asked how many pseudo devices (the total number of pseudo devices you want to make available to the Multi\_View utility) to create. This is the total number of devices available to all Multi-Tech's terminals. You can have a maximum of 256 pseudo devices in your system.
9. The confirmation screen lists the values you selected. If these values are correct, type **Y** and the installation process continues.

If there is an error in any of the values displayed, type **N** and the first screen appears. You must then reenter the information for each card.

When you accept the confirmation list (by typing **Y**), a series of messages displays while the driver is being installed and the kernel rebuilt. When the display finishes, press ENTER to continue. When **Installation complete** displays, press ENTER .

10. Select **Host** and press ENTER. Remove the diskette from floppy drive.
11. Select **Exit** and press ENTER.
12. To reboot the system, enter the following commands:

Type **sync** and press ENTER.

Type **sync** again and press ENTER.

Type **haltsys** and press ENTER.

Driver installation for the ISI card now is complete.

## Activating Ports in SCO Open Server 5

SCO Open Server 5 provides a device database that monitors the activity of serial ports through which users can log onto the host. If your ISI ports are used by terminals (e.g., to allow users to log onto your host), you must create an entry in the system's device database that furnishes specific information for the terminals that will be used on each ISI port. The database is referenced each time a user attempts to log in. If there is no database entry for a particular terminal, access to the host is denied.

1. Turn on your system, noting that the firmware for each ISIH-2S/2U loads successfully. If the firmware for a given ISIH card does not load, none of its ports will be accessible. (If this happens, see Multi-Tech's Administrative Utility section.)
2. The device database can be modified in two ways:
  - To create terminal accounts with default settings, type `/tcb/bin/ttys_update`.
  - To customize terminal entries, you must create them individually by entering the system administrator's shell (you must be logged in as the root user). To enter the administrator's shell, type `sysadmsh` and press ENTER.
3. Create device entries for each port of the ISI card by selecting the following from the database menu: **Accounts, Terminal, Create**.
4. Enter the complete name of the first device you want to create, substituting the base name, board number, and port letter for the parameters: **ttylb**. Use a lower case **x** value for local DTE (terminal) support and an upper case **X** value for modem control for each port you want to enable. The port status can be altered later, but one setting must be selected at this time.
5. Repeat this process for each port on each board you have installed. **Record the setting you select for each port.**
6. Using device names created in the previous section, type the following command for each port you want to activate: **enable ttylbx**
7. Repeat this command for each port you want to activate, using the lower case letter for local terminal use or upper case for modem control.

---

***Note:** Only one of the options (e.g., modem control or local terminal access) should be enabled for any port at one time. For example, you cannot enable ttyl1a and then enable ttyl1A. To change the status of a port, disable the current status (disable ttyl1a) and then enable it for the desired status (enable ttyl1A).*

---

## Removing the Driver (SCO Open Server 5)

To remove the Multi-Tech Serial Card Driver, you should enter the configuration utility (e.g., custom for SCO Open Server 5) and follow the instructions to remove the entire driver and rebuild the kernel without the ISI driver. If it is necessary to reinstall the driver due to I/O address or IRQ overlap, remove the driver first.

## Multi\_View Utility

This section guides you through the Multi\_View Utility for SCO and UNIXWare systems. While installing the ISIH-2S/2U drivers, you also install the Multi\_View utility for multiple page terminals. This section profiles the Multi\_View utility and gives you the necessary information to create a Multi\_View information file.

Once installed, Multi\_View can be opened by typing the following command:

### **Multi\_View [options]**

Multi\_View initializes the multiple page capacity of terminals with multiple pages of memory. While Multi\_View works even on a dumb terminal (without multiple pages of memory), your terminal should have multiple pages of memory and be capable of retaining the position of the cursor on each page to get the proper effect.

Most state-of-the-art terminals have multiple pages of memory that allow them to switch between sessions. Each page of memory available on the terminal allows its user to establish another session on the host. The multiscreen capability of the terminal stores screen information and cursor position for each session to a different page of memory.

Multi\_View allows the host to process the session-switching hot keys and issue the necessary escape sequence to the terminal so the appropriate page displays. Multi\_View treats each new screen opened by the user as a virtual screen and maintains mapping between each virtual screen created and a page of memory on the terminal. The number of virtual screens and pages of memory available are dependent on the terminal emulation, the particular terminal being used, and the number of pseudo devices created by the system administrator during installation.

In an ideal case, there can be as many virtual screens as there are pages of memory on the terminal. If more virtual screens are specified than there are pages of memory, two virtual screens can be mapped to a single page of memory where both sessions's screens display when that page of memory is recalled.

Once Multi\_View successfully reads the terminal description and initializes the terminal, the hot key sequence for *help* displays. The following hot keys are defined:

- Go to  $n^{\text{th}}$  virtual screen
- Create new virtual screen
- Switch between current and previous screens
- Provide help on hot keys
- Quit Multi\_View with an exit status of zero
- End Multi\_View with a nonzero exit status

To define your own terminal capability database, refer to the *Description File Format* below. The following options are defined:

- h Prints the Help file. Multi\_View uses the environment variable MTDSPLY to choose the utility to display this file. If no such variable is found in the environment, then Multi\_View uses the *pg* utility.
- t Informs Multi\_View to use a terminal description different from the one specified by the TERM variable in the user environment.
- f Allows user to instruct Multi\_View to read the terminal description from a different file than the default description file. The default description file is *usr/bin/msfile*.

### Description File Format

A description file may contain descriptions for multiple terminal types. Separate each terminal entry by a blank line. The first line for each terminal contains the various names by which that terminal is known. The three types of entries for each terminal emulation are hot key entries, terminal escape sequences, and timing specifications.

### Hot Key Entries

These entries have three columns. The first column specifies a mnemonic, which is associated with a specific action taken by Multi\_View. The mnemonics are listed below:

#### Mnemonic Description

<b>vs</b>	Identifies the virtual screen entry. An entry is present for each virtual screen that needs to be opened by Multi_View
<b>sw</b>	Identifies the hot key sequence for switching between two virtual screens
<b>cm</b>	Identifies the hot key sequence that instructs Multi_View to create a new virtual screen
<b>lm</b>	Identifies the hot key sequence for displaying help on the hot keys
<b>qm</b>	Identifies the hot key sequence to exit Multi_View with a zero exit status
<b>em</b>	Identifies the hot key sequence to exit Multi_View with a nonzero exit status

The second column contains the keystroke sequence to press to make the action described by the mnemonic in the first column to take place.

The third column specifies the escape sequence sent by the terminal to Multi\_View when the key combination specified in column two is pressed.

In other words, these entries tell Multi\_View that the terminal sends the escape sequence specified in column three to Multi\_View when the keystrokes specified in column two are pressed and that Multi\_View should take the action specified in column one whenever it receives the characters specified in column three.

## Terminal Escape Sequences

The terminal escape sequence entries describe the escape sequence to be sent to the terminal. The first column contains a mnemonic, which are described below:

Mnemonic	Description
<b>ps</b>	Describes the escape sequence to send to the terminal to switch to the appropriate physical page. The physical pages are numbered in the order they are specified in the description file.
<b>clear</b>	Specifies the escape sequence to clear the screen.

The second column has the character sequence to be sent to the terminal by Multi\_View.

## Timing Specification

The timing specification is the interval in tenths of a second that the utility waits before checking for an escape sequence. The timing specification is defined below:

Mnemonic	Description
<b>time</b>	Specifies the interval, in units of 0.1 seconds, Multi_View waits while reading characters before checking for escape sequences.

A sample file for the Wyse50 terminal is as follows:

```

wy50 wyse50 w50 ; line 1
    vs    Shift_F1    \001' \015    ; line 2
    vs    Shift_F2    \001a\015    ; line 3
    sw    Shift_F3    \001b\015    ; line 4
    cm    Shift_F4    \001c\015    ; line 5
    cm    Shift_F5    \001d\015    ; line 6
    lm    Shift_F6    \001e\015    ; line 7
    qm    Shift_F7    \001f\015    ; line 8
    ps                    \033w0    ; line 9
    ps                    \033w1    ; line 10
    clear                \033+    ; line 11
    time                    1    ; line 12

```

- Line 1 Gives all the different names that the Wyse50 terminal is known by.
- Line 2 Specifies the virtual screen 0 settings. When the help screen appears, **Shift+F1** displays for the virtual screen **0**. The entry means the terminal is going to send a string with the first ASCII character being the start of header (01 Hex), second character a hyphen (-), and the last character a carriage return **cr** when **Shift+F1** is entered on the terminal and Multi\_View is switched to the shell/process associated with virtual screen 0.
- Line 3 Specifies the entry for virtual screen 1.
- Line 4-8 Describes the hot keys used to switch between current and previous virtual screens, create a new virtual screen, display the hot key help, quit Multi\_View with a zero exit status, and end Multi\_View with a nonzero status.
- Lines 9,10 Describes the physical pages on the terminal. The second string on each line gives the escape sequence to be sent to the terminal to switch to the appropriate physical page.
- Line 11 Clear string to clear the screen.
- Line 12 Specifies a 0.1 sec. (at least) wait in reading data before checking for hot keys.

Each character in the escape sequence or hot key can be specified as an ASCII character if it is printable. If not printable, it should be specified in an octal format with leading 0s and preceded by a \. For example, an ASCII escape character can be specified as \033.

Do not switch the screen while outputting; it can break the escape sequence sent to the terminal. When there is more than one virtual screen, all outputs from the inactive virtual screens are blocked. The virtual screen the user currently is working on is the only active screen.

The fullest potential of Multi\_View is realized on a multiscreen terminal. However, Multi\_View can be used on a dumb terminal that has only a single page of memory. When there is only one page, the screen output is unavoidably garbled from different virtual screen outputs.

Some important ASCII unprintable characters and their octal values are listed below.

SOH (^a)	\001	STX (^b)	\002
ETX (^c)	\003	EOT (^d)	\004
ENQ (^e)	\005	ACK (^f)	\006
ESC (^D)	\033	Newline (NL)	\012
Carriage Return (CR)	\015		

Known limitations include:

- No null characters are allowed in the hot keys.
- No hot key can be a complete substring of another hot key.

## Administration Utility

Multi-Tech also provides an administrative utility called *Multi\_Admin*, which aids in troubleshooting Multi-Tech's multiport boards. This section guides you through the Administration Utility for SCO and UNIXWare systems. This interactive menu utility displays various types of Multi-Tech's multiport boards that can be installed in your system. You specifically can observe the status and statistics of any installed multiport board or any of its ports (e.g., MultiClusterU, ISI608, or ISIH1-2S/2U).

This utility periodically updates the statistics and status information for selected boards and/or ports. The displayed statistics are self-explanatory.

The **-v** option provides detailed information and can be used to analyze problems when calling Multi-Tech's technical support:

Usage:           Multi\_Admin [ -v ]

While you can view statistics and status on-screen, you also can store them to a log file and fax the log to a technical support member at Multi-Tech to troubleshoot.



## Linux Driver Installation

To install the Linux driver:

1. Insert the driver installation diskette.
2. Prepare a temporary installation directory: **mkdir isicom**
3. Change your current directory to the temporary installation directory: **cd \isicom**
4. Place the **isicom.tar** file into the isicom directory.
5. Then extract the file using the tar utility: **tar xvf /isicom/isicom.tar**
6. Make sure the following are installed on your system: the make utility, the GNU C compiler (gcc), and kernel sources.
7. Run the bash Install script to compile the driver as a loadable module and to compile the user space firmware loader.
8. The files are copied to the destination folder. If you don't specify the folder, the destination folder default is **/usr/local/ISICOM** (case sensitive). This also creates device files for the ISI cards, normal and callout ports, in the /dev folder.
9. To load the driver manually, use the ISIH-2S/2U installation configuration stored in the ISICOMStart file in the destination folder.

Or, you can include the configuration in the appropriate start-up script stored in the /etc/rc.d/ folder, so it loads when you start the computer.

10. If you make any changes to this configuration, edit the first line of the ISICOMSTART file. The correct syntax for this line is as follows:

```
insmod <destination folder>isicom.o
ISIBase1=0xXXXX
Irq1=XX
ISIBase2=0xXXXX
Irq2=XX
```

ISIBasex and Irqx represent the base I/O address and IRQ that are passed to the driver at module loading time. Refer to the insmod manual page for more details on parameter passing.

---

***Note:** A base I/O address of 0, e.g., ISIBaseX=0x0, or omission of these parameters for any card X, disables that particular card.*

---

## Miscellaneous:

Device files corresponding to ports on the ISIH-2S cards are created in the /dev folder. Use ttyMxy for normal ports and cumxy for corresponding callout ports. The letter x is the card number (1–4), and y is the port number, (a–p) for 16-port cards.

Normal ports (ttyM) are configured for dial-in connections. Callout ports (cum) are used for dial-out connections.

To view busy I/O address space on your system, type:

```
cat /proc/ioports
```

To view busy IRQs, type:

```
cat /proc/interrupts
```

To load the driver manually, use insmod.

Example: To load two ISI cards configured with base I/O addresses 0x210 and 0x200 and IRQs 5 and 10, enter the following in the destination folder:

```
insmod isicom  
ISIBase1=0x210  
Irq1=5  
ISIBase2=0x200  
Irq2=10
```

To remove the driver manually, type **rmmod isicom**. This removes the driver only if no ISI ports are in use.



**MODEM 4**  
**AT Commands, S-Registers,  
and Result Codes**

## Modem AT Commands

ISIH-2S/2U modems are controlled by instructions called *AT commands*, so called because the *attention characters*, *AT*, precede each command or sequence of commands (known as a *command string*). You can send commands to the modem from your keyboard while in terminal mode, or you can use communications software to issue these commands automatically.

The modem is in command mode when it is not dialing or online. When it is in command mode, you have access to a complete communications system that allows you to use several features, including the basic AT command set described in this chapter. Using the basic AT command set, you can enter phone numbers for automatic dialing, configure modem options, and monitor telephone activity. In addition, you can command your modem to perform advanced features such as error correction, data compression, speed conversion, and more.

This chapter describes the modem's operational modes and shows you how to use each modem AT commands. These commands and responses are compatible with all systems and with all data communications software using the AT command set.

### Modes of Operation

The modem operates in two basic functional modes: *command mode* and *online mode*. (There is also an in-between state, *wait-for-carrier*, in which the modem is out of command mode but not yet online.) When you turn on the modem, it is in command mode and is ready to accept and respond to commands from your keyboard or software.

The modem enters online mode after it dials, connects with another modem, and detects a valid carrier signal. If it does not detect a carrier signal within the time frame controlled by the S-register **S7**, the modem abandons the call and reenters command mode.

You can make the modem enter online mode without dialing by entering **AT** and then **D** (dial) or **A** (force answer mode). The modem exits online mode if the carrier signal is lost or intentionally dropped. When this happens, the modem hangs up and reenters command mode. By sending certain *escape* characters to the modem while online, you can make it enter command mode without losing the carrier signal. While waiting to establish the carrier, you can type any character from the keyboard to make the modem to go back to the command mode.

### Command Structure

You can control a wide variety of modem operations and options when the modem is in command mode. AT commands tell the modem to dial a number, to answer a call, to operate at a certain speed, to use a certain compression technique, and many other functions. AT commands consist of one or two letters, which may be preceded by an ampersand (&), a percent character (%), or a slash character (/). The **Q** command, for example, determines whether the modem returns result codes, while the **&Q** command selects the asynchronous communications mode.

A parameter after a command (0, 1, 2, etc.) tells the modem which option to use. If you do not specify a parameter, the modem assumes the 0 (zero) option. **E**, for example, is the same as **E0**. You can issue several commands on a single line (a command string) as long as the line does not exceed 40 characters.

---

*Note: Each character in a command counts toward the 40 character command line maximum. Example: **Q1** is a single command, but it counts as two characters in the command line.*

---

Each command has a valid range of parameters. For example, **&S** can have only 0 or 1 as a parameter. Valid commands always generate an OK result code, and a few generate an additional response such as a list of parameters. An invalid command such as **&S3**, which has a parameter outside the valid range, generates an ERROR result code. Most commands have a default parameter that is enabled when the modem is turned on or reset with the **ATZ** or **AT&F** command. Factory defaults are stored in read-only memory (ROM) and cannot be changed. User-defined defaults can be stored in nonvolatile random-access memory (NVRAM) and can be changed or deleted at will.

### Command Editing

Always begin a command with the letters *AT*. Enter the entire command string in upper or lower case, but do not mix cases within the command string. The AT command is not executed until you press ENTER. Use the BACKSPACE key to erase the previous command character. It will not erase the AT characters once they are typed. If your keyboard has no BACKSPACE key, use CTRL+H. (You can change the character recognized by the modem as BACKSPACE to any other ASCII character by changing register **S5**.)

Press CTRL+X to cancel an entire command that has been typed but not yet executed. This also clears the command buffer. The effect is the same as backspacing the command, only quicker.

The modem stores characters entered in a command in its command buffer until they are executed by pressing ENTER. The command buffer's capacity is 40 characters. The attention characters (AT) do not count toward the 40-character command line maximum. You may use spaces for increased readability when typing a command. Spaces are not stored in the command buffer, and they do not count towards the 40-character command line maximum. Special characters, such as hyphens and parentheses, are not allowed.

If you exceed the 40-character limit or type invalid characters, the command buffer is automatically erased and an ERROR message appears. Retype the command within the 40-character limit, using only the allowed characters.

The commands in this chapter are organized by function. Abbreviated commands are listed on the next page by function along with a short description and page numbers that refer to a more detailed description, immediately following this list.

Topic	Command	Description
Dialing Action, p. 71	<b>D</b>	Dial
	<b>H</b>	On-hook/off-hook
Dial Modifiers, p. 71	<b>L, P, T, W</b>	Command accepted, but has no function
	<b>,</b>	Command accepted, but has no function
	<b>;</b>	Command accepted, but has no function
	<b>! \$ @ ^</b>	Command accepted, but has no function
Phone Number Memory, p. 72	<b>&amp;Z</b>	Store a phone number
	<b>DS</b>	Dial a stored number
Configuration Storage & Recall, p. 72	<b>&amp;W</b>	Store configuration
	<b>&amp;F</b>	Load factory default configuration
	<b>Z</b>	Reset modem
	<b>&amp;Y</b>	Select stored configuration on power-up
Modem Responses (Result Codes), p. 73	<b>E</b>	Echo command mode characters
	<b>Q</b>	Result codes: enable/disable
	<b>V</b>	Result codes: verbose/terse
	<b>\V</b>	Protocol result code
	<b>X</b>	Result codes and call progress
	<b>&amp;Q</b>	Select asynchronous communications mode
Online Connection, p. 75	<b>B</b>	Answer tone
	<b>C</b>	Carrier control
	<b>F</b>	Echo online data characters
	<b>&amp;G</b>	Guard tones
	<b>-C</b>	Data calling tone
	<b>N</b>	Modulation handshake
	<b>\T</b>	Disable inactivity timer
	<b>Y</b>	Long space disconnect
RS-232 Interface Controls, p. 77	<b>&amp;C</b>	Carrier Detect control
	<b>&amp;D</b>	Data Terminal Ready control
	<b>&amp;S</b>	Data Set Ready control
Error Correction & Data Compression, p. 78	<b>\N0 or &amp;Q6</b>	Non-error correction mode
	<b>\N3</b>	Auto-reliable mode
	<b>\N2</b>	Reliable mode
	<b>%C0</b>	Data compression disabled
	<b>%C1</b>	Data compression enabled
Immediate Action, p. 79	<b>A/</b>	Repeat last command
	<b>I</b>	Information request
	<b>&amp;B</b>	V.32 auto retrain
	<b>&amp;V</b>	View current configuration
Flow Control, p. 80	<b>&amp;M0</b>	Asynchronous mode
	<b>&amp;K0 or \Q0</b>	Flow control disabled
	<b>&amp;K3 or \Q3</b>	Hardware flow control
	<b>&amp;K4 or \Q1</b>	XON/XOFF flow control
	<b>\X0</b>	XON/XOFF no pass-through
	<b>&amp;J</b>	Auxiliary relay control
	<b>\J</b>	Enable data buffer control
	<b>\G</b>	Modem port flow control
	<b>\K</b>	Set break control
Escape Sequences, p. 82	<b>+++AT&lt;cr&gt;</b>	Default in-band escape sequence
	<b>A</b>	Force answer mode
	<b>O</b>	Go back online

## Dialing Commands

Use dialing commands to dial and hang up.

### **Ds**    **Dial**

*s* = phone number

Default: none

Causes the modem to dial the telephone number immediately following it. For example, if you type **ATD5551212<cr>**, the modem dials the number 555-1212.

### **Hn**    **On-Hook/Off-Hook**

*n* = 0 or 1

Default: 0

Makes the modem hang up (go on-hook) or simulate the action of picking up a telephone handset (go off-hook).

**H0** (or **H**) hangs up the modem

**H1** brings the line off-hook, just as if you had picked up the telephone handset.

It is not necessary to use the **H1** command to bring the line off-hook when using the **D** command. The modem automatically goes off-hook when you press ENTER at the end of the dial command.

## Dial Modifier Commands

ISIH-2S/2U modems rely on the terminal adapters on the card for dialing. For backwards compatibility, the following dial modifier commands can be included in the dial string. They are accepted by the modem, but ignore the actual function. These commands are:

<b>L</b>	<b>Redial Last Number</b>
<b>P, T</b>	<b>Pulse or Tone Dialing</b>
<b>W</b>	<b>Wait for New Dial Tone</b>
<b>,</b>	<b>Dialing Pause</b>
<b>;</b>	<b>Return to Command Mode After Dialing</b>
<b>!</b>	<b>Flash On-Hook</b>
<b>\$</b>	<b>Detect Call Card Tone</b>
<b>@</b>	<b>Quiet Answer</b>
<b>^</b>	<b>Disable Data Calling Tone Transmission</b>

## Phone Number Memory Commands

ISIH-2S/2U modems can store up to four telephone numbers in nonvolatile memory. You can store the numbers with the **&Z** command and dial them with the **ATDS** command.

### **&Zn=s** Store a Phone Number

*s* = phone number

*n* = 0, 1, 2 or 3

Default: none

You can store a telephone number string in the modem's phone number memory. You can store four of these strings using the **&Zn=s** command. The memory locations are labeled *N0* through *N3*. For example, the telephone number 1-612-555-1212 is stored at memory location *N2* by typing **&Z2=16125551212** and pressing ENTER.

### **DSn** Dial a Stored Number

*n* = 0, 1, 2, or 3

Default: none

You can automatically dial a telephone number that is stored in the modem's number memory by typing **ATDSn**, where *n* = 0 through 3. For example, you can dial a number stored at *N2* by typing **ATDS2** in terminal mode and pressing ENTER.

## Configuration Storage and Recall Commands

The ISIH-2S/2U stores parameters in two places. It stores factory default parameters in read-only memory (ROM), and customized parameters in nonvolatile random access memory (NVRAM). You cannot change the default parameters in ROM, but you can change parameters in temporary memory and then store them in NVRAM as custom settings. You can then recall the custom settings as if they were factory default settings.

### **&Wn** Store Configuration

*n* = 0

Default: **&W0**

The **&W** command stores current AT commands and S-register values in nonvolatile memory, so you won't lose your custom settings when you turn off the modem or reset it.

**&W0** (or **&W**) stores all current AT command and S-register values in nonvolatile random access memory (NVRAM) and configures the modem so it reads your custom settings in NVRAM when the modem is turned on or when it is reset with the **Z** command. The **&F** reset command continues to read the factory default settings in ROM.

### **&Fn** Load Default Configuration

*n* = 0

Default: **&F0**

ISIH-2S/2U modems store factory default AT command settings and S-register values in read-only memory (ROM); they store your custom AT command and S-register values in nonvolatile random access memory (NVRAM).

The **&F0** (or **&F**) command resets modem to the factory default values stored in ROM.



**Zn Reset Modem***n* = 0 or 1

Default: none

The **Z** command resets the modem to the configuration last saved by the **&W** command. The default values come from the customized configuration in NVRAM.

**Z1** is the same as **Z0**, and functions identically.

**&Yn Select Stored Configuration for Hard Reset***n* = 0

Default: 0

This command is included for compatibility with applications that issue the **&Y0** command. Modem functions are not changed.

**&Y0** selects the profile stored at location 0 on power-up.

**Modem Response (Result Code) Commands**

ISIH-2S/2U modems can give responses to commands. The most common is *OK*, but the modems also can alert you or your software to dial tones, busy signals, connection speeds, and whether the connection is made with error correction or compression enabled. These responses are called *result codes*; they can be terse (numbers) or verbose (text).

**En Echo Command Mode Characters***n* = 0 or 1Default: **E1**

Normally, when you type commands on the keyboard, the modem echoes the characters back to the computer or terminal, which displays them on the monitor. Use the **E** command to turn this feature off and on.

**E0** disables the echo.

**E1** enables the echo.

**Qn Result Codes Enable/Disable***n* = 0 or 1Default: **Q0**

Use the **Q** command to enable or disable result codes for applications such as computer-controlled auto dialing.

**Q0** (or **Q**) enables result codes.

**Q1** disables result codes for applications such as computer-controlled auto-dialing.

**Vn Result Codes (Verbose/Terse)***n* = 0 or 1Default: **V1**

The **V** command controls whether the modem's result codes display as text (*verbose*) or numeric (*terse*) messages. For example, if no carrier signal is detected after dialing, the result can display either as **NO CARRIER** or as the number **3**.

**V0** (or **V**) displays the modem's result codes as a number.

**V1** displays result codes as text.

**V2**, an additional command given anytime after **ATV1** is entered, displays the connect message of both the local modem and the remote modem.

### **Xn** Result Codes and Call Progress Selection

$n = 0, 1, 2, 3, 4, 5, 6, \text{ or } 7$

Default: **X4**

Selects which result codes the modem provides in command mode and determines whether the modem uses *smart dialing* or *blind dialing*. When it smart dials, the modem listens for dial tones and busy signals and responds to them. When it blind dials, the modem ignores the signals and relies on timing instead.

**X0** causes the modem to blind dial. Instead of looking for a dial tone, it pauses for the time set in register **S6** and then dials regardless. Once a connection is made, it sends the basic code **CONNECT** to the terminal. It ignores any busy signals.

**X1** causes the modem to blind dial. In addition to the basic **CONNECT** code, it provides extended codes consisting of the word **CONNECT** and the speed of the connection (**CONNECT 14400** or **CONNECT 28800**, for example). In this mode, the modem does not recognize or respond to dial tones or busy signals.

**X2** causes the modem to wait for a dial tone before dialing. If it does not detect a dial tone within the time set by **S6**, the modem sends a **NO DIALTONE** result code to the terminal. In this mode, the modem provides extended result codes but does not respond to busy signals.

**X3** causes the modem to blind dial and to look for a busy signal. If it detects one, it sends a **BUSY** result code to the terminal. In this mode, the modem provides extended result codes, but it does not respond to dial tones.

**X4** causes the modem to look for a dial tone and a busy signal and respond with **NO DIALTONE** or **BUSY**, as appropriate. It also provides extended result codes. It is the most useful setting for most data communication programs and is the default setting.

**X5** causes the modem to look for a dial tone and a busy signal and respond with **NO DIALTONE** or **BUSY**, as appropriate. It also provides extended result codes. It is the most useful setting for most data communication programs and is the default setting.

**X6** causes the modem to look for a dial tone and a busy signal and respond with **NO DIALTONE** or **BUSY**, as appropriate. It also provides extended result codes. It is the most useful setting for most data communication programs and is the default setting.

**X7** causes the modem to wait for a dial tone before dialing. If it doesn't detect a dial tone within the time set by **S6**, the modem sends only the basic result code to the terminal (**ERROR**, **NO CARRIER**, or **CONNECT**, for example). In this mode, the modem does not respond to busy signals.

**&Qn Asynchronous Communications Mode**

$n = 0, 5, \text{ or } 6$

Default: **&Q5**

Allows you to select the type of asynchronous communications mode for your modem.

---

*Note: These commands are the same as several of the \Nn commands, described later in this chapter.*

---

**&Q0** selects asynchronous mode with data buffering. This is the same as \N0, nonerror correction mode with data buffering.

**&Q5** selects error control with data buffering. This is the same as \N3, V.42/MNP auto-reliable mode.

**&Q6** selects asynchronous mode with data buffering. This is the same as \N0, non-error correction mode with data buffering.

## Online Connection Commands

The following commands control the conditions of the online connection.

**Bn Answer Tone**

$n = 0, 1, 2, 3, 15, \text{ or } 16$

Default: **B1** and **B16**

Selects the frequency the modem uses for its answer tone. (The answer tone is the tone transmitted by the receiving modem to the calling modem, thus initiating the *handshake* between the two modems.) At higher speeds (2400 bps and above) there is no conflict because all protocols use the Bell frequency of 2225 Hz. Lower speeds require different frequencies.

**B0** selects ITU-T V.22 mode when the modem is at 1200 bps.

**B1** selects Bell 212A when the modem is at 1200 bps. This is a default.

**B15** selects V.21 when the modem is at 300 bps.

**B16** selects Bell 103J when the modem is at 300 bps. This is a default.

**Cn Dummy Command****-Cn Data Calling Tone**

$n = 0 \text{ or } 1$

Default: **-C0**

The data calling tone is a tone of a certain frequency and cadence, as specified in the V.25 standards, which identifies whether it is remote data, fax, or voice. The frequency is 1300 Hz, with a cadence of .5 s on and 2 s off.

**-C0** disables the V.25 data calling tone.

**-C1** enables the V.25 data calling tone.

**F Dummy command**

**&Gn Guard Tones**

$n = 0, 1, \text{ or } 2$

Default: **&G0** (models outside U.K.) or **&G2** (U.K. models only)

Controls the presence or absence of guard tones from the transmitter when in answer mode at either 1200 or 2400 bps. Guard tones are used in Europe and other areas to allow the modem to function in the telephone systems. Guard tones are not used in the United States. U.K. models are locked at **&G2** (1800 Hz guard tone).

**&G0** disables ITU-T guard tones.

**&G1** enables ITU-T 550 Hz guard tone.

**&G2** enables ITU-T 1800 Hz guard tone.

**Nn Modulation Handshake**

$n = 0 \text{ or } 1$

Default: **N1**

Controls whether the local modem performs a negotiated handshake with the remote modem at connection time when the communication speed of the two modems is different.

**N0** enables handshaking only at the communication standard specified by S37 and the **ATB** command.

**N1** always begins the handshake only at the communication standard specified by S37 and the **ATB** command, but allows fallback to a lower speed as the handshake proceeds. This is the default.

**\Tn Inactivity Timer**

$n = 0$

Default: **\T0**

The inactivity timer specifies the length of time, in minutes, that the modem waits before disconnecting when no data is sent or received. This timer is specified in register **S30**. The **\T0** command disables the inactivity timer.

**Yn Long Space Disconnect**

$n = 0, 1$

Default: **Y0**

When two modems are connected in reliable mode, a link disconnect request packet is sent to request a disconnect. In non-error correction mode, there is no *polite* way to request a disconnect. As a result, some *garbage* may be received when a hang-up command is issued.

**Y0** disables the modem's use of the break signal.

**Y1** enables long space disconnect.

## RS-232 Interface Commands

These commands define how the ISIH-2S/2U modems use and respond to standard RS-232 signals.

### **&Cn Carrier Detect Control**

$n = 0$  or  $1$

Default: **&C1**

Allows you to control the Carrier Detect (CD) signal on the RS-232/V.24 interface. This is a signal from the modem to your computer indicating that the carrier signal is being received from a remote modem. Normally, CD goes *high* (turns on) when the modem detects a carrier on the communications link and *drops* (turns off) when it loses the carrier. By using **&C**, you can force the signal to stay high, or to drop momentarily when the remote modem disconnects. This option is useful with some CBX phone systems and mainframe front ends, which require CD to act in this manner.)

**&C0** ignores the state of the carrier from the remote modem. CD is forced high.

**&C1** allows CD to act normally—to go high when the modem detects a carrier, and to drop when it loses the carrier.

### **&Dn Data Terminal Ready Control**

$n = 0, 1, 2,$  or  $3$

Default: **&D2**

The Data Terminal Ready (DTR) signal on pin 20 of the RS-232/V.24 interface must be high, or *on*, in order for the modem to operate. A high DTR signal tells the modem that the computer it is connected to is ready to communicate through the modem.

The DTR signal can also be used to cause the modem to reset to its default parameters, as if you had given the modem an ATZ command.

**&D0** (or **&D**) causes the modem to ignore the DTR signal and treat it as always on.

**&D1** causes the modem, if in online data mode, to enter command mode, issue an OK and remain connected when the DTR drops.

**&D2** causes the modem to hang up when DTR drops while the modem is in online data mode.

**&D3** causes the modem to reset when DTR drops. It will also hang up if it is online.

### **&Sn Data Set Ready Control**

$n = 0$  or  $1$

Default: **&S0**

Controls the state of the Data Set Ready (DSR) signal on the RS-232/V.24 interface. Normally, DSR follows CD. You can force the signal high or allow it to act normally.

**&S0** forces DSR high (on).

**&S1** allows DSR to act normally, that is, to follow CD.

## Error Correction and Data Compression Commands

You can configure modems to any of three different V.42 modes of operation (with or without compression): non-error correction, auto-reliable, and reliable modes. You also can turn data compression on or off.

### **\Nn** Error Correction Modes

$n = 0, 1, 2, 3, 4, 5, \text{ or } 7$

Default: **\N3**

Select the modem's error correction mode using the **\N** command.

**\N0** disables the modem's V.42 error correction capabilities, and the modem functions as a non-error correction modem with data buffering. This is the same as **&Q6**, described earlier in this chapter.

**\N1** causes the modem to function in direct mode.

**\N2** enables reliable mode, in which the modem uses its V.42 error correction capabilities for all transmissions. In reliable mode, the modem must be connected to a modem with the V.42 MNP protocol.

**\N3** enables auto-reliable mode. During the handshaking procedures at the start of the online connection, the modem queries whether the other modem is using V.42 error correction. If the modem determines that the other modem is using V.42, it switches itself into reliable (V.42) mode and enables error correction. If it determines that the other modem is not using V.42, the modem remains in non-error correction mode. (This is the same as **\N5** and **\N7**.)

**\N4** enables reliable mode, in which the modem uses its V.42 error correction capabilities for all transmissions. In reliable mode, the modem must be connected to a modem with a V.42 protocol (MNP or LAP-M).

The V.42 standard includes MNP Class 3 and 4 and LAP-M error correction methods.

**\N5** enables auto-reliable mode. During the handshaking procedures at the start of the online connection, the modem queries whether the other modem is using V.42 error correction. If the modem determines that the other modem is using V.42, it switches itself into reliable (V.42) mode and enables error correction. If it determines that the other modem is not using V.42, the modem remains in non-error correction mode. (This is the same as **\N3** and **\N7**.)

**\N7** enables auto-reliable mode. During the handshaking procedures at the start of the online connection, the modem queries whether the other modem is using V.42 error correction. If the modem determines that the other modem is using V.42, it switches itself into reliable (V.42) mode and enables error correction. If it determines that the other modem is not using V.42, the modem remains in non-error correction mode. (This is the same as **\N3** and **\N5**.)

**%Cn Data Compression**

*n* = 0 or 1

Default: %C1

The %C command allows you to disable data compression. Data compression is normally enabled.

%C0 disables V.42bis/MNP 5 data compression.

%C1 enables V.42bis/MNP 5 data compression.

## Immediate Action Commands

Use immediate action commands to obtain information about AT commands and current modem settings.

**A/ Repeat Last Command**

Default: None

Type **A/** to repeat the previous command. Do not precede this command with **AT** or press ENTER to execute it.

**In Information Request**

*n* = 0

Default: none

This command displays specific product information about your modem.

**I0** or **I** returns the controller firmware version number. Use this command to identify your modem's firmware level before calling Multi-Tech Technical Support. (Same as **I3**.)

**&Bn Dummy command**

**&V View Current Configuration**

Default: none

Use the **&V** command to display the active modem settings.

## Flow Control Commands

Flow control refers to techniques used by data terminal equipment and the modem to pause and resume the flow of information between them. It prevents a device from accepting more data than it can handle. The modem implements flow control in both directions. When the modem halts the flow of data, it is called flow control. When the computer halts the flow, it is called pacing.

### **&Kn** Local Flow Control Selection

$n = 0, 3, \text{ or } 4$

Default: **&K3**

Allows you disable flow control and enable hardware or software flow control.

**&K0** completely disables data flow control initiated by the modem. (Same as **\Q0**.)

**&K3** enables modem's use of Clear to Send (CTS) signal on the RS-232/V.24 interface to regulate data flow. When CTS drops, data flow is suspended until the signal goes *high* (on) again. This method of flow control works in conjunction with pacing (i.e., computer-initiated flow control), which uses the Request to Send (RTS) signal on the RS-232/V.24 interface. Hardware flow control cannot be enabled unless an active error correction protocol is selected. This is the factory default setting. (This is the same as **\Q3**.)

**&K4** enables XON/XOFF software flow control. XON/XOFF flow control is an in-band method of data flow regulation. In-band data regulation means that the XON (^Q) and XOFF (^S) characters are inserted into the stream of data rather than using separate control lines. When an XOFF character is detected, the data stream is suspended until an XON character is detected. If you issue the **&K4** command to the modem, it will respond to XON/XOFF pacing, and use XON/XOFF characters as its own method of flow control to the computer. (This is the same as **\Q1**.)

The drawback to using this method of pacing is that some files may contain these characters as part of the file data. If such a file is transferred using a modem with XON/XOFF flow control enabled, the file transfer could fail due to indefinite suspension.

### **\Qn** Local Flow Control Selection

$n = 0, 1, \text{ or } 3$

Default: **\Q3**

Allows you disable flow control and enable hardware or software flow control.

**\Q0** completely disables data flow control initiated by the modem. (This is the same as **&K0**.)

**\Q1** enables XON/XOFF software flow control. XON/XOFF flow control is an in-band method of data flow regulation. In-band data regulation means that the XON (^Q) and XOFF (^S) characters are inserted into the stream of data rather than using separate control lines. When an XOFF character is detected, the data stream is suspended until an XON character is detected. If you issue the **&K4** command to the modem, it will respond to XON/XOFF pacing, and use XON/XOFF characters as its own method of flow control to the computer. (This is the same as **&K4**.)



The drawback to using this method of pacing is that some files may contain these characters as part of the file data. If such a file is transferred using a modem with XON/XOFF flow control enabled, the file transfer could fail due to indefinite suspension.

**\Q3** enables modem's use of Clear to Send (CTS) signal on the RS-232/V.24 interface to regulate data flow. When CTS drops, data flow is suspended until the signal goes *high* (on) again. This method of flow control works in conjunction with pacing (i.e., computer-initiated flow control), which uses the Request to Send (RTS) signal on the RS-232/V.24 interface. Hardware flow control cannot be enabled unless an active error correction protocol is selected. This is the factory default setting. (This is the same as **&K3**.)

**\Xn XON/XOFF Pass-Through**

$n = 0, 1$

Default: **\X0**

When XON/XOFF pacing is active, the local modem has two options regarding the XON and XOFF characters. It can respond to and discard the characters from the computer, or it can respond to the characters and pass them through the data communications link to the remote modem, thereby pacing the remote modem as well.

**\X0** causes the modem to respond to and discard the XON and XOFF characters (default)

**\X1** causes the modem to respond to and pass on the XON and XOFF characters

**\Jn Data Buffer Control**

$n = 0$

Default: **\J0**

**\J0** disables force line rate less than or equal to DTE rate

**\J1** enables force line rate less than or equal to DTE rate

**\Kn Set Break Control**

$n = 0, 1, 2, 3, 4, 5$

Default: **\K5**

Determines how the modem processes a break signal received from the local DTE during an online connection.

**\K5** causes the modem to send the break to the remote modem in sequence with transmitted data, non-destructive, non-expedited.

## Escape Sequences

Escape sequences are also known as escape codes. They are used to cause the modem to enter command mode from online mode without disconnecting the call.

### **+++AT<cr>In-Band Escape Sequence**

If the modem is online with a remote modem, you can cause the modem to enter command mode without disconnecting the call by typing an escape code. The default escape code used by the modem is three plus signs (+++) followed by the letters *AT*, up to 10 command characters (most typically *H*, to hang up), and ENTER. The modem then escapes to command mode, executes the command (if any), and remains in command mode. For example, to hang up the modem at the end of a call, type **+++ATH <cr>**.

### **A Force Answer Mode**

You can use the **A** command to force the modem into answer mode. Type **ATA** when in command mode to immediately bring your modem off-hook, out of command mode, into online answer mode, and to cause it to transmit its carrier signal over the phone line. If no responding carrier tone is received by your modem within 45 seconds (or by the time you specified in register **S7**), your modem stops transmitting its tone, hangs up, and goes back into command mode.

### **On Go Back Online**

*n* = 0, 1, or 3

Default: none

Use the **O** command to bring the modem out of command mode and back into online mode. The **O** command reverses the result of entering the escape code. The **O** command brings modem into the online mode (originate or answer) it was in prior to entering command mode.

**O0** causes the modem to exit command mode and return to online data mode.

**O1** causes the modem to issue a retrain before returning to online data mode.

**O3** causes the modem to issue a rate renegotiation before returning to online data mode.

## Modem S-Registers

*S-registers* are small regions of memory where modem configuration information is stored. Whereas AT commands tell a modem *what* to do, S-registers tell the modem *how* to do it. Each S-register has a name that consists of the letter *S* and a number (**S0**, **S1**, **S2**, etc.), hence the term *S-register*. Use the **Sr?** command to read the value stored in an S-register and the **Sr=n** command to change it.

### **S0** Number of Rings Until Modem Answers

Unit: 1 ring  
Range: 0–255  
Default: 0

Defines number of rings the modem waits before answering an incoming call. Default value is zero, which effectively disables the auto-answer function. When auto-answer is disabled, the modem can only answer via the **ATA** command. Set the **S0** register value to one to cause the modem to answer the call immediately after the first ring. Maximum number of rings that can be configured is 255.

### **S1** Ring Count

Unit: 1 ring  
Range: 0–255  
Default: 0

Counts number of rings that have occurred. It is a *read* type of register and is seldom used in typical operation. Each time an incoming ring signal is detected, **S1** increases its value by one, up to a maximum of 255. If you set **S1** to a value other than its default value of zero, or if the value is increasing with rings, this new value remains stored in **S1** for eight seconds after the last ring is counted, after which the value reverts back to zero.

### **S2** Escape Code Character

Unit: Decimal  
Range: 0–255  
Default: 43 (+)

Defines escape code character by its decimal ASCII code. Default character is the plus (+) sign (decimal 43). **S2** can be set for any ASCII character. Setting an **S2** value greater than 127 results in no escape character, resulting in no means of entering command mode from online mode without breaking the online connection unless you use the **BREAK** method.

---

*Note:* If you change the **S2** value, you must make corresponding changes in your data communications software.

---

### **S3** Return Character

Unit: Decimal  
Range: 0–127  
Default: 13 (^M)

Defines carriage return character by its decimal ASCII code. Default setting is the ^M character (decimal 13), the code for ENTER on most keyboards. Can be set for any ASCII character.

---

*Note: If you change the **S3** value, you must make corresponding changes in your data communications software.*

---

**S4 Line Feed Character**

Unit: Decimal

Range: 0–127

Default: 10 (^J)

Defines the line feed character by its decimal ASCII code. Default setting is ^J (decimal 10), the code for the line feed key on most keyboards that have such a key. Can be set for any ASCII character.

**S5 Backspace Character**

Unit: Decimal

Range: 0–127

Default: 8 (^H)

Defines backspace character by its decimal ASCII code. Default setting is the ^H character (decimal 8), the code for BACKSPACE on most keyboards. Can be set for any ASCII character. Setting S2 to a value greater than 32 disables the backspace character.

---

*Note: If you change the **S5** value, you must make corresponding changes in your data communications software.*

---

**S6 Wait Time for Dial Tone**

Unit: 1 second

Range: 2–65 (North America), 4–255 (International), 4–7 (U.K.)

Default: 2 (North America), 4 (International and U.K.)

Defines length of time the modem waits after ENTER is pressed before carrying out a dial command. Default setting is two seconds for North America, four seconds elsewhere.

**S7 Time to Wait for Carrier**

Unit: 1 second

Range: 1–255 (USA), 1–45 (Canada and International), or 1–55 (UK)

Default: 50 (North America and International) or 55 (U.K.)

Determines amount of time the modem waits for a carrier signal before it disconnects. Default value is 50 seconds except the UK model, which defaults to 55 seconds. After dialing, the modem waits for a carrier signal for up to 50 or 55 seconds and if none is detected, terminates the call. Maximum **S7** value is 255 seconds for the US model, 45 seconds for Canadian and International models, and 55 seconds for the UK model. **S7** also determines the wait for silence time for the @ dial modifier.

**S8 Pause Time for Comma**

Unit: 1 second

Range: 0–65 (North America), 4–255 (International), 4–7 (UK)

Default: 2 (North America), 4 (International and UK)

Determines the length of pause caused by a comma character in a dialing command. Default setting is two seconds for North American model and four seconds for international and UK models. **S8** can be set for up to 65 seconds. **S8** also defines the length of time the modem waits before retrying a call after it detects a busy signal. Some computer systems need more than two seconds to reset. If this is the case, increase the value of **S8**.

**S10 Carrier Loss Disconnect Delay Time**

Unit: 100 ms

Range: 1–254

Default: 20

Defines the length of time, in milliseconds, that the modem waits after a loss of carrier signal before the it disconnects. The default setting is 2000 ms (20 units of 100 ms each). Maximum delay is 25400 milliseconds, or 25.4 seconds (decimal 254).

**S11 Tone Dialing Spacing and Duration**

Unit: 1 ms

Range: 50 - 150 (US) or 80–255 (Canada, UK, International)

Default: 95 (US) or 80 (Canada, UK, International)

Sets the speed of tone dialing (spacing and tone duration times). The default value is 95 units for domestic models and 80 units for Canadian and International models, where each unit is one ms. In other words, for domestic modems, each tone is sustained for 95 ms followed by a 95 ms pause. The minimum **S11** value allowed is 50 ms (50 units). The maximum **S11** value is 150 ms (150 units).

**S28 Enable / Disable V.34 Modulation**

Unit: decimal

Range: 0, 1–255

Default: 1 (enabled)

Enables or disables V.34 modulation. Setting **S28** to zero (0) disables V.34 modulation. Any other setting (1-255) enables V.34 modulation.

**S35 Data Calling Tone**

Unit: decimal

Range: 0–1

Default: 0 (disabled)

Enables or disables the V.25 data calling tone, which allows remote data, fax and voice discrimination. Setting **S35** to zero (0) disables V.25 data calling tone; setting **S35** to 1 enables data calling tone. The default setting is 1.

**S37 Maximum Dial Line Rate**

Unit: decimal

Range: 0–19

Default: 0

Sets the maximum dial line rate. When set to zero (0), the maximum dial line rate is the same as the maximum modem speed. This is the most common setting and allows other modem functions to actually determine the line rate used for each connection. It is the default. Consider using **S37** to set a maximum dial line rate if you need to artificially retain a lower modem speed.

0 = maximum modem speed	13 = 19200 bps
1 = reserved	14 = 21600 bps
2 = 1200/75 bps	15 = 2400 bps
3 = 300 bps	16 = 26400 bps
4 = reserved	17 = 28800 bps
5 = 1200 bps	18 = 31200 bps
6 = 2400 bps	19 = 33600 bps
7 = 4800 bps	
8 = 7200 bps	
9 = 9600 bps	
10 = 12000 bps	
11 = 14400 bps	
12 = 16800 bps	

**S42 Enable / Disable Auto Rate**

Unit: decimal

Range: 0-1

Default: 1 (enabled)

Enables and disables the 56K auto rate. Retrain and fallback are disabled in data mode. Set **S42** to zero (0) to disable auto rate, or 1 (the default) to enable auto rate.

**S43 Enable / Disable V.32bis Start-up Auto Mode**

Unit: decimal

Range: 0-1

Default: 1 (enabled)

*Used for testing and debugging only.* Enables and disables V.32bis start-up auto mode operation. Set **S43** to zero (0) to disable start-up auto mode, or 1 (the default) to enable start-up auto mode.

**S89 Off-line Time**

Unit: 1 second  
Range: 0, 5-255  
Default: 0

Sets the length of time, in seconds, a modem waits in the off-line command mode before it goes into standby mode. If **S89** is set to 20 seconds, the modem waits 20 seconds in off-line command mode before going into standby mode. Setting **S89** to zero (0) prevents the modem from ever entering standby mode.

Setting **S89** to any value between zero and five (1-4) effectively sets the value to five, because five seconds is the minimum possible wait time.

**S108 Line Code Control**

Unit: Decimal  
Range: 0, 1  
Default: 1

Controls the line coding used by the modem.

S108 = 0      mu-law  
S108 = 1      A-law (default)

**S109 PCM Mode Control**

Unit: Decimal  
Range: 0–2  
Default: 1

Controls the PCM mode (V.90 or K56Flex). Determines which mode the modem will answer in for PCM connections.

S109 = 0      K56Flex support only  
S109 = 1      Both V.90 and K56Flex supported  
S109 = 2      V.90 support only

## Reading and Assigning S-Register Values

Use the **S** command to assign a value to an S-register and to read an it's current value. To read an S-register value, in terminal mode, type **S**, the S-register number, and a question mark (?), and press ENTER. For example, to display the value of register **S7**, type **ATS7?** and press ENTER. The value appears as a three-digit decimal number (e.g., *045*).

To assign a new value to an S-register, type **S**, the S-register number, an equals sign (=), and a decimal number. Convert all ASCII characters to their decimal equivalents before entering. Valid S-register decimal values are shown for each register in the previous section. To make the change permanent, use the **&W0** command.

### Examples of Assigning Values

1. You want to have longer pauses caused by the comma in a dial command: five seconds instead of two. Type **ATS8=5** to assign 5 as the value for register **S8**. The modem now pauses five seconds for every comma in a dial command.
2. You want to configure your modem to answer incoming calls after the fourth ring instead of after the first ring. To configure register **S0** with a value of 4, type **ATS0=4** and press ENTER.
3. You are calling long distance to another country code, and it is taking a long time to connect. The register **S7** (time to wait for carrier) factory default setting of 50 seconds is insufficient; a time-out occurs and cancels the call before a connection is made. To change the **S7** value to 75 seconds, type **ATS7=75** and press ENTER. Now, after dialing, the modem allows 25 more seconds for a carrier signal before aborting the call. The additional 25 seconds should provide enough time for international calls.

### Examples of Reading Values

1. To verify that you entered the value correctly in the preceding examples, type **ATS8?** and press ENTER in the first example, **ATS0?** in the second example, and **ATS2?** in the third example. You should receive the responses *005*, *004*, and *075*, respectively.
2. When configuring S-registers, it is a good practice to include the verification read command in the same command string as the configuration assignment command. In the three preceding examples, type **ATS8=5S8?**, **ATS0=4S3?**, and **ATS7=75S7?**, respectively.

## AT Commands that Affect S-Registers

For maximum throughput, the IS1HI-2S/2U's default configuration is for originating a call to another 33,600 bps modem that supports error correction, data compression, and flow control. If the receiving modem is not compatible, the IS1HI-2S/2U can match any ITU-T or Bell standard modem (but not proprietary protocols).

If you require a different configuration for your application—for example, if you want to use an IS1HI-2S/2U modem strictly as an auto answering device or for service that does not support error correction—you can change the command parameters and S-register values in active memory and save the new values with the **&W** command.



The **&W0** (or **&W**) command stores all current AT command and S-register values into nonvolatile random access memory (NVRAM) and configures the modem so that it reads your custom settings in NVRAM when the modem is turned on or when it is reset with the Z command. (The **&F** reset command will continue to read the factory default settings in read-only memory [ROM].) For convenience, you can include the **&W** command in the same command string that sets the new values in active memory as in the following example: `AT+N2&C1S0=10&W0<cr>`

## Modem Result Codes

Terse	Verbose	Definition
0	OK	Command executed without error; ready for next command.
1	CONNECT	Modem has detected carrier and gone online.
2	RING	Modem has detected ring caused by incoming call.
3	NO CARRIER	No carrier signal has been detected within the allowed time.
4	ERROR	Error in command line (too many, or invalid characters).
5	CONNECT 1200	Modem detected carrier at 1200 bps and gone online.
6	NO DIALTONE	No dial tone detected.
7	BUSY	Busy signal detected.
8	NO ANSWER	The remote system did not answer.
10	CONNECT 2400	Modem detected carrier at 2400 bps and gone online.
11	CONNECT 4800	Modem detected carrier at 4800 bps and gone online.
12	CONNECT 9600	Modem detected carrier at 9600 bps and gone online.
13	CONNECT 14400	Modem detected carrier at 14400 bps and gone online.
14	CONNECT 19200	Modem detected carrier at 19200 bps and gone online.
24	CONNECT 7200	Modem detected carrier at 7200 bps and gone online.
25	CONNECT 12000	Modem detected carrier at 12000 bps and gone online.
86	CONNECT 16800	Modem detected carrier at 16800 bps and gone online.
40	CONNECT 300	Modem detected carrier at 300 bps and gone online.
55	CONNECT 21600	Modem detected carrier at 21600 bps and gone online.
56	CONNECT 24000	Modem detected carrier at 24000 bps and gone online.
57	CONNECT 26400	Modem detected carrier at 26400 bps and gone online.
58	CONNECT 28800	Modem detected carrier at 28800 bps and gone online.
59	CONNECT 31200	Modem detected carrier at 31200 bps and gone online.
60	CONNECT 33600	Modem detected carrier at 33600 bps and gone online.
	CONNECT 45000	Modem detected carrier at 45000 bps and gone online.
	CONNECT 56000	Modem detected carrier at 56000 bps and gone online.

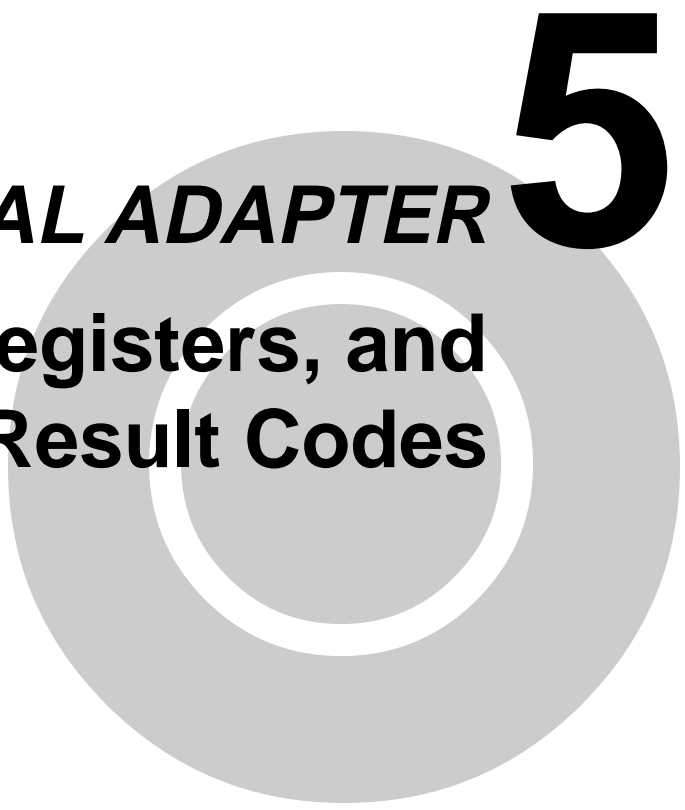
- 88 DELAYED Delay is in effect for the dialed number.
- 89 BLACKLISTED The dialed number is blacklisted.
- 90 BLACKLIST FULL The blacklist is full.

**Extended Result Codes.** If the extended result codes configuration option is enabled, **EC** is added to the following result codes:

- 5 CONNECT 1200
- 10 CONNECT 2400
- 11 CONNECT 4800
- 12 CONNECT 9600
- 13 CONNECT 14400
- 14 CONNECT 19200
- 24 CONNECT 7200
- 25 CONNECT 12000
- 86 CONNECT 16800
- 40 CONNECT 300
- 55 CONNECT 21600
- 56 CONNECT 24000
- 57 CONNECT 26400
- 58 CONNECT 28800
- 59 CONNECT 31200
- 60 CONNECT 33600
- CONNECT 45000
- CONNECT 56000

**EC** is replaced by one of the following codes, depending on the type of error control connection:

<b>Code</b>	<b>Error Correction</b>
V42bis	LAP-M V.42 error control and V.42bis data compression
V42	LAP-M V.42 error control only
MNP5	MNP4 error control and MNP 5 data compression
MNP4	MNP 4 error control only
NoEC	No error control protocol



***TERMINAL ADAPTER*** **5**  
**AT Commands, S-Registers, and  
Result Codes**

## Terminal Adapter AT Commands

One of the ways you can communicate with and configure your terminal adapter (TA) is to use AT commands. AT commands are so-called because, with only a few exceptions, each command string begins with the characters *AT*. Using AT commands, you can read and set parameters and perform actions such as dialing.

### Entering AT Commands

You can send AT commands to the TA by typing them on the keyboard, by typing them in the terminal window of a data communications program such as HyperTerminal, or indirectly by configuring your data communications program.

Enter AT commands in the following format: *AT* **<command string>** **<cr>**. The *AT* characters cause the TA to interpret the following string of characters as a command. The command string consists of one or more commands. The carriage return character, **<cr>**, sends the command string to the TA. If you are entering a command string in your communication program's terminal window, insert the carriage return character by pressing ENTER. On the other hand, if you are configuring a communications program, you typically must insert the carriage return character by adding **^M** to the end of the command string.

The TA has three modes of operation: offline command mode (the default state), online command mode, and data mode. The TA responds to AT commands only when it is in one of the command modes. After the TA establishes a connection and goes online in data mode, it interprets any further characters you enter as data rather than commands and transmits them to the remote device.

When the TA is in data mode, you can switch it to online command mode by sending it an *escape sequence*. The TA responds to two types of escape sequences: in-band (escape sequence is part of the data stream) and out-of-band (escape sequence is outside the data stream). The in-band escape sequence is **+++AT<cr>**; the out-of-band escape sequence is **<break>AT<cr>**. You can change the in-band escape character (+) by changing the value in register **S2**. You can send the break signal in the out-of-band escape sequence only from software, *not* by pressing SHIFT+BREAK on your keyboard.

When it detects the escape sequence, the TA enters online command mode, in which it responds to commands while maintaining the connection with the remote device.

The TA's command buffer can store 80 characters, including spaces and other characters used in telephone numbers. If you mistype a command string, you can edit it by using the backspace key, but only before you press ENTER. As you type a command string, it appears on your monitor screen, letting you verify your input as you type it.

AT commands recognized by the IS1HI-2S/2U terminal adapter are listed by function on the following page. For an alphabetic list of AT commands, see *AT commands* in the index. The commands in this chapter are organized by function. Abbreviated commands are listed on the following page by function along with a short description and page numbers that refer to a more detailed description, immediately following this list.

Topic	Command	Description	
Command Execution, p. 94	<b>AT</b>	Attention code	
	<b>Return</b>	Command execution	
	<b>+++AT&lt;cr&gt;</b>	In-band escape code	
	<b>&lt;break&gt;AT&lt;cr&gt;</b>	Out-of-band escape code	
Switch Configuration, p. 94	<b>%A97</b>	Dialing method	
	<b>!C0</b>	Switch type	
	<b>!C6</b>	Data SPID	
	<b>*!C6</b>	Voice SPID	
	<b>!D3</b>	SAPI-0 data TEI	
	<b>*!D3</b>	SAPI-0 voice TEI	
	<b>!L</b>	List DN, SPID, TEI, Data protocol & switch type	
	<b>&gt;Dn</b>	Embedded Protocol Analyzer	
	<b>!N1</b>	Data directory number	
	<b>*!N1</b>	Voice directory number	
	<b>!Z=n</b>	Rate adaptation protocol	
	Serial Port Configuration, p. 97	<b>En</b>	Command mode echo
		<b>L</b>	List telephone numbers
		<b>L5</b>	List current operating parameters
		<b>L6</b>	List S-register values
		<b>L8</b>	Display low level ISDN status
		<b>Qn</b>	Status displays
		<b>Sr=n</b>	Set S-register
		<b>Sr?</b>	Read S-register
		<b>Vn</b>	Terse/verbose result codes
<b>Xn</b>		Connect messages	
<b>Z</b>		Restore parameters to current power-up profile	
<b>&amp;Cn</b>		DCD (Data Carrier Detect) control	
<b>&amp;Dn</b>		DTR (Data Terminal Ready) control	
<b>&amp;En</b>		Flow control	
<b>#Xn</b>		Send Single Multiple Xoff Characters	
<b>&amp;Fn</b>		Load quick setup factory profile	
<b>&amp;Rn</b>		CTS (Clear To Send) control	
<b>&amp;Sn</b>		DSR (Data Set Ready) control	
<b>&amp;V</b>		View port configuration	
<b>&amp;Wn</b>		Store active profile	
<b>&amp;Zn=</b>		Store telephone number	
<b>DSn</b>		Dial a Stored telephone number	
<b>SDn</b>		Persistent DTR dialing	
<b>%En</b>		Escape sequence options	
<b>@P3=</b>		Parity	
<b>@P4=</b>		Data bits	
<b>@P6=</b>		Stop bits	
Data Call Commands, p. 104		<b>A</b>	Answer 103
		<b>D</b>	Dial
		<b>H</b>	Hang up
		<b>In</b>	Display product information
		<b>O</b>	Return online
	<b>@Config</b>	Start ConfigMenu	

## Command Implementation

### **AT Attention Code**

Values: n/a

Default: n/a

AT precedes all command strings except the *A/* command and escape codes.

### **RETURN Command Execution**

Values: n/a

Default: n/a

Press the RETURN (ENTER) key to carry out a command. The RETURN key is sometimes abbreviated <cr> in command examples.

### **+++AT<cr> In-Band Escape Code**

Values: ASCII

Default: + (43)

Sets the TA to enter command mode without disconnecting the call when it is online with a remote device. The default escape code is three + characters, followed by *AT*, up to 80 command characters, and a RETURN (press ENTER). The TA escapes to command mode, executes any commands in the string, and then remains in command mode. Use the *S2=z* command to change the escape character.

### **<break>AT<cr> Out-of-Band Escape Code**

Values: n/a

Default: n/a

Places the TA in command mode while remaining online. Enter a break signal, the letters *AT*, up to 80 command characters, and a RETURN (press ENTER).

## Switch Configuration Commands

Use the following commands to select your network switch type (e.g., Northern Telecom DMS-100) and to specify other information required to make an ISDN connection.

### **%A97=n Dialing Method**

Values: n = 0 or 1

Default: %A97=0 (En bloc)

Standardized ISDN signalling protocols such as DSS1, DSS2, and SS7 support *sending complete indication*, a signal that no more digits will follow. Adding such a signal to a telephone number is often impractical; therefore, many private networks send the number of a called party using a procedure called *overlap sending*, in which no sending complete indication is sent. Computer users can automatically append the *sending complete indication* to the telephone number by choosing the *en bloc* method of sending, which results in faster call setup. Use the %A97= command to select between the two methods.

**%A97=0** En bloc sending during call SETUP

**%A97=1** Overlap sending during call SETUP

**!C0=n Network Switch Type**

Values: n = 0, 1, 2, or 5

Default: **!C0=2** (International—NET3)**!C0=5** (USA—US N1-1)

Selects one of the network switch types supported by the ISIH-2S/2U. International factory default setting is **!C0=1** (Northern Telecom DMS-100). Default for USA is **!C0=5** (USA—US N1-1).

**!C0=0** AT&T 5ESS**!C0=1** Northern Telecom DMS-100**!C0=2** NET3 (Euro ISDN)**!C0=5** US NI-1**!C6=n SPID 0**

Values: n = 0–20-character string

Default: null string

Specifies the channel 0 service profile identifier (SPID) that the ISDN service provider assigned at subscription time. The data SPID string can have up to 20 characters.

---

***Note:** For DMS-100 switches, any ASCII character except the underline ( \_ ) character is valid. For NI-1 and AT&T switches, only the digits 0–9 are valid. (Not needed for NET3 switch type.)*

---

**\*!C6=n SPID 1**

Values: n = 0- to 20-character string

Default: null string

Specifies the channel 1 service profile identifier (SPID) that the ISDN service provider assigned at subscription time. The voice SPID string can have up to 20 characters.

---

***Note:** For DMS-100 switches, any ASCII character except the underline ( \_ ) character is valid. For NI-1 and AT&T switches, only the digits 0–9 are valid. (Not needed for NET3 switch type.)*

---

**!D3=n TEI 0**

Values: n = 0–63, 240 (auto), 241 (disable)

Default: **!D3=240** (Auto TEI)

Sets the terminal endpoint identifier (TEI) for channel 0. A TEI is a number used by the central office switch to identify uniquely each device that is connected to the network. When it uses dynamic TEI assignments (auto TEI), the central office switch assigns a TEI each time the TA connects to the network. If your ISDN service provider assigned a fixed TEI at subscription time, you must configure the TA with the fixed TEI number.

You can also use **!D3=** to disable the data channel, which may be useful when multiple TAs are attached to a network terminator bus.

**!D3=0–63** Sets the TEI to a fixed value from 0 through 63**!D3=240** Sets the data channel for dynamic TEI negotiation (factory default)**!D3=241** Disables TEI

**\*/D3=n TEI 1**

Values: n = 0–63, 240 (auto), 241 (disable)

Default: **\*/D3=240** (Auto TEI)

Sets the terminal endpoint identifier (TEI) for channel 1. A TEI is a number used by the central office switch to identify uniquely each device that is connected to the network. When it uses dynamic TEI assignments (auto TEI), the central office switch assigns a TEI each time the TA connects to the network. However, the ISDN service provider may assign a fixed TEI at subscription time, in which case you must configure the TA with the fixed TEI number.

**\*/D3=0-63** Sets the TEI to a fixed value from 0 through 63**\*/D3=240** Sets voice channel for dynamic TEI negotiation (factory default)**\*/D3=241** Disables TEI**!L Display Network Configuration**

Values: n/a

Default: n/a

Displays the current DN, SPID, TEI, Data protocol, and switch type.

**!L** Displays the current network configuration**>Dn Embedded Protocol Analyzer**

Values: 0, 1, 2, 3, 98, or 99

Default: n/a

Records and analyzes various protocols on the B-channel, D-channel, and DTE-DCE interface. The Embedded Protocol Analyzer is useful as a diagnostic tool, in that essential data messages display, which enables you to observe interactive operations of the TA, Central Exchange, and remote communications equipment.

**>D0** Displays B-channel traffic, decoded as V.120**>D1** Displays D-channel traffic, decoding layers 2 and 3 (Q.921 and Q.931)**>D2** Displays D-channel traffic, decoding layer 2 only (Q.921)**>D3** Displays D-channel traffic, decoding layer 3 only (Q.931)**>D5** Displays async PPP data**>D6** Displays sync PPP data**>D98** Disables Embedded Protocol Analyzer, buffered data unchanged**>D99** Enables Embedded Protocol Analyzer, clearing buffered data**!NI=n DN 0**

Values: n = 24-character string

Default: null string

Sets directory number (DN) for channel 0. The directory number is a telephone number assigned to the TA at subscription time by the ISDN service provider. The DN is a string of up to 24 characters; valid characters are 0–9, the \* character, and the # character.

**!NI=n** Sets the DN for the data channel



**\*!NI=n DN 1**

Values: n = 24-character string

Default: null string

Sets directory number (DN) for channel 1. The directory number is telephone number assigned to the TA at subscription time by the ISDN service provider. The DN is a string of up to 24 characters; valid characters are 0–9, the \* character, and the # character.

**\*!NI=n** Sets the DN for the voice channel

**!Z=n Rate Adaption Protocol**

Values: n = 5, 9, or 12

Default: **!Z=9** (PPP)

Selects the rate adaption protocol used to communicate with another terminal adapter. The local and remote terminal adapters must be set to the same protocol for communication to take place.

**!Z=5** V.120 protocol

**!Z=9** PPP protocol

## Serial Port Configuration Commands

Use the following commands to control the interaction between the TA and the computer connected to it.

**En Command Mode Echo**

Values: n = 0 or 1

Default: **E1** (Echo on)

When you enter commands, the TA echoes the characters back to the computer or terminal where they appear on the monitor. This command turns this feature on and off.

**E0** Echo off

**E1** Echo on

**L5 and L6 List Active Profile**

Values: n = 5 or 6

Default: none

Lists current operating parameters of the TA. This information is useful when changing communications software or when changing default settings. **ATL5** lists AT command parameters, and **ATL6** lists values currently stored in the S-Registers. (For more information on S-Registers, see Chapter 6, *Terminal Adapter S-Registers*.)

**L8 Lists Low Level ISDN Status****Qn Enable/Disable Result Codes**

Values: n = 0, 1, or 2

Default: **Q0** (Enable result codes)

Controls whether the TA sends result codes to the computer. (Use the **V** command to select the format of the result codes.)

**Q0** Enable result codes.

**Q1** Disable result codes (quiet mode) for applications such as computer-controlled auto dialing.

**Sr=n Set S-Register**

Values: r = 0, 2–5, 7, 10, 25, 32, 50–53; n varies

Default: None

Sets the value of an S-register, where *r* is the number of the S-register, and *n* is the value you want to set. (For more information on S-Registers, see Chapter 6, *Terminal Adapter S-Registers*.)

**Sr? Read S-Register**

Values: r = 0–5 (S1 is read only), 7, 10, 25, 32, 50–53; n varies

Default: None

Reads the value of an S-register, where *r* is the number of the S-register. (For more information on S-Registers, see Chapter 6, *Terminal Adapter S-Registers*.)

**Vn Terse/Verbose Result Codes**

Values: n = 0 or 1

Default: *VI* (Verbose)

Controls whether the TA's result codes display as digits (terse) or as words (verbose). (Use the *Q* command to enable or disable the display of result codes.)

*V0* Enable terse result codes.

*VI* Enable verbose result codes.

**Xn Connect Messages**

Values: n = 0, 1, or 2

Default: *X2* (Enable all messages)

Selects the result code messages the TA sends to the computer.

*X0* Enables messages *OK*, *CONNECT*, *RING*, *NO CARRIER*, and *ERROR* (terse result codes 0–4).

*X1* Enables all messages except *BUSY* (terse result codes 0–5, 10–14, 17–19, 28, and 32). If a call is placed to a busy line, *NO CARRIER* displays.

*X2* Enables all messages (terse result codes 0–5, 7, 10–14, 17–19, 28, and 32).

**Z Reset to Stored Profile**

Values: none

Default: none

Resets TA to its current power-up profile and clears the command buffer. The result is the same as turning the TA off and on. When you type *ATZ*, the state of the *&W* command determines where default values originate. *&W0* defaults come from the customized configuration in NVRAM, and *&W1* defaults come from the factory default configuration in ROM. Because *Z* clears the command buffer, it must be the last command in a command string; normally it is issued by itself: *ATZ*. Note that whereas the *&F0* reset command always restores the factory default profile, the *Z* reset command restores either the factory default or the stored profile, depending on how the *&W* command is set.

**&Cn DCD Control**

Values: n = 0, 1, or 2

Default: **&C1** (DCD normal)

Controls behavior of the DCD (Data Carrier Detect) signal. Normally, the DCD goes high when the TA establishes a connection and drops when the connection is lost. However, you can force DCD to remain high at all times or to remain high except for a brief drop following a disconnect.

**&C0** DCD is forced high at all times.

**&C1** DCD goes from low to high when TA establishes a connection (DCD normal).

**&C2** DCD drops briefly following a disconnect, then rises again. Register S10 defines how long the DCD signal remains low after a disconnect.

**&Dn DTR Control**

Values: n = 0, 1, 2, or 3

Default: **&D1** (Exits Data Mode and reenters AT command mode)

Controls how the TA responds to the DTR (Data Terminal Ready) signal. A high DTR signal tells the TA that the connected computer is ready to communicate.

**&D0** TA ignores the DTR signal.

**&D1** If DTR lowers when the TA is online, TA hangs up, returns to command mode, and disables autoanswer. If the TA is offline, it doesn't answer or dial while DTR is low.

**&D3** When DTR lowers, the TA resets the data port and disables autoanswer. If DTR lowers when the TA is online, the TA hangs up, resets the active configuration to the stored configuration, and disables autoanswer.

---

*Note: If you want to accept calls while DTR is low, the TA must be configured to ignore DTR. This is accomplished by entering AT&D0<cr>. With this configuration, the TA is able to accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while the calls comes in.*

---

**&En Flow Control**

Values: n = 3–7, 12, 13

Default: **&E4, &E6, &E13**

Selects method by which the TA controls the flow of data to and from the computer, to prevent either device from accepting data faster than it can handle. The TA provides flow control in both directions. When the TA halts data flow, it is called *flow control*; when the computer halts data flow, it is called  *pacing*.

**&E3** Disable flow control by the TA.

**&E4** Hardware flow control. **&E4** causes the TA to use the CTS signal to regulate flow control. When CTS goes low, data flow from the computer is suspended until CTS goes high again. This method works with pacing, which uses the RTS signal on pin 4. Hardware flow control cannot be enabled unless an error correction protocol is selected.

- &E5** XON/XOFF flow control. This is an in-band method, where the XON and XOFF characters (^Q and ^S, respectively) are inserted into the data stream, rather than using separate control lines. When an XOFF character is detected, the data stream is suspended until an XON character is detected. The drawback to this method is that some files may contain these characters, causing the file transfer to be suspended indefinitely.
- &E6** When XON/XOFF pacing is active, the TA responds to and discards the XON/XOFF characters from the computer.
- &E7** When XON/XOFF pacing is active, the TA responds to the XON/XOFF characters and passes them through the communications link to the remote device, thereby pacing the remote terminal adapter as well.
- &E12** Disables pacing
- &E13** Enables pacing.

**#Xn Send Single/Multiple Xoff Characters**

Values: n = 0 or 1

Default: **#X0**

Allows the TA to send either a single or multiple Xoff characters to exert flow control to the terminal. The **#X0** command (factory default setting) causes one Xoff to be sent until the TA's buffer reaches the Xon level. The **#X1** command causes an Xoff to be sent for every character received after the TA reaches its buffer full level.

- #X0** One Xoff character sent until the buffer reaches the Xon level (default)
- #X1** Multiple Xoff characters sent for every character received after buffer reaches the full level.

**&Fn Load Quick Setup Profile**

Values: n = 0-3

Default: **&F0**

For quick setup, the TA includes Quick Setup Profiles. Each contains configuration parameters for a specific type of port operation. To load a Quick Setup Profile into active memory use the command **&Fn**, where *n* is the number of the profile you want to load. You then can customize the profile and store it with the **&W** command, so it loads automatically on power-up or reset. These profiles are stored in permanent memory and are not user-configurable. (See Appendix E.)

- &F0** Profile 0 — Modem-like async operation (default)
- &F1** Profile 1 — V.120 async operation
- &F3** Profile 3 — ML-PPP async operation

**&Rn CTS Control**

Values: n = 0, 1, or 2

Default: **&R1** (CTS forced high)

Allows you to control the state of the CTS (Clear to Send) signal. Normally the CTS signal follows the state of the RTS signal when TA is online.

**&R0** CTS acts normally; that is, it follows RTS.

**&R1** CTS is forced high, but still provides online flow control.

**&R2** CTS is forced high, but it drops on disconnect for the period of time set by S10. CTS still provides flow control when the TA is online.

**&Sn DSR Control**

Values: n = 0, 1, or 2

Default: **&S1** (DSR normal)

Controls the state of the DSR (Data Set Ready) signal on the RS232E/V.24 interface. A high DSR signal indicates to the computer that the TA is ready to transmit data.

**&S0** DSR is always high.

**&S1** DSR acts normally; that is, it follows the state of the CD signal, which goes high when the ISIH-2S/2U detects a carrier signal, and goes low when the carrier signal is lost.

**&S2** DSR is always high, except on disconnect, when it drops for the period of time set by S10 and then goes high again.

**&Vn View Port Configuration Parameters**

Values: n = 0, 1, 2

Default: n/a

Allows you to view the port configuration parameters for ports 0 and 1. This listing is the equivalent of both L5 and L6 combined.

**&V0** Displays port 0 configuration parameters.

**&V1** Displays port 1 configuration parameters.

**&V2** Displays both port 0 and port 1 configuration parameters.

**&Wn Store Active Profile**

Values: n = 0 or 1

Default: **&W1** (Use factory default profile)

Stores your active profile, or configuration, in memory, so you don't lose your custom settings when you turn off the TA or reset it.

**&W0** Stores all current AT command and S-register values in nonvolatile random access memory (NVRAM) and configures the TA so it reads your custom settings in NVRAM when the modem is turned on or when it is reset with the **Z** command. (The **&F** reset command continues to read the factory default settings in ROM.)

**&W1** Erases your custom settings in NVRAM the next time the TA is turned off or reset, causing the TA to read the factory default settings in ROM whenever it is turned on or reset.

**&Zn=x Store Telephone Number**

Values: n = 0–9; x = dial string

Default: n/a

Allows you to store a telephone number in a memory register for faster dialing. To store a number, type **&Z**, the register number (0–9) where you want to store the number, the = character, and the dialing string you want stored. Then press ENTER. The dialing string can have up to 80 characters. To read a stored number, type **AT&Zn?** (e.g., **AT&Z4?**) where *n* is the number of the register you want to read. To display a list of all numbers stored in memory, type **ATL** and press RETURN:

```
0 14082345678
1 16125551212
2 14089876543
3
4 6313551
5
6 4258513
7
8 16126313550
9 12138880123
```

**DSn Dialing a Stored Telephone Number**

Values: n = 0–9

Default: n/a

To dial a stored telephone number, type **ATDSn** in terminal mode, where *n* is the location of the number you want to dial. For example, typing **ATDS6 <cr>** dials a telephone stored in memory register 6 location.

**\$Dn Persistent DTR Dialing**

Values: n = 0, or 1

Default: **\$D0** (Disabled)

Enables or disables persistent DTR dialing (PDD). PDD causes the terminal adapter to automatically and continually redial stored telephone number 0 when the port has no active calls and DTR is high.

**%En Escape Sequence Options**

Values: n = 0–5

Default: **%E1** and **%E4**

By default, the modem responds only to the +++ escape method. However, you can use the **%E** command to set the modem to respond only to the <break> method, to respond to either +++ or the <break> method, or to ignore both methods and not escape.

```
%E0 Modem won't escape
%E1 +++ escape method
%E2 <BREAK> escape method
```

**%E3** Both +++ and <BREAK> escape methods

**%E4** Disable *OK* response to +++

**%E5** Enable *OK* response to +++

**%E1 %E5** Enable +++ method and *OK* response to +++

**%E3 %E5** Enable +++ or <BREAK> method and *OK* response to +++

#### **@P3=n Parity at Power-Up**

Values: n = 0–4

Default: **@P3=4** (None)

Use only to set the type of parity the TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to parity the computer is using.

**@P3=0** Odd

**@P3=1** Even

**@P3=2** Mark

**@P3=3** Space

**@P3=4** None

#### **@P4=n Data Bits**

Values: n = 7 or 8

Default: **@P4=8** (8 data bits)

Use only to set the number of data bits the TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to the number of data bits the computer is using.

**@P4=7** 7 data bits

**@P4=8** 8 data bits

#### **@P6=n Stop Bits**

Values: n = 1 or 2

Default: **@P6=1** (1 stop bit)

Use only to set the number of stop bits the TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to the number of stop bits the computer is using.

**@P6=1** 1 stop bit

**@P6=2** 2 stop bits

## Data Call Commands

Use these commands to make or configure data calls.

### **A Answer Call**

Values: none

Default: none

Forces TA to answer an incoming call. To cause the TA to autoanswer, set register *S0* to a value higher than 0.

### **Dn Dial**

Values: string of up to 25 characters

Default: none

Causes TA to dial a telephone number (e.g., **ATD785-3500 <cr>**).

### **Hn Hang Up**

Values:  $n = 0$  or  $1$

Default: **H0**

Forces TA to go off-hook (take control of the telephone line) or go on-hook (hang up). Since TA goes off-hook automatically when it dials, **H** command normally is used only to hang up. To hang up, first escape to command mode (**+++AT <cr>**), then type **ATH** (or **ATH0**) **<cr>**. Or, include the hang up command in the escape sequence: **+++ATH <cr>**.

**H0** Go on-hook (hang up).

**H1** Go off-hook.

### **In Display Product Information**

Values:  $n = 0, 1,$  and  $2$

Default: none

Displays the following TA product information:

**I0** Product ID (e.g., *247*)

**I1** Firmware version number (e.g., *1.00*)

**I2** Model number

### **O Return Online**

Values: none

Default: none

Returns TA to online mode from the online command mode. When TA makes a data connection, it enters online data mode. The TA typically remains in this mode until it receives an escape sequence or until the call ends. When it detects an escape sequence, the TA enters online command mode, where it can accept AT commands while retaining the online connection. To return the TA to online mode from the online command mode, enter the command **ATO** and press ENTER.

### **@CONFIG Start ConfigMenu**

Values: none

Default: none

Starts TA's internal configuration utility, which allows you to customize the configuration for your application. Enter the command while in terminal mode.



## Terminal Adapter S-Registers

S-registers are sections of memory in which values are stored that affect how the TA operates. S-registers are so-called because each has a name that begins with the character *S*. Use the *S* command to assign a value to or to read the current value of an S-register. To assign a value to an S-register, use the command *Sr=n*, in which *r* is the register number, and *n* is the value you want to assign to the register, e.g., *S7=45*. To read an S-register value, use the command *Sr?*, in which *r* is the register number, e.g., *ATS7?*.

### S-Register Summary

S-Register	Function
S0	Rings until answer
S1	Ring count
S2	Escape character
S3	Carriage return character
S4	Line feed character
S5	Backspace character
S7	Wait for connection (abort timer)
S10	DCD Drop Time
S25	DTR Drop Time
S32	Escape sequence timeout
S50	Caller line ID (CLI)
S52	Auto-protocol detection

#### **S0** Number of Rings Until Answer

Unit: 1 ring  
 Range: 0–255  
 Default: 1

Sets the number of rings the TA waits for before it answers and begins its connect sequence. *S0=0* turns off the ability to automatically answer a call. *S0=1* causes the TA to automatically answer after 1 ring. Note that if the *S0* value is set too high, the calling device may time out before the TA answers the call. For autoanswer, *S0* must have a nonzero value, DTR must be high (*&D* command), and the TA must be offline.

#### **S1** Ring Count

Unit: 1 ring  
 Range: 0–255  
 Default: 0

Counts the number of rings that have occurred, up to a maximum of 255. It is a read-only register and is seldom, if ever, used in typical operation.

**S2 Escape Character**

Unit: Decimal ASCII code  
Range: 0–127  
Default: 43 (+)

Specifies the character used by the TA to escape from data mode and return to command mode.

**S3 Carriage Return Character**

Unit: Decimal ASCII code  
Range: 0–127  
Default: 13 (^M)

Specifies the character used by the TA to indicate the end of a command line.

**S4 Line Feed Character**

Unit: Decimal ASCII code  
Range: 0–127  
Default: 10 (^J)

Specifies the character used by the TA to indicate the end of a status message.

**S5 Backspace Character**

Unit: Decimal ASCII code  
Range: 0–32, 127  
Default: 8 (^H)

Specifies the character used by the TA to delete the previous character in command line.

**S7 Wait for Connection (Abort Timer)**

Unit: 1 second  
Range: 0–255  
Default: 45

Sets Abort Timer delay time, which is the length of time TA waits for a connection after dialing. If no connection is established during the specified time, the TA ends the call.

**S10 DCD Drop Time**

Unit: 50 ms  
Range: 0–254, 255  
Default: 20

Sets the amount of time the DCD signal will be dropped when a call is disconnected if the DCD signal is configured for a momentary drop on disconnect (**&C2**)

**S25 DTR Drop Time**

Unit: 100 ms  
Range: 0, 1–255  
Default: 5

Sets the time that DTR must remain low before the TA disconnects. The S25 unit value for 0 is 40 ms. For values from 1 through 255, the unit value is 100 ms.

**S32 Escape Sequence Timeout**

Unit: 100 ms  
Range: 0–255  
Default: 20

Sets the time allowed in an escape sequence from the receipt of the *A* in *AT* to the receipt of the carriage return. If the **S32** time interval expires before you press **ENTER**, the escape sequence ends. The default time is 2 seconds.

**S50 Caller Line ID CLI**

Unit: Decimal ASCII code  
Range: 0 or 1  
Default: 1 (enabled)

Sets whether the mechanism for identifying the two endpoints of a connection is enabled or disabled. Since RING messages only appear for ISDN data calls, the CLI feature does not define a means of conveying Calling Party information to the terminal for ISDN voice calls. The CLI information is only included with the first RING message for a given incoming call, and appears as follows:

```
RING      FM: 5552000 TO: 5551000
```

If the Calling Party Number information is not included in the incoming SETUP message, the RING message appears as follows:

```
RING      TO: 5551000
```

If the Called Party Number information is not included in the incoming SETUP message, the RING message will appear as follows:

```
RING      FM: 5552000
```

If neither the Called Party Number nor the Calling Party Number is included in the incoming SETUP message, the RING message will contain no additional information.

**S52 Auto-Protocol Detection**

Unit: Decimal ASCII code  
Range: 0 or 1  
Default: 1

Sets whether the mechanism for identifying V.120 or PPP, operation is enabled or disabled. This is applicable for an ISDN data call and once determined by the TA, the protocol used by means of the information conveyed by the SETUP message, then the indicated protocol is activated. The default setting is 1, which enables the Auto-Protocol Detection function.

## Terminal Adapter Result Codes

When the TA receives an AT command from the computer or terminal, it attempts to execute the command, then sends a status message to the computer or terminal that reports the result of the command. The TA provides you with several of these response messages, or *result codes*, which can be displayed on your monitor or intercepted and used by your communications software. Using the *V* command, you can select whether the result codes are *terse* (numbers) or *verbose* (words).

The TA's result codes are listed in the following table. Note that the speed of an ISDN channel is always either 56 Kbps or 64 Kbps. *CONNECT* messages indicate the speed of the connection between the TA and your computer or terminal.

<b>Terse</b>	<b>Verbose</b>
0	OK
1	CONNECT
1P	CONNECT/PPP
1PC	CONNECT/PPP COMPRESSED
1V	CONNECT/V.120
1VC	CONNECT/V.120 COMPRESSED
2	RING
3	NO CARRIER
4	ERROR
6	NO DIALTONE
7	BUSY
56	CONNECT 56000
56P	CONNECT 56000/PPP
56PC	CONNECT 56000/PPP COMPRESSED
56V	CONNECT 56000/V.120
56VC	CONNECT 56000/V.120 COMPRESSED
64	CONNECT 64000
64P	CONNECT 64000/PPP
64PC	CONNECT 64000/PPP COMPRESSED
64V	CONNECT 64000/V.120
64VC	CONNECT 64000/V.120 COMPRESSED
65	CONNECT MODEM

## Using AT Commands to Operate the Terminal Adapter

You can configure and operate the Terminal Adapter entirely with AT commands, if you want. Remember, you can issue AT commands only from a terminal or from a computer running a communications program in terminal mode. This section describes how to use AT commands for basic operations such as calling, answering a call, and hanging up.

### Modes of Operation

The TA has three modes of operation: offline command, online command, and data.

#### Offline Command Mode

In offline command mode, the TA communicates with the terminal or computer and responds to AT commands. There is no data communications link with a remote device.

#### Data Mode

The TA enters data mode when it makes a successful data communications link with a remote device. In data mode, the TA can send and receive data, but it does not respond to AT commands. Instead, it treats them as data, and transmits them to the remote device.

#### Online Command Mode

In online command mode, the TA responds to AT commands while maintaining a data communications link; however, transmission of data is suspended. To enter online command mode from data mode, type the escape sequence `+++AT<cr>`. To return to data mode from online command mode, type `ATO<cr>`.

### Making a Call

Before you can place a data call, you must configure the TA for the local switch type, serial port speed, and the data type of the ISDN device you want to call.

#### Dialing

To dial a number using AT commands, you must first start a data communications program. In the program's terminal mode, type `ATDxxxxxxx<cr>`, where xxxxxxxx is the telephone number you want to dial, and <cr> is the carriage return character that is sent when you press ENTER, e.g., `ATD7853500<cr>`. The dial string can contain up to 80 characters.

To make it easier to read the dial string, you can use hyphens, spaces or parentheses. These characters are ignored by the TA. For example, the TA would read the following dial strings the same way:

```
ATD16127853500 <cr>
ATD 1-612-785-3500 <cr>
ATD 1 (612) 785-3500 <cr>
```

#### Canceling a Call

To cancel a call before the TA makes a connection, press any key.

### Storing a Telephone Number

To store a telephone number, type **&Zn=x** in terminal mode, where *n* is the number of the memory register in which the number is to be stored, and *x* is the dial command string that you want to store. For example, type **AT&Z9=612-785-3500 <cr>** to store the number 612-785-3500 in memory register 9.

### Dialing a Stored Telephone Number

To dial a stored telephone number, type **DS=n** in terminal mode, where *n* is the location of the number you want to dial. For example, type **ATDS=3 <cr>** dials a telephone stored in memory register 3 location.

### Displaying a Stored Number

To display a stored telephone number, type **&Zn?** in terminal mode, where *n* is the memory register where the number is stored. For example, type **AT&Z5? <cr>** to display the telephone number in memory register 5. To list all ten telephone numbers stored in memory, type **ATL <cr>**.

## Answering a Call

You can answer incoming calls to the TA either manually or automatically. When the TA detects an incoming call, it turns on the RI signal on the V.24 interface and sends a *RING* result code to the computer or terminal after each ring. If you enable autoanswer, the TA automatically answers the call. To manually answer the call, use the **A** command.

### Answering Manually

If your communication program is in terminal mode when the *RING* result code appears on your monitor, manually answer the call by typing **ATA <cr>**.

### Answering Automatically

To set the TA to answer a call automatically :

1. Enable autoanswer by setting register **S0** to the ring on which you want the TA to answer (e.g., in terminal mode, type **S0=4** to make the TA answer on the fourth ring). You also can use one of the configuration utilities to the turn autoanswer on and set the number of rings.
2. Make sure that the TA is offline.

The TA answers the call after the number of rings specified by **S0**. To disable autoanswer, use a configuration utility or the command **S0=0**.

---

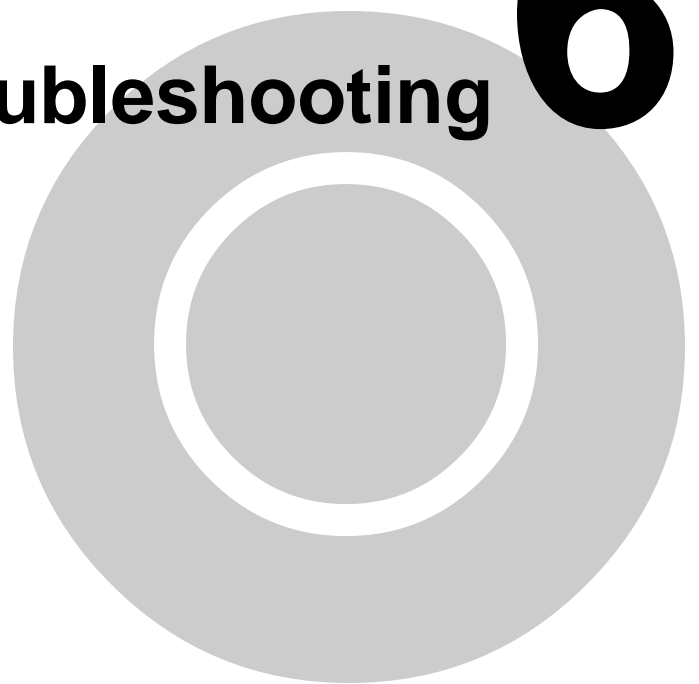
*Note: If the user wants to accept calls while DTR is low, the TA must be configured to ignore DTR. To ignore, enter **AT&D0<cr>**. With this configuration, the TA can accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while the calls comes in.*

---

## Hanging Up

To hang up a call, first escape to online command mode (**+++AT<cr>**), then enter the **H** command (**ATH<cr>**). The escape sequence and hang up command can be combined into one command string: **+++ATH<cr>**.

# Troubleshooting **6**



## Troubleshooting

This chapter covers common problems you may have with your ISIH-2S/2U and how to solve them. The ISIH-2S/2U was thoroughly tested at the factory before shipping. If you are unable to connect successfully, or if you experience data loss or garbled characters, during connecting, it is possible the modem or terminal adapter is defective. However, it is more likely that the source of your problem lies elsewhere. Always make sure all hardware is connected properly. Then review the common problems listed in this chapter for recommendations on what to change or do. Problems you may encounter include the following:

- The TA/modem does not respond to commands.
- The TA/modem dials but cannot make a connection.
- You can place data calls but not voice calls, or vice versa.
- You cannot place two simultaneous data calls.
- The TA/modem disconnects while online.
- The TA/modem cannot connect when answering.
- File transfer appears slower than it should be.
- Data is being lost
- There are garbage characters on the monitor

If you experience problems, please check the following possibilities before calling Tech Support (see Chapter 6).

### **The terminal adapter does not respond to commands**

- Make sure you issue commands from the data communications software, either automatically or manually, in terminal mode. (You cannot send commands to the TA/modem from the DOS prompt.)
- Make sure you are in terminal mode in your data communications program; then type AT and press ENTER. If you get an OK response, your connections are good and the problem likely is in your phonebook entry or session settings.
- If you don't get an OK, the problem may still be in the communications software. Make sure you have done whatever is necessary in your software to make a port connection. Not all communications programs connect to the COM port automatically. Some connect when the software loads and remain connected until the program ends. Others, like MultiExpress Terminal, can disconnect without ending the program (make sure the Connect icon looks plugged in). MultiExpress Terminal also allows multiple terminals to be open, but only one can access the modem/TA at a time.
- Your communications software settings may not match the physical port where the TA is connected. The serial cable may be plugged into the wrong connector—check your computer documentation to make sure. Or, you may have selected a COM port in your software other than the one where the TA/modem is connected—compare the settings in your software to the connection.



- Peripheral expansion cards, such as bus mouse and sound cards, may include a serial port preconfigured as COM1 or COM2. The extra serial port, or the card itself, may use the same COM port, memory address, or interrupt request (IRQ) as your communications port. Be sure to disable any unused ports.

To look for address or IRQ conflicts if you use Windows 3.1x, select **File** then **Run** in **Program Manager**. Type **MSD** and press ENTER. Then select **Mouse, COM Ports, and IRQ Status** and note the addresses and IRQs that are in use. If you find an IRQ conflict, note which IRQs are not being used, then change one of the conflicting devices to use one of the unused IRQs. If you find an address conflict, change the address of one of the conflicting devices.

To change a port address or IRQ in Windows 3.1x, double-click the **Control Panel** icon and then the **Ports** icon. Click the port you want to change; then click **Settings** and then **Advanced** and select the new port address and/or interrupt. If you want to use COM3 or COM4, note that COM3 shares an IRQ with COM1, as does COM4 with COM2, so you should change their IRQs to unused ones if possible.

If you use Windows 95, right-click **My Computer** and select **Properties**. Click the **Device Manager** tab and then double-click **Ports**. Double-click the Communications Port where your modem/TA is connected. In the port's **Properties** sheet, click the **Resources** tab to view the port's Input/Output range and Interrupt Request. If another device is using the same address range or IRQ, it appears in the **Conflicting Device List**. Remove the check from **Use Automatic Settings** to change the port's settings, so they do not conflict with the other device. Or, select the port the conflicting device is on and change it instead. If you need to open your computer to change switches or jumpers on the conflicting device, refer to the your computer's documentation.

- The serial port may be defective. If you have another serial port, install the TA on it, change the COM port setting in your software, and try again.
- The TA may be defective. Call Tech Support for assistance (see Chapter 6).

### **The terminal adapter dials but cannot make a connection**

Possible be several reasons the TA fails to make a connection include:

- Lack of a proper physical connection to the communication line
- A busy signal
- A wrong number
- No terminal adapter at the other end
- A faulty communications device, computer, or software at the other end
- Incompatibility between communications devices
- An improperly configured ISIH-2S/2U TA

Narrow the list of possibilities by using extended result codes. To enable them, enter **ATV1X2** and press ENTER while in terminal mode or include V1X2 in the TA's initialization string (V1X2 is enabled by default). When you dial again, the TA reports the call's progress.

- If the modem/TA reports BUSY, the other number may be busy. Try again later.
- If the TA reports NO CARRIER, no connection was made. You may have dialed the correct number, but the other computer or software was turned off or faulty. Check the number and try again or try calling another system to make sure your TA is working. Also, check that you accurately configured the TA with the correct switch type, TEIs, data protocols, and other parameters needed for a successful call (see Chapter 3).

#### **You can place data calls but not voice calls, or vice versa**

- You might not have ordered both voice and data service from your ISDN provider. Check your contract or latest statement of service from your ISDN provider.
- Your ISDN provider may have programmed the switch incorrectly. Call the provider.

#### **You cannot place two simultaneous data calls**

- You may not have ordered an ISDN line configuration that supports two simultaneous calls. Check your contract or latest statement of service from your ISDN provider. Also, your ISDN provider may have programmed the switch incorrectly. Call the provider.
- You may have misconfigured your TA to dial two simultaneous data calls. The command `AT&J1&W0<cr>` is used to indicate whether outgoing calls should be made on two B-channels by default.
- You may be using the wrong *bundling* dial modifier (e.g., `ATD7853500&7853502<cr>`). The ampersand in this command string is correct. Note other valid characters joining two telephone numbers include a Plus Sign (+) and an exclamation Mark (!).

---

*Note: In Windows 95, if the Use Country Code and Area Code box is checked in the Properties window for dial-up connection, the bundling modifier (i.e., &, + or !) is removed from the dialing string when the user attempts to make a connection. The solution is to not check the Use Country Code and Area Code box or to simply add the bundling dial modifier to the phone number at the time of connection.*

---

#### **The terminal adapter disconnects while online**

- Check for loose connections between the computer, the ISDN jack, and AC power.
- The problem may have originated at the other end of the line. Try again.
- If you were online with a BBS or online service, it may have hung up due to lack of activity on your part or because you exceeded your time limit for the day. Try again.

#### **The terminal adapter cannot connect when answering**

- Autoanswer may be disabled. Turn on autoanswer in your data communications program, or send the command `ATS0=1` to your TA in terminal mode.

---

*Note: If you want to accept calls while DTR is low, the TA must be configured to ignore DTR. This is accomplished by entering `AT&D0<cr>`. With this configuration, the TA is able to accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while the calls comes in.*

---

**File transfer appears slower than it should**

- If you have a Universal Asynchronous Receiver/Transmitter (UART) that is compromising data throughputs, we recommend you replace it with a special I/O card.
- If you are running under Windows 3.1 and have a 16550AFN UART, you must replace the Windows serial driver, COMM.DRV, to take full advantage of the UART's speed.
- Check the serial port baud rate in your communications software and make sure it is set as high as your UART allows.

**Data is being lost**

- Your UART may not be reliable at serial port speeds over 9600 bps or 19,200 bps. Reset your serial port speed to a lower rate or replace your serial port with a faster one.
- Check the serial port baud rate in your communications software, and make sure it is set as high as your UART allows.
- Make sure the flow control method you selected in software matches the method selected in the TA.

**There are *garbage* characters on the monitor**

- Your computer and the remote computer may be set to different parities. Check with the remote system with which you are communicating and set your communications software to use the same parity as the remote system.



# **Service, Warranty, and Technical Support/BBS**

# 7



## Introduction

This chapter begins with the terms of your MultiModemISI's five-year warranty. If you have questions or problems with your terminal adapter, carefully read the *Technical Support* section. It includes technical support telephone numbers, space for recording information about your ISIH-2S/2U, and an explanation of how to send in your ISIH-2S/2U should you require service. The final sections explain how to use our bulletin board service (BBS), how to upgrade ISIH-2S/2U via flash PROM, and how to get information and support through CompuServe and the Internet.

## Limited Warranty

Multi-Tech Systems, Inc. (MTS) warrants that its products will be free from defects in material or workmanship for a period of five years from the date of purchase, or if proof of purchase is not provided, five years from date of shipment. MTS MAKES NO OTHER WARRANTY, EXPRESSED 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 the 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 PURCHASE PRICE FOR DEFECTIVE PRODUCTS.

## Online Warranty Registration

To register your Multi-Tech product online, enter the following URL on your Internet browser:

<http://www.multitech.com/register>



## **Service**

If your tech support specialist decides that service is required, your ISIH-2S/2U may be sent (freight prepaid) to our factory. Return shipping charges will be paid by Multi-Tech Systems (within North America).

Include the following with your ISIH-2S/2U:

- A description of the problem
- Return billing and return shipping addresses
- Contact name and phone number
- Check or purchase order number for payment if the ISIH-2S/2U is out of warranty (Check with your technical support specialist for the standard repair charge for your ISIH-2S/2U card.)
- If possible, note the name of the technical support specialist with whom you spoke

If you need to inquire about the status of the returned product, be prepared to provide the serial number (located on the Multi-Tech label on the component side of the card) of the product sent.

Send the ISIH-2S/2U to: Multi-Tech Systems, Inc.

2205 Woodale Drive

Mounds View, Minnesota 55112

ATTN: Service or Repairs

Check with your Multi-Tech supplier on the availability of local service and/or loaner units in your area.



## The Multi-Tech BBS

For customers who don't have Internet access, Multi-Tech maintains a bulletin board system (BBS) that mirrors the FTP site. The BBS includes new product information, product upgrade files, and problem-solving tips. The phone number for the Multi-Tech BBS is 800/392-2432 (USA and Canada) or 612/785-3702 (international and local).

You can access the BBS with any asynchronous modem operating at 1200 bps to 33,600 bps at a setting of 8 bits, no parity, and 1 stop bit (8-N-1).

### To log on to the Multi-Tech BBS

1. Set your communications program to 8-N-1.
2. Dial our BBS at 800/392-2432 (USA and Canada) or 612/785-3702 (international and local).
3. At the prompts, type your first name, last name, and password. Then press ENTER. If you are a first time caller, the BBS asks if your name is spelled correctly. If you answer yes, a questionnaire appears. You must complete the questionnaire to use the BBS on your first call.
4. Press ENTER until the Main Menu appears. In the Main Menu you have access to two areas: the Files Menu and News. For help with menu commands, type ?.

### To Download a File

*If you know the file name:*

1. From the Main Menu, type **F** to access the Files Menu, then type **D**.
2. Enter the name of the file you want to download from the BBS.
3. If a password is required, enter the password.
4. Enter **Y** or **N** to the automatic logoff question.
5. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
6. If you select Zmodem, the transfer begins automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most data communication programs, the PAGE DOWN key initiates the download.)
7. When the download is complete, press ENTER to return to the File Menu.
8. To exit the BBS, type **G** and press ENTER.

*If you don't know the file name:*

1. From the Main Menu, type **F** to access the Files Menu. For a list of file areas, type **L** and press ENTER; then type **L** and press ENTER again. (If you don't enter the second **L**, a list of *all* the files on the BBS appears.)
2. To mark each file area you want to examine, type its list number and press ENTER.
3. Type **L** to list all the files in the selected file areas. Type **C** to go forward in the file list and **P** to go back.
4. To mark one or more files for download, type **M**, press ENTER, type the list numbers of the files, and then press ENTER again.
5. Type **D**. A list of the files you marked appears. Type **E** if you want to edit the list. Otherwise, type **D** again to start the download process.
6. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
7. If you select Zmodem, the file transfers automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most data communications programs, the PAGE DOWN key initiates the download.)
8. When the download is complete, press ENTER to return to the File Menu.
9. To exit the BBS, type **G** and press ENTER.

### **Reading a Message**

When you log on, the BBS tells you if you have a personal message (mail). At the prompt **Would you like to read it now?**, type **R** to read the message. This is the only point where you can read your mail. You cannot read messages from the Message Menu.

### **Leaving a Message**

The Multi-Tech BBS has no public discussion area. To leave a personal message, select the Message Menu by typing **M** at the Main Menu. Type **E**, then press RETURN to select the Sysop conference. Enter the name of the recipient (or *sysop*), the subject, and the message text. Press ESCAPE to finish. Type **S** to save the message and exit. To abort the message at any point, leave any of the fields blank and press RETURN.

### **Bulletins**

When you log on, the BBS asks if you want to view the bulletin menu. Bulletins are menu driven. To read a bulletin, enter its number. You also can access bulletins by typing **B** at the Main Menu.

## Upgrading the ISIH-2S/2U with FlashPro

The ISIH-2S/2U has a flash PROM that contains firmware code for the hardware. At various times, Multi-Tech adds enhancements and/or fixes to the firmware. The flash technology used in the ISIH-2S/2U allows you load these upgrades into the PROM through the ISIH-2S/2U TA serial port.

### *Using FlashPro to Upgrade Firmware*

1. Download FLASHPRO.ZIP and a new .HEX file from the Multi-Tech BBS.
2. Unzip the FLASHPRO.ZIP file. Place this unzipped file and the .HEX file in the same directory.
3. Run FlashPro by typing **FLASHPRO**, a space, **-M** and pressing ENTER at the DOS prompt.
4. In the Main Menu, select **Configure** and press ENTER. Select **Active Port** and select the COM port to which the TA is connected. Select **Baud Rate** and select the rate at which you want to program. Press ESC when finished.
5. In the Main Menu, select **Select File to Program**. Select the **.HEX** file. Press ESC when finished.
6. In the Main Menu, select **Program Firmware**. When prompted to confirm the file to program, type **Y**.
7. If you need more assistance programming FlashPro, contact our Technical Support department.

## About CompuServe

In addition to the BBS, Multi-Tech provides technical support through CompuServe's Modem Vendor Forum (GOMODEMVEN). Refer to your CompuServe documentation for special operating procedures.

## About the Internet

Multi-Tech is a commercial user on the Internet, and we retrieve e-mail messages from our customers on a periodic basis. If you prefer to receive technical support via the Internet, you can contact Tech Support at the following address:

[http://www.mutltitech.com/\\_forms/email\\_tech\\_support.htm](http://www.mutltitech.com/_forms/email_tech_support.htm)

Multi-Tech's presence includes a Web site at:

<http://www.multitech.com>

and an ftp site at:

<ftp://ftp.multitech.com>

## About the Multi-Tech Fax-Back Service

Multi-Tech's fax-back system provides 24-hour access to sales, marketing, and technical literature for customers in the USA. Dial 612/717-5888, follow the voice prompts, and request the document number for either the Sales and Marketing catalog or the Technical Support catalog of documents. For convenience, write your fax number in the following space: \_\_\_\_\_

From the Sales and Marketing catalog, you can request to have newsletters, *white* papers, press releases, brochures faxed to you. From the Technical Support catalog, you can request basic modem operation and troubleshooting guides. With either catalog, simply enter the fax-back document number of the literature you want to receive.



# Appendix

## Appendix A: Determining Current System Settings

Use the instructions below to determine base I/O addresses and interrupt vectors for SCO and UNIXWare systems and to remove an existing device to free up its interrupt value.

1. The serial device table is listed in the configuration directory. Type **cd /etc/conf/sdevice.d** and press ENTER.
2. To view the contents of the table, type **cat\* | more** and press ENTER.
3. A table of entries and fields displays. The seventh and eighth fields of this table display the starting and ending I/O addresses for each device installed in your system. You must select a unique I/O address for each card you are installing, noting that each ISIH-2S/2U requires the base I/O address and the next seven addresses. Make certain that none of these addresses is being used.
4. The sixth field from the left contains the interrupt values currently in use. If you require more interrupt values than are available, the serial I/O (sio) devices are good candidates for removal.

To Remove an SIO Device

1. You will be modifying three files to remove the serial drivers from the kernel. Edit **/etc/conf/cf.d/mdevice**. Look for the line that looks like this:

```
sio  Iocrwip  iHctr  sio  0  5  1  2  -1
```

Remove the **r** in the third column and save the modified file. This tells the Link Kit that sio is not a required device.

2. Next, edit **/etc/conf/sdevice.d/sio**. Look for the line that corresponds to the COM port that you want to disable.

```
sio  Y  1  7  1  4  3f8  3ff  0  0
sio  Y  1  7  1  3  2f8  2ff  0  0
```

Change the **Y** to **N** on the line of the appropriate COM port.

3. Next edit **/etc/conf/pack.d/sio/space.c**. If you are removing COM 1, delete the following line from this file:

```
{0, IBM_BOARD, 1,4,0 (sd)0x3f8,0, 0,MCRBIT3}, /*ibm COM1*/
```

If you are removing COM 2, delete the following line:

```
{0, IBM_BOARD, 1,3,8 (sd)0x2f8,0, 0,MCRBIT3}, /*ibm COM2*/
```

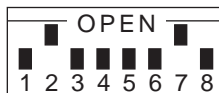
4. After you have modified these files, continue with the ISIH-2S/2U driver installation using the freed IRQ value(s).

## Appendix B: Base I/O Switch Settings

The table below provides the DIP switch settings for valid base I/O addresses of the ISIH-2S/2U. The switches can be set to OPEN (**O** in the table below) or to CLOSED (**C** in the table below). Holding the board with the switch facing you (reading numbers 1-8 left to right), the UP position for the switch is OPEN, and the DOWN position is CLOSED. S1 below is labeled as 1 on the left side of the switch and so on, through S8. For an example, turn to the next page and compare the default switch settings with the address 200h listing.

### Address Switch Settings

I/O Addr. (hex)	DIP Switch Settings							
	S1	S2	S3	S4	S5	S6	S7	S8
100	C	C	C	C	C	O	C	C
110	C	O	C	C	C	O	C	C
120	C	C	O	C	C	O	C	C
130	C	O	O	C	C	O	C	C
140	C	C	C	O	C	O	C	C
150	C	O	C	O	C	O	C	C
160	C	C	O	O	C	O	C	C
170	C	O	O	O	C	O	C	C
180	C	C	C	C	O	O	C	C
190	C	O	C	C	O	O	C	C
1A0	C	C	O	C	O	O	C	C
1B0	C	O	O	C	O	O	C	C
1C0	C	C	C	O	O	O	C	C
1D0	C	O	C	O	O	O	C	C
1E0	C	C	O	O	O	O	C	C
1F0	C	O	O	O	O	O	C	C
200	C	C	C	C	C	C	O	C
<b>210*</b>	C	O	C	C	C	C	O	C



220	C	C	O	C	C	C	O	C
230	C	O	O	C	C	C	O	C
240	C	C	C	O	C	C	O	C

\* Denotes default setting

I/O Addr. (hex)	S1	S2	S3	S4	S5	S6	S7	S8
250	C	<b>O</b>	C	<b>O</b>	C	C	<b>O</b>	C
260	C	C	<b>O</b>	<b>O</b>	C	C	<b>O</b>	C
270	C	<b>O</b>	<b>O</b>	<b>O</b>	C	C	<b>O</b>	C
280	C	C	C	C	<b>O</b>	C	<b>O</b>	C
290	C	<b>O</b>	C	C	<b>O</b>	C	<b>O</b>	C
2A0	C	C	<b>O</b>	C	<b>O</b>	C	<b>O</b>	C
2B0	C	<b>O</b>	<b>O</b>	C	<b>O</b>	C	<b>O</b>	C
2C0	C	C	C	<b>O</b>	<b>O</b>	C	<b>O</b>	C
2D0	C	<b>O</b>	C	<b>O</b>	<b>O</b>	C	<b>O</b>	C
2E0	C	C	<b>O</b>	<b>O</b>	<b>O</b>	C	<b>O</b>	C
2F0	C	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	C	<b>O</b>	C
300	C	C	C	C	C	<b>O</b>	<b>O</b>	C
310	C	<b>O</b>	C	C	C	<b>O</b>	<b>O</b>	C
320	C	C	<b>O</b>	C	C	<b>O</b>	<b>O</b>	C
330	C	<b>O</b>	<b>O</b>	C	C	<b>O</b>	<b>O</b>	C
340	C	C	C	<b>O</b>	C	<b>O</b>	<b>O</b>	C
350	C	<b>O</b>	C	<b>O</b>	C	<b>O</b>	<b>O</b>	C
360	C	C	<b>O</b>	<b>O</b>	C	<b>O</b>	<b>O</b>	C
370	C	<b>O</b>	<b>O</b>	<b>O</b>	C	<b>O</b>	<b>O</b>	C
380	C	C	C	C	<b>O</b>	<b>O</b>	<b>O</b>	C
390	C	<b>O</b>	C	C	<b>O</b>	<b>O</b>	<b>O</b>	C
3A0	C	C	<b>O</b>	C	<b>O</b>	<b>O</b>	<b>O</b>	C
3B0	C	<b>O</b>	<b>O</b>	C	<b>O</b>	<b>O</b>	<b>O</b>	C
3C0	C	C	C	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	C
3D0	C	<b>O</b>	C	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	C
3E0	C	C	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	C
3F0	C	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	<b>O</b>	C



## Appendix C: Pin Assignments

The MultiModem Hybrid Series comes with either U-interface or S/T-interface network connection cable, and analog fax/modem DAA. The U-interface connection cable is for direct ISDN line connection, which does not need any extra ISDN NT1 device. The S/T-interface connection cable is for connecting to NT1. Both the U- and S/T-interface use an RJ-45 phone jack but with different pin assignments. The bundled RJ-45 phone cord can be used for both U- or S/T-interface connections. The fax/modem DAA uses an RJ-11 phone jack to connect to PSTN (analog telephone line) directly.

### The RJ-45 Pin-outs of U-interface

Pin 1	Not connected
Pin 2	Not connected
Pin 3	Not connected
Pin 4	Signal
Pin 5	Signal
Pin 6	Not connected
Pin 7	Not connected
Pin 8	Not connected

### The RJ-45 Pin-outs of S/T-interface

Pin 1	Not connected
Pin 2	Not connected
Pin 3	Transmit signal (T1)
Pin 4	Receive signal (R1)
Pin 5	Receive signal (R2)
Pin 6	Transmit signal (T2)
Pin 7	Not connected
Pin 8	Not connected

### The RJ-11 Pin-outs of Analog Fax/Modem DAA

Pin 1	Not connected
Pin 2	Not connected
Pin 3	Tip
Pin 4	Ring
Pin 5	Not connected
Pin 6	Not connected

## Appendix D: ISIH-2S/2U Testing Utilities

This disk contains two files to be used in conjunction with MultiModemISI boards. These files are described in two sections:

- Operation with factory default settings (file name: **ISI608.BIN**)
- Operation with other than the factory default settings (file name: **608TERM.EXE**)

---

*Note: This program is a DOS utility.*

---

### 1. Operation with factory default settings:

The 608TERM.EXE program is a utility program that emulates a terminal to test the connection from PC keyboard to ISI board to modem to ISI board to PC display. Before executing 608TERM, the program must be executed to initialize the ISI board (when the ISI board's factory settings are unchanged). The following displays:

```
ISI608 Terminal Utility Version 1.00

Loading Firmware to ISI608 located at address 200h
Loading default file: ISI608.BIN

ISI608 loading firmware . . .
ISI608 verifying firmware . . . Verify OK.
ISI608 firmware loaded successfully.

ISI firmware loaded successfully . . .

Enter 1 to 8 for eight ports ISI.
Enter port number?
```

---

*Note: This program must be run anytime the PC is powered down or rebooted.*

---

The first step in this utility is to identify the port to be tested. In order for the test to function, the selected port must be connected to an activated modem. The valid entries for the MultiModemISI are 1 through 8. Once a port is selected, the following displays:

```
Enter 8 == 1200 baud
Enter 11== 2400 baud
Enter 15== 9600 baud
Enter 16== 19200 baud
Enter 17== 38400 baud
Enter 18== 57600 baud
Enter 19== 115200 baud

Enter the baud rate you wish to run?
```

This step allows selection of a baud rate for testing. Once a baud rate is selected, the following displays:

```
ISI Terminal Utility is ready. Press F10 to Exit.
```

This message indicates that keyboard entry can now be performed. Any characters typed on the keyboard are sent through the MultiModemISI board to the modem and then returned to display on the PC screen. When operation is verified, exit the utility by pressing F10.

## 2. Operation with setting other than factory defaults

The 608TERM.EXE program is a utility program that emulates a terminal to test the connection from PC keyboard to ISI board to modem to ISI board to PC display. Prior to executing 608TERM, the program must be executed to initialize the ISI board.

Enter **608TERM -h <cr>** to display the 608TERM program requirements. The following displays:

```
A:\>608TERM -h
```

```
Usage is:
```

```
ISITerm -l<2 to 7, 10 to 12 and 15> for specifying IRQ level.
```

```
-A<address> for specifying base address.
```

```
-H this help screen.
```

---

***Note:** This program must be run anytime the PC is powered down or rebooted.*

---

Whenever the base IO address and/or the IRQ values have been changed, a parameter string must be added to the command line. The string takes the form of [-Axxxx], where xxxx represents the new base IO address value and [-Iy] and y represents the IRQ value selected. Three potential combinations exist for the formatting of the command line:

1. Changing only the base IO address setting, the command line takes the form:  
**608TERM [-Axxxx]**
2. Changing only the IRQ setting, the command line takes the form: **608TERM [-Iy]**
3. Changing both the base IO address and the IRQ settings, the command line takes the form: **608TERM [-Axxxx] [-Iy]**

For example, if the base IO address switch setting were changed to 2C0h, the new command line would be: **A:\>608TERM -A2C0**

The following displays:

```
A:\>608TERM -A2C0

Loading Firmware to ISI608 located at address 2C0h
Loading default file: ISI608.BIN

ISI608 loading firmware . . .
ISI608 verifying firmware . . . Verify OK.
ISI608 firmware loaded successfully.

ISI firmware loaded successfully . . .

Enter 1 to 8 for eight ports ISI.
Enter port number ?
```

The first step in this utility is to identify the port to be tested. In order for the test to function, the selected port must be connected to a modem that is switched on. Valid entries for the MultiModemISI are 1 through 8. Once a port is selected, the following displays:

```
Enter 8 == 1200 baud
Enter 11== 2400 baud
Enter 15== 9600 baud
Enter 16== 19200 baud
Enter 17== 38400 baud
Enter 18== 57600 baud
Enter 19== 115200 baud

Enter the baud rate you wish to run?
```

This step allows selection of a baud rate for testing. Once a baud rate is selected, the following displays:

```
ISI Terminal Utility is ready. Press F10 to Exit./
```

This message indicates that keyboard entry can now be performed. Any characters typed on the keyboard are sent through the ISI board to the modem and then returned to display on the PC. When operation has been verified, exit the utility by pressing F10.

---

## Appendix E: Configuration Profiles

### Quick Setup Factory Profiles

For quick setup, the Terminal Adapter includes four Quick Setup Factory Profiles, each of which is configured for a specific type of port operation. You can load a Quick Setup Factory Profile into active memory by using the command **&Fn**, where n is the number of the profile you want to load. If you want, you can then customize the profile and store it, using the **&W** command so that it loads automatically when the TA is turned on or reset. These profiles are stored in permanent memory and are not user-configurable as such.

**&F0** Profile 0—Modem-like asynchronous operation (default)

**&F1** Profile 1—V.120 asynchronous operation

**&F3** Profile 3—ML-PPP asynchronous operation

### Quick Setup Example

The following procedure assumes you want to load, modify, and store Quick Setup Factory Profile 2 as your default configuration.

1. Select the profile closest to the requirements of your application, in this case, Quick Setup Factory Profile 2.
2. In terminal mode, type **AT&F2** and press ENTER. Quick Setup Profile 2 loads into the TA's active memory.
3. Enter any additional AT commands that you need to customize the selected profile to your application (see Chapter 5, *Terminal Adapter AT Commands, S-Registers, Result Codes*).
4. Type **AT&W0** and press ENTER to save your customized port configuration.
5. Your customized profile now loads automatically whenever the TA is turned on or reset.

**Profile 0 (&F0)—Modem-Like Asynchronous Operation**

<b>AT Command</b>	<b>Description</b>
&C1	DCD functions normally
\$D0	Disable persistent DTR dialing
&D1	Hang up when DTR drops
E1	Enable command mode echo
&E4	Enable hardware flow control
&E6	Discard XON/XOFF characters
&E13	Enable pacing
#X0	Disable Sending Multiple Xoff Characters
&J0	Disable Automatic Channel Bundling
&K0	Disable Data Compression
%E1	Enable +++ escape method
%E4	No OK response to +++ or <BREAK> escape
&M0	Asynchronous mode
@P3=4	No parity at power-up
@P4=8	8 data bits
@P6=1	1 stop bit
&R1	CTS always high
S0=1	Answer after 1 ring
S2=43	Set escape character to + (ASCII 43)
S3=13	Set carriage return character to CR (ASCII 13)
S4=10	Set line feed character to LF (ASCII 10)
S5=8	Set backspace character to BS (ASCII 8)
S7=45	Wait 45 seconds for connection before aborting
S10=20	Set DCD drop time to 700 ms
S25=5	Set DTR detect time to 50 ms
S32=20	Set escape sequence guard time to 2 seconds
S50=1	Caller Line ID Enabled
S52=1	Auto-Protocol Detection Enabled
S53=2048	Maximum Frame Size 2048 Characters
&S1	DSR follows DCD
\$\$SB1152	Select 115,200 bps for DTE interface
V1	Select verbose messages

**Profile 1 (&F1)—V.120 Asynchronous Operation**

<b>AT Command</b>	<b>Description</b>
&C1	DCD functions normally
\$D0	Disable persistent DTR dialing
&D1	Hang up when DTR drops
E1	Enable command mode echo
&E4	Enable hardware flow control
&E6	Discard XON/XOFF characters
&E13	Enable pacing
#X0	Disable Sending Multiple Xoff Characters
&J0	Disable Automatic Channel Bundling
&K0	Disable Data Compression
%E1	Enable +++ escape method
%E4	No OK response to +++ or <BREAK> escape
&M0	Asynchronous mode
@P3=4	No parity at power-up
@P4=8	8 data bits
@P6=1	1 stop bit
&R1	CTS always high ring
S2=43	Set escape character to + (ASCII 43)
S3=13	Set carriage return character to CR (ASCII 13)
S4=10	Set line feed character to LF (ASCII 10)
S5=8	Set backspace character to BS (ASCII 8)
S7=45	Wait 45 seconds for connection before aborting
S10=20	Set DCD drop time to 700 ms
S25=5	Set DTR detect time to 50 ms
S32=20	Set escape sequence guard time to 2 seconds
S50=1	Caller Line ID Enabled
S52=1	Auto-Protocol Detection Enabled
S53=2048	Maximum Frame Size 2048 Characters
&S1	DSR follows DCD
\$SB1152	Select 115,200 bps for DTE interface
V1	Select verbose messages
!Z=5	Enable V.120 data protocol

**Profile 3 (&F3)—ML-PPP Asynchronous Operation**

<b>AT Command</b>	<b>Description</b>
&C1	DCD functions normally
\$D0	Disable persistent DTR dialing
&D1	Hang up when DTR drops
E1	Enable command mode echo
&E4	Enable hardware flow control
&E6	Discard XON/XOFF characters
&E13	Enable pacing
#X0	Disable Sending Multiple Xoff Characters
&J0	Disable Automatic Channel Bundling
&K0	Disable Data Compression
%E1	Enable +++ escape method
%E4	No OK response to +++ or <BREAK> escape
&M0	Asynchronous mode
@P3=4	No parity at power-up
@P4=8	8 data bits
@P6=1	1 stop bit
&R1	CTS always high
S0=1	Answer after 1 ring
S2=43	Set escape character to + (ASCII 43)
S3=13	Set carriage return character to CR (ASCII 13)
S4=10	Set line feed character to LF (ASCII 10)
S5=8	Set backspace character to BS (ASCII 8)
S7=45	Wait 45 seconds for connection before aborting
S10=20	Set DCD drop time to 700 ms
S25=5	Set DTR detect time to 50 ms
S32=20	Set escape sequence guard time to 2 seconds
S50=1	Caller Line ID Enabled
S52=1	Auto-Protocol Detection Enabled
S53=2048	Maximum Frame Size 2048 Characters
&S1	DSR follows DCD
\$\$SB1152	Select 38,400 bps for DTE interface
V1	Select verbose messages
!Z=9	Enable MLPPP data protocol



## Appendix F: Ordering ISDN BRI (2B+D) Lines

Two ways to specify your ISDN line configuration to your service provider are:

- Use ISDN *ordering codes* where the user and the Local Exchange Carrier (LEC) or Internet Service Provider (ISP) use common nomenclature to describe elements of service.
- Use a *building block approach* where the naming conventions are not standard, and the user and provider must establish a set of provisioning options.

Several lists of contacts for ISDN service providers are located at the end of this appendix.

### Loop Qualification

The first step in ordering (*provisioning*) an ISDN BRI line is to contact your LEC and verify ISDN BRI loop availability in your location. There is a distance limitation of approximately 2 miles (1800 Kf) from the BRI loop. Each request for BRI is handled on a case-by-case basis. Once qualified, the LEC requires information on the type of equipment and protocol used. Most ISDN BRI is configured as *voice and data*. (Since LEC network primarily is analog, ISDN digital technology converts the digital signal into analog, transports it over its analog lines, and then reconverts it into digital data at the other end). As a general procedure, when ordering an ISDN BRI (2B+D) line:

1. Plan ahead. The BRI line order may take four weeks or more to get provisioned.
2. Contact your LEC representative early in the process to ensure ISDN BRI loop availability for your location.
3. Provide the LEC representative with
  - Your correct address for the BRI service.
  - The type of equipment (e.g., Multi-Tech ISIHI-2S/2U) and the protocol specifications it supports. Use the *ISDN BRI (2B+D) Line Ordering Checklist* provided later in this document for protocol specifications.
  - The type of jack required by the ISIHI-2S/2U (i.e., RJ-45 male 2-wire U Basic Rate Interface).
4. Wait for installation notification from the LEC. Ask the LEC representative what type of switch is used (AT&T 5ESS and NT DMS-100 are most prevalent).
5. Ensure availability of an *auxiliary* analog line (if you plan to use the TA's AUX RJ-11 analog connector for a standard telephone connection). Make sure you have a 115 VAC (60 Hz) power outlet near your computer for the TA's two-prong outlet-mounted power transformer.
6. Record all of the information provided by your LEC.

## Bearer Service

Circuit Switch Voice bearer (CSV) and Circuit Switch Data bearer (CSD) are broad categories of bearer service options that the phone companies can provide. Bearer services provide different types of guarantees about the reliability and synchronization of the data. Currently, there are ten different bearer services for circuit-mode and three services for packet mode.

Bearer services are defined in terms of a number of attributes, which include mode (circuit or packet), structure (bit-stream or octet-stream), transfer rate (e.g., 64 Kbps), transfer capability (basically, the content, for instance speech, 7 KHz audio, video, or unrestricted), and other attributes that specify protocols to use along with other things.

The attributes of the bearer service are encoded into a bearer code (BC) that is sent every time a new connection is set up. In theory, this allows the switches to choose from a variety of different switching paths techniques, depending on requirements. In practice, the SPID determines what services are needed for switching, as this simplifies things for the telephone companies. The bearer code is not completely ignored; however, there are certain bearer services that are unavailable on your B-channels, based on how they are configured. It is important to note that the bearer code is sent to the switch every time a connection is established. However, the SPID is sent to the switch only when you physically attach your equipment to your phone line.

At this time the switch gives your device a terminal equipment identifier (TEI), which is used from then on to identify all connection requests from that piece of equipment. This allows the switch to look at the TEI and bearer code, determine the SPID, and see if the bearer code and the SPID match up.

## Using ISDN Ordering Codes (IOCs)

An organization called *ISDN Solutions Group*, made up of ISDN service providers and equipment vendors, formed to simplify the often complex task of ordering an ISDN line. Their method, supported by most (but not all) service providers, uses ISDN ordering codes to define the ISDN line configuration. Your ISDN TA has been tested to operate with the ordering codes B1, Capability C, Capability R, I2, J2, J3, Capability S, and M5.

### **B1 (previously *Generic Data B*)**

- 1B service
- Data only on 1 B channel
- One directory number

### **Capability C (previously *Generic Data C*)**

- 1B service
- Alternate voice and data on one B channel
- One directory number

**Capability R (previously *Generic Data I*)**

- 2B service
- Data only on each B channel
- Two directory numbers

Applications include:

- 115.2K or 128 Kbps data only (no voice capability)
- Generic 115.2K/128 Kbps data transfer applications (including remote access and LAN/WAN connectivity and telecommuting)

**I2 (previously *Generic Data I-1DN*)**

- 2B service
- Data only on each B channel
- One directory number

Not available on the Northern Telecom switch. Two directory numbers are required for 2B operation. In this case use J2.

**J2 (previously *Generic Data J*)**

- 2B service
- Alternate voice and data on one B channel; data only on other B channel
- Two directory numbers

**J3 (previously *Generic Data J-1DN*)**

- 2B Service
- Alternate voice and data on one B; data only on other B channel
- One directory number

Not available on the Northern Telecom switch. Since two directory numbers are required for 2B operation, use J2.

**Capability S (previously *Generic Data M*)**

- Recommended IOC since it supports the most features for voice and data applications. However, ISDN tariffs in some areas may warrant ordering codes with fewer features (e.g., where there is an additional monthly charge for having voice service on both B channels). If yours is a data only application, Capability R may be more cost-effective.
- 2B service
- Alternating voice/data on each B channel
- Two directory numbers

Applications for Capability S include:

- 115.2K or 128 Kbps data
- 56K/64K bps data with voice or modem support
- Generic 115.2K/128 Kbps data transfer applications (including remote access and LAN/WAN connectivity and telecommuting).

**M5 (previously *Generic Data M-IDN*)**

- 2B Service
- Alternate voice/data on each B channel
- One directory number

Not available for services provided with Northern Telecom or AT&T switches. Since two directory numbers are required for 2B operation, use Capability S.

## Ordering ISDN Without IOCs

The form below can guide you and your telephone company in specifying and obtaining ISDN service when IOCs are not used. To support most ISDN TA features, telephone service must meet certain requirements. These requirements are described in the following sections. Some features may be added or deleted, depending on your actual data service needs and availability in your area. Before ordering, talk to your telephone company about which services are provided in your area.

Complete and fax the form below to your telephone company to request the proper ISDN line for use with your ISDN TA module.

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_

ZIP Code: \_\_\_\_\_ Daytime Telephone Number: \_\_\_\_\_

1. Request an ISDN BRI (Basic Rate Interface) line with:

- U-Interface Reference Point
- 2B1Q Line Coding.

2. Choose one of the following:

\_\_\_\_\_ 2B+D Service (supports up to 128 Kbps), or

\_\_\_\_\_ 1B+D Service (supports up to 64 Kbps).

3. Indicate the ISDN Switch Type and Software Protocol you will be using:

\_\_\_\_\_ AT&T 5ESS with:

\_\_\_\_\_ Custom, 5E6 and later software, or

\_\_\_\_\_ NI1 (National ISDN-1)

\_\_\_\_\_ Northern Telecom DMS-100 with:

\_\_\_\_\_ BCS-32 and later software (Pvc1), or

\_\_\_\_\_ National ISDN-1 (Pvc2)

\_\_\_\_\_ Siemens EWSD with National ISDN-1

4. Request that the ISDN line you are ordering allocates one dynamic TEI (Terminal Endpoint Identifier) per phone number.

5. Order specific services for your particular ISDN Switch:

**AT&T 5ESS**—request a line with:

Feature: Value

B1 Service: DMD (On Demand)

B2 Service: DMD (only if 2B+D ordered)

Data Line Class: PM (Point-to-MultiPoint)

Maximum B Channels: 2 (if 2B+D) or 1 (if 1B+D)

Circuit Switched Voice (CSV) Bearer Channels: Any

CSV Calls: 1 (recommended for test purposes)

Number of Circuit Switched Data (CSD) Bearer Channels: Any

Number of CSD Calls: 2 (if 2B+D ordered), or 1 (if 1B+D ordered)

Terminal Type: Type A

Turn these features OFF:

Packet Mode Data

MultiLine Hunt

Multiple Call Appearances

EKTS (Electronic Key Telephone Sets)

Shared Directory Numbers

Accept *Special* Type of Number

Intercom Groups

Modem Pools (Network Resource Selector)

Message Waiting

Hunting

InterLATA Competition

**Northern Telecom DMS-100**—request a point-to-multipoint line with:

Line Type: Basic Rate, Functional

Electronic Key Telephone Sets (EKTS): NoCall

Appearance Handling (CACH): No

Non-Initializing Terminal: No

Circuit Switched Service: Yes

Packet Switched Service: No

TEI: Dynamic

Bearer Service: Circuit Switched Voice and Data Permitted on any B channel  
(Packet Mode Data not permitted)

6. Select a long distance carrier (record here)\_\_\_\_\_

7. Contact the selected long distance carrier and request Circuit-Switched 64 Kbps Clear Channel Access (if available).

8. Request telephone company to provide the following ISDN TA configuring information (record here):

- ISDN Switch Type: \_\_\_\_\_
- ISDN Switch Protocol Version: \_\_\_\_\_
- ISDN Phone Number 1: \_\_\_\_\_
- ISDN Phone Number 2: \_\_\_\_\_ (if 2B+D ordered)
- ISDN Line Type: \_\_\_\_\_ (point-to-point or multipoint)
- If MultiPoint, SPID Number 1: \_\_\_\_\_ (with prefix and suffix)
- If MultiPoint, SPID Number 2: \_\_\_\_\_ (with prefix and suffix)

9. If you use standard 5ESS or DMS-100, your protocol selection is complete. Fax the information in steps 1-8 to your phone company. If you use 5ESS *Custom* or DMS-100 *Pvc1* protocol support, continue with **5ESS Custom** or **DMS-100 Pvc1** below.

### **5ESS Custom Line Additional Parameters**

The AT&T 5ESS central office telephone switch supports a proprietary ISDN D-channel call control protocol called *Custom*, based on CCITT recommendations. The ISDN TA configured for switch type AT&T 5ESS works with lines providing this protocol on 5ESS switches with software version 5E6 or later.

The ISDN TA supports the following configurations on 5ESS Custom lines:

- Point-to-Point with one phone number (recommended configuration with no POTS interface)
- Multipoint with one phone number
- Multipoint with two phone numbers (recommended configuration with POTS interface)

The requirements for the 5ESS line are shown below:

B1 Service: DMD (On-demand)

B2 Service: DMD (On-demand)

Data Class Line: PM (Point-to-MultiPoint)

Max. B Channels: 2

Number of CSV Calls: 2

CSV Bearer Channels: Any

Number of CSD Calls: 2

Circuit Switched: Any

Terminal Type Bearer Channels: Type A

Multipoint lines require the phone company to create a SPID for each phone number on the line. Except for the ability to spread two calls across two phone numbers, multipoint lines offer no special features and may create complications. However, if you use a multipoint line, the parameters are similar to the point-to-point lines, except for the SPIDs.

The 5ESS switch provides supplementary features that the ISDN TA may not support. Enabling these features may have undesirable consequences. Features to avoid are:

- Packet mode data
- Multiline Hunt Groups
- EKTS (Electronic Key Telephone Set)
- Shared directory numbers
- Intercom groups
- Modem Pools (Network resource selector)
- Message waiting
- Hunting
- Inter LATA competition
- Accept special type of number

If POTS interface is installed, the ISDN TA supports these supplementary features:

- Two call appearances
- Three- and six-way conferencing
- Call transfer

Only the second SPID uses these features, since the first SPID is the data-only port.

### **DMS-100 Pvc1 Line Additional Parameters**

The Northern Telecom DMS-100 telephone switch supports a proprietary ISDN D-channel call control protocol called Protocol Version 1 (*Pvc1*) that is based on CCITT recommendations. The ISDN TA configured for switch type DMS-100 works with lines providing this protocol on DMS-100 switches with software version BCS-32 or later.

The ISDN TA supports the following configurations on DMS-100 Custom lines:

- Multipoint with one phone number (for 1B+D service)
- Multipoint with two phone numbers (for 2B+D service)

Requirements for the DMS-100 multipoint line are defined in Local Interface Requirements, Local Service Requirements, and below. Fax this information to your local phone company. The line should have two service profiles with the parameters below to support BONDING and the POTS port, if installed.

Line Type: Basic rate, functional

EKTS: No

CACH: No

Initializing terminal: Yes

Bearer services: Circuit-switched voice & data permitted (Packet mode data not permitted)

Circuit-switched service: Yes

Packet-switched service: No

Protocol version: Functional Pvc1

TEI: Dynamic



**For More Information**

Several national and state organizations have ISDN line ordering information that can help when provisioning an ISDN BRI line.

**National ISDN Users Forum (NIUF)**

The National ISDN Users Forum (NIUF) implemented a series of *Compatibility Packages* (IOCs) to standardize and simplify ISDN ordering. For more information, contact:

*<http://www.niuf.nist.gov/niuf/docs/428-94.html#SSets>*

**Vendors' ISDN Association (VIA)**

Deepak Kamlani

VIA, Inc.

Bishop Ranch 2

2694 Bishop Drive , Suite 105

San Ramon, CA 94583

Phone: +1.510.277.8110

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Email: *[dkamlani@inventures.com](mailto:dkamlani@inventures.com)*

Web: *<http://www.via-isdn.org>*

**National ISDN Council (NIC)**

Pat Donovan

Phone: +1.201+649.7949

Email: *[john.p.donovan@bell-atl.com](mailto:john.p.donovan@bell-atl.com)*

Web: *<http://www.belcore.com/nic>*

**Contact Information – ISDN Service Providers****United States**

AT&T Digital Long Distance Service

*<http://www.att.com/home64/>*

Ameritech

*<http://www.ameritech.com>*

Ameritech ISDN

*<http://www.ameritech.com/products/data/isdn/index.html>*

Ameritech ISDN Availability

*<http://www.ameritech.com/products/data/isdn/isdnfrm1.html>*

Ameritech Data Services

*[http://www.ameritech.com/products/business/asg\\_data\\_services.html](http://www.ameritech.com/products/business/asg_data_services.html)*

Bell Atlantic

*<http://www.bell-atl.com/>*

Bell Atlantic Small Business ISDN

*<http://www.bell-atl.com/isdn/sbs/>*

Bell Atl. ISDN Fact Sheet

*<http://www.ba.com/isdn.html>*

Bell Atl. Residence Customer Information

<http://www.bell-atl.com/customer/consumer/home.html>

Bell Atl. Residence Customer ISDN

<http://www.bell-atl.com/customer/consumer/isdn/>

Bell Atl. Residential ISDN Market Trial

<http://www.ba.com/nr/95/jul/resisdn.html>

BellSouth Telecommunications

<http://www.bell.bellsouth.com/>

BellSouth Corporate Page

<http://www.bellsouth.com/>

BellSouth ISDN Products & Services

<http://www.bell.bellsouth.com/products-services/isdn-main.html>

BellSouth ISDN InfoCenter

[http://www.ocn.com/ocn/isdn/isdn\\_top.html](http://www.ocn.com/ocn/isdn/isdn_top.html)

BellSouth ISDN Deployment

<http://www.ocn.com/ocn/bell/stats.html>

BellSouth ISDN Availability Lookup

<http://www.ocn.com/cgi-bin/lookup>

GTE

<http://www.gte.com/>

Switched Data Services

<http://wcn.gte.com/06prod/03SWITCH.html>

GTE Hawaii unofficial ISDN Page

<http://www.aloha.net/hol/docs/isdn.html>

Northern Arkansas Telephone Company

<http://southshore.k12.ar.us/natcol.html>

Nynex (nee New York/New England Tel)

<http://www.nynex.com/>

Pacific Bell (California, USA)

<http://www.pacbell.com/>

Pacific Bell Service Options and Rates

<http://www.pacbell.com/Products/SDS-ISDN/isd-22.html>

Search Pac Bell server for ISDN

<http://www.pacbell.com/cgi-bin/pbweb-search?textit=0&sspec=isdn>

Pacific Telesis Group

<http://www.pactel.com/>

Southwestern Bell Telephone

<http://www.sbc.com/>

Southwestern Bell ISDN info

<http://www.sbc.com/swbell/kc/128.html>

Southwest Bell Tariff

<http://www.icus.com/swbtariff.html>

Southwestern Bell Telephone Houston Digiline

info <http://www.icus.com/swb-hou.html>

SNET (Connecticut)

<http://www.snet.net/>

US West Faxback Service: 800-PATHWAY (item 99=Index)

US West Center (Minneapolis): 800-223-7508

U.S. West

<http://www.uswest.com>

U.S. West ISDN Info

<http://www.uswest.com/isdn/index.html>

WilTel

<http://www.wiltel.com/>

## **Canada**

Stentor

<http://www.stentor.ca/>

CanISDN: The Canadian ISDN Resource Centre

<http://www.canisdn.net/>

Stentor ISDN Services

<http://www.stentor.ca/basie/products/isdn/isdn.html>

## **Europe**

Deutsche Telekom

<http://www.dtag.de/dtag/>

Euro-ISDN Informationen der Telekom

<http://www.netcs.com/NetCS-Public/edss1.ger.html>

France Telecom

<http://www.francetelecom.com/>

Sweden Telia AB Rgn V

<http://www.west.telia.se/>

Swiss Telecom

<http://www.vptt.ch/>

Netherlands Rollout voor de ISDN FAQ

<http://student.twi.tudelft.nl/~s674129/rollout.html>

Neuradne Telekom informacije (Slovenia)

<http://www.abm.si/~dalibor/telekom/>

## **Middle East**

Bezeq - Israel TeleComm

<http://www.bezeq.co.il/>

Israel

[http://wwwold.technion.ac.il/teach/topnet/cnpp95/ISDN\\_in\\_Israel/isdn.html](http://wwwold.technion.ac.il/teach/topnet/cnpp95/ISDN_in_Israel/isdn.html)

## **Australia**

Telestra

<http://www.telstra.com.au/prod-ser/isdn/index.html>

## **Japan**

NTT

<http://www.ntt.jp/>

NTT official server

<http://www.info.hqs.cae.ntt.jp/>

NTT ISDN Info

<http://www.info.hqs.cae.ntt.jp/SER/ISDN/ISDN.html>

## **Russia**

Russian ISDN Home Page

<http://mp.aha.ru/koi/isdn/>

## **ISDN User Groups**

Global '95 Worldwide ISDN Solutions

<http://www.bellcore.com/GLOBAL95/home.html>

ISDN '95 Symposium

<http://www.ieee.org/comsoc/ISDN.html>

PRIDUF Home Page (Pacific Region ISDN/Data User Forum)

<http://www.ptc.org/PRIDUF.html>

North American ISDN Users' Forum (NIUF)

<http://www.niuf.nist.gov/misc/niuf.html>

NIUF INFORMATION HOME PAGE

[http://www.ocn.com/ocn/niuf/niuf\\_top.html](http://www.ocn.com/ocn/niuf/niuf_top.html)

The California ISDN Users' Group CIUG Home Page

<http://www.ciug.org/>

The Florida ISDN Users Group

<http://www.ccg4isdn.com/isdn/fiug.html>

The New York ISDN Users Group

<http://www.interport.net/~digital/index.html>

The Texas ISDN Users Group (TIUG)

<http://www.crimson.com/isdn/>

Southern African ISDN Forum

<http://www.saif.org.za/>

IIIUF - Indonesian ISDN & Internet User Forum

<http://www.idola.net.id/i3uf/i3uf.htm>

Bellcore ISDN Home Page (Bell & NIUF documents)

<http://www.bellcore.com/ISDN/ISDN.html>

## Appendix G: ASCII Conversion Chart

CTRL	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	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	157
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  
 SOH Start of Header  
 STX Start of Text  
 ETX End of Text  
 EOT End of Transmission  
 ENQ Enquiry  
 ACK Acknowledge  
 BEL Bell or Alarm  
 BS Backspace  
 HT Horizontal Tab  
 LF Line Feed

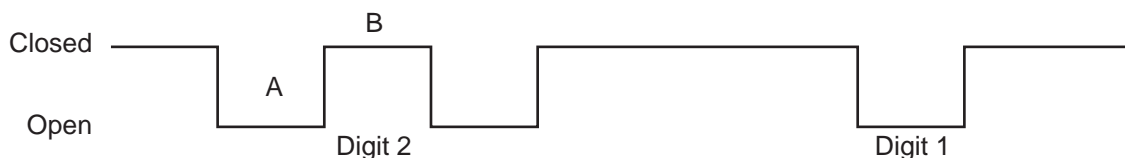
VT Vertical Tab  
 FF Form Feed  
 CR Carriage Return  
 SO Shift Out  
 SI Shift In  
 DLE Data Link Escape  
 DC1 Device Control 1  
 DC2 Device Control 2  
 DC3 Device Control 3  
 DC4 Device Control 4  
 NAK Negative Acknowledge

SYN Sync.  
 ETB End Transmission Block  
 CAN Cancel  
 EM End of Medium  
 SUB Substitute  
 ESC Escape  
 FS File Separator  
 GS Group Separator  
 RS Record Separator  
 US Unit Separator  
 DEL Delete

## Appendix H: Dial Pulses and Tones

### Dial Pulses

When you pulse dial, as when you make a call with a rotary dial telephone, your telephone or modem generates codes in the form of pulses that simulate the opening and closing of old-fashioned electric relays, or switches. The number of pulses in a code is the same as the digit they encode; thus, the digit 1 is represented by one pulse, the digit 2 by two pulses, etc. In the figure below, the digit 2 is pulse dialed, followed by the digit 1. Each pulse consists of an A ms open (break) and a B ms closed (make), where A is either 60 or 67 ms, and B is either 40 or 33 ms, for a total of 100 ms per cycle, or a rate of 10 pulses per second. The interdigital pause time is 800 ms. The pulse ratios are controlled by the **&P** command.



### Tone Dial Frequencies

The tone dialing method combines two frequencies for each of the twelve digits found on a touch-tone dial pad. This method is referred to as dual-tone multifrequency (DTMF) dialing.

The four horizontal rows on a touch-tone keypad use four low-frequency tones (697, 770, 852, 941 Hz), while the three vertical columns use three high-frequency tones (1209, 1336, 1477 Hz). The tone frequency tolerance is  $\pm 0.02\%$ .

For example, the digit 4 is dialed by combining two tone frequencies: 770 Hz from the second row, and 1209 Hz from the first column. In another example, the digit 9 is dialed with tone frequencies 852 Hz and 1477 Hz.

	Hz	Digits		
697		1	2	3
770		4	5	6
852		7	8	9
941		*	0	#
Hz	1209	1336	1477	

The extended DTMF characters (A, B, C, D) are the high-end frequencies (1633 Hz) defined on some telephone sets with a fourth vertical column of buttons. This fourth column provides for extended PBX control functions. The actual functions that are provided depend on the PBX manufacturer's implementation and feature set.

	Hz	Digits		
697	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
770	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
852	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
941	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hz	1209	1336	1477	1633

## Appendix I: AT Command Summary (Modem)

### COMMAND DESCRIPTION

**AT**      **Attention Code**  
The attention code precedes all command lines except A/ and the escape sequence.

**RETURN**      **RETURN Key**  
or **ENTER**      Press the RETURN (ENTER) key to carry out most commands.

**A**      **Force Answer Mode**  
Answer call immediately without waiting for ring.

**A/**      **Repeat Last Command**  
Repeat the last command string. Do *not* precede this command with AT. Do *not* press RETURN (or ENTER) to carry out.

**Bn**      **Answer Tone**  
 $n = 0, 1, 2, 3, 15, \text{ or } 16$   
B0      Select ITU-T V.22 mode when modem is at 1200 bps  
B1      Select Bell 212A when modem is at 1200 bps  
B15     Select V.21 when the modem is at 300 bps  
B16     Select Bell 103J when the modem is at 300 bps

**&Bn**      **Dummy command**

**Cn**      **Dummy command**

**&Cn**      **Carrier Detect Control**  
 $n = 0 \text{ or } 1$   
&C0     Force Carrier Detect on  
&C1     Let Carrier Detect follow carrier signal

**-Cn**      **Data Calling Tone**  
 $n = 0 \text{ or } 1$   
-C0     Disable V.25 data calling tone  
-C1     Enable V.25 data calling tone

**%Cn**      **Data Compression Control**  
 $n = 0 \text{ or } 1$   
%C0     Disable V.42bis / MNP 5 data compression  
%C1     Enable V.42bis / MNP 5 data compression



COMMAND	DESCRIPTION
<b>Ds</b>	<p><b>Data Compression Control</b>  <i>s</i> = phone #            Dial telephone number <i>s</i>, where <i>s</i> may include up to 40 alphanumeric characters, including <b>L</b>. (Can also include the following dial string modifiers, which modem accepts but ignores function: <b>P</b>, <b>T</b>, <b>V</b>, <b>W</b>, comma ( , ), colon ( : ), semicolon ( ; ), <b>!</b>, <b>\$</b>, <b>@</b>, and <b>^</b>.)</p>
<b>&amp;Dn</b>	<p><b>Data Terminal Ready Control</b>  <i>n</i>=0, 1, 2, or 3            &amp;D0 Modem ignores DTR signal            &amp;D1 When DTR drops while in online data mode, the modem enters command mode, issues an OK, and remains connected            &amp;D2 When DTR drops while in online data mode, the modem hangs up            &amp;D3 When DTR drops, modem hangs up and resets as if <b>ATZ</b> command was issued</p>
<b>DSn</b>	<p><b>Dial Store Telephone Number</b>  <i>n</i> = 0, 1, 2, or 3            Dial a number previously stored in directory number <i>n</i> by <b>&amp;Zn=</b> command. For example, <b>ATDS3</b>.</p>
<b>En</b>	<p><b>Echo Command Mode Characters</b>  <i>n</i> = 0 or 1            E0 Do not echo command mode characters            E1 Echo command mode characters</p>
<b>F</b>	<p><b>Dummy command</b></p>
<b>&amp;Fn</b>	<p><b>Load Default Configuration</b>  <i>n</i> = 0            &amp;F0 Load factory default values as active configuration</p>
<b>&amp;Gn</b>	<p><b>Guard Tones</b> (International model only)  <i>n</i> = 0, 1, or 2            &amp;G0 Turn off ITU-T guard tone            &amp;G1 Turn on ITU-T 550 Hz guard tone            &amp;G2 Turn on ITU-T 1800 Hz guard tone            Note: the UK model is locked to &amp;G2, which turns on the ITU-T 1800 Hz guard tone.</p>
<b>Hn</b>	<p><b>Hook Control</b>  <i>n</i> = 0 or 1            H0 Go on-hook (hang up)            H1 Go off-hook</p>
<b>In</b>	<p><b>Information Request</b>  <i>n</i> = 0, 3            I0 Display controller firmware version number            I3 Display controller firmware version number</p>

**COMMAND DESCRIPTION**

- L Redial Last Number**  
Value in dialing command. Must be placed immediately after **ATD**.
- Nn Modulation Handshake**  
 $n = 0$  or  $1$   
N0 Modem performs handshake only at communication standard specified by S37 and the B command.  
N1 Modem begins handshake at communication standard specified by S37 and the B command, but can fallback to a lower speed during handshake.
- \Nn Error Correction Mode Selection.**  
 $n = 0, 1, 2, 3, 4, 5,$  or  $7$   
\N0 Non-error correction mode with data buffering (same as &Q6)  
\N1 Direct mode  
\N2 MNP reliable mode  
\N3 V.42\MNP auto-reliable mode  
\N4 V.42 reliable mode  
\N5 V.42, MNP, or non-error correction. Same as \N3  
\N6 V.42, MNP, or non-error correction. Same as \N3
- On Go Back On Line**  
 $n = 0, 1,$  or  $3$   
O0 Exit online command mode and return to data mode.  
O1 Issue a retrain and return to online data mode.  
O3 Issue a rate renegotiation and return to data mode.
- P Pulse-Dial**  
Modem accepts, but ignores actual function.
- Qn Result Codes Enable/Disable**  
&Q0 Asynchronous with data buffering. Same as \N0.  
&Q5 Error control with data buffering. Same as \N3.  
&Q6 Asynchronous with data buffering. Same as \N0.
- \Qn Local Flow Control Selection**  
 $n = 0, 1,$  or  $2$   
\Q0 Disable flow control. Same as &K0  
\Q1 XON/XOFF software flow control.  
\Q2 RTS/CTS hardware flow control.
- Sr=n Set Register Value**  
 $r = 0-8, 10-11, 28, 35, 37, 42-43,$  or  $89$ ;  $n$  varies  
Set value of S-register  $r$  to value of  $n$ , where  $n$  is entered in decimal format.

<b>COMMAND</b>	<b>DESCRIPTION</b>
<b>Sr?</b>	<b>Read Register Value</b> <i>r</i> = 0–810-11,28, 35, 37, 42-43, or 89 Read value of S-register <i>r</i> and display value in 3-digit decimal form.
<b>&amp;Sn</b>	<b>Data Set Ready Control</b> <i>n</i> = 0 or 1 &S0 Force DSR high (on) &S1 Let DSR follow CD
<b>T</b>	<b>Tone-Dial</b> Modem accepts, but ignores actual function.
<b>\Tn</b>	<b>Inactivity Timer</b> <i>n</i> = 0 \T0 Disable inactivity timer
<b>Vn</b>	<b>Result Codes (Verbose/Terse)</b> <i>n</i> = 0 or 1 V0 Result codes sent as digits (terse response) V1 Result codes sent as words (verbose response) V2 Displays connect message of both the local modem and the remote modem (additional command given anytime after ATV1 is entered)
<b>&amp;V</b>	<b>View Current Configuration</b> Display the active modem settings
<b>\Vn</b>	<b>Protocol Result Code</b> <i>n</i> = 0 or 1 \V0 Do not append protocol result code to DCE speed. \V1 Append protocol result code to DCE speed
<b>W</b>	<b>Wait for New Dial Tone</b> Modem accepts, but ignores actual function.
<b>&amp;Wn</b>	<b>Store Configuration</b> <i>n</i> = 0 &W0 Store current settings in NVRAM; modem will load these at power-on or with the ATZ command instead of reading factory ROM defaults.

**COMMAND DESCRIPTION****Xn Result Codes and Call Progress Selection***n* = 0–7

- X0 Basic result codes (CONNECT only); does not look for dial tone or busy
- X1 Extended result codes (with CONNECT 1200, CONNECT 2400, etc.); does not look for dial tone or busy signal.
- X2 Extended result codes with NO DIAL TONE; does not look for busy signal
- X3 Extended result codes with BUSY; does not look for dial tone
- X4 Extended result codes with NO DIAL TONE and BUSY
- X5 Extended result codes with NO DIAL TONE and BUSY
- X6 Extended result codes with NO DIAL TONE and BUSY
- X7 Basic result codes with NO DIAL TONE and BUSY

**\Xn XON/XOFF Pass-Through***n* = 0, 1

- \X0 Respond to and discard XON/XOFF characters
- \X1 Respond to and pass on XON/XOFF characters

**Yn Long Space Disconnect***n* = 0, 1

- Y0 Disable sending or responding to long space break signal on disconnect
- Y1 Enable long space break signal on disconnect

**&Yn Select Stored Configuration for Hard Reset***n* = 0

- &Y0 Select stored configuration 0 at power-up (included for backward compatibility with some software)

**Z Modem Reset**

Resets modem to default values. Defaults from NVRAM if &W0 is set; from ROM if &W1 is set.

**&Zn=x Store Telephone Number***n* = 0-3, *x* = dialing string

Stores telephone dial string *x* in memory location *n*. Dial the stored number using the command ATDS=*n*.

**, Dialing Pause**

Modem accepts, but ignores actual function.

**; Return to Command Mode After Dialing**

Modem accepts, but ignores actual function.

---

**COMMAND DESCRIPTION**

**!**      **Flash On-Hook**  
Modem accepts, but ignores actual function.

**\$**      **Detect Call Card**  
Modem accepts, but ignores actual function.

**@**      **Quiet Answer**  
Modem accepts, but ignores actual function.

**^**      **Disable Data Calling Tone Transmission**  
Modem accepts, but ignores actual function.

**+++AT<cr>      Escape Sequence**

Puts modem in command mode while still remaining on line. Type +++ followed by the letters A and T, up to ten command characters and a RETURN.

## Appendix J: S-Register Summary (Modem)

REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
<b>S0</b>	1 ring	0, 1–255	0	Sets the number of rings before the modem answers. ATSO=0 disables auto answer completely.
<b>S1</b>	1 ring	0–255	0	Counts the rings that have occurred.
<b>S2</b>	decimal	0–255	43 (+)	Sets ASCII code for the escape code character. Values greater than 1227 disable the escape sequence.
<b>S3</b>	decimal	0–127	13 (^M)	Sets ASCII code for the RETURN character.
<b>S4</b>	decimal	0–127	10 (^J)	Sets ASCII code for the LINE FEED character.
<b>S5</b>	decimal	0–127	8 (^H)	Sets ASCII code for the BACKSPACE character. Values greater than 32 disable the backspace character.
<b>S6</b>	1 sec	2–65 4–255 4–7	2 4	Sets time the modem waits for dial tone before canceling call.
<b>S7</b>	1 sec	1–255 1–45 1–55	50 45 55	Sets time the modem waits for carrier signal before aborting call. Also sets the wait for silence time for the @ dial modifier.
<b>S8</b>	1 sec	0–65 4–255 4–7 4	2 4 4	Sets length of pause caused by comma character in dialing command.
<b>S10</b>	100 ms	1–254	20	Sets how long carrier signal must be lost before modem disconnects.
<b>S11</b>	1 ms	50–150 80–255 80–255	95 80	Sets spacing and duration of dialing tones. Minimum: 50 ms
<b>S28</b>	decimal	0, 1–255	1	0 disables, 1–255 enables V.34 modulation.
<b>S35</b>	decimal	0–1	0	0 disables, 1 enables the V.25 data calling tone, which allows data/fax/voice discrimination.
<b>S37</b>	decimal	01–19	0	Sets the maximum dial line rate. 0 = maximum speed 1 = reserved 2 = 1200/75 bps 3 = 300 bps 4 = reserved 5 = 1200 bps 6 = 2400 bps 7 = 4800 bps 8 = 7200 bps 9 = 9600 bps 10 = 12000 bps 11 = 14400 bps 12 = 168000 bps 13 = 19200 bps 14 = 21600 bps 15 = 24000 bps 16 = 26400 bps 17 = 28800 bps 18 = 31000 bps 19 = 33600 bps

---

<b>S42</b>	decimal	0-1	10	Enables/disables 56K auto rate. Retrain and fallback are disabled in data mode. 0 = disable; 1 = enable.
<b>S43</b>	decimal	0-1	1	<i>For testing and debugging only.</i> Enables / disables V.32bis start-up auto mode operation. 0 = disable, 1 = enable.
<b>S89</b>	1 sec	0, 5-255	0	Sets the length of time in the off-line command mode before the modem goes into standby mode. A value of zero prevents standby mode; a value of 1-4 sets the value to 5.
<b>S108</b>	decimal	0, 1	1	Controls the line coding used by the modems S108 = 0           mu-law S109 = 1           A-law (default)
<b>S109</b>	decimal	0-2	1	Controls the PCM mode (V.90 or K56Flex). Determines which mode the modem will answer in for PCM connections. S109 = 0           K56Flex support only S109 = 1           Both V.90 and K56Flex supported S109 = 2           V.90 support only

## Appendix K: Result Code Summary (Modem)

Terse	Verbose	Definition
0	OK	Command executed without error; ready for next command.
1	CONNECT	Modem has detected carrier and gone online.
2	RING	Modem has detected ring caused by incoming call.
3	NO CARRIER	No carrier signal has been detected within the allowed time.
4	ERROR	Error in command line (too many, or invalid characters).
5	CONNECT 1200	Modem detected carrier at 1200 bps and gone online.
6	NO DIALTONE	No dial tone detected.
7	BUSY	Busy signal detected.
8	NO ANSWER	The remote system did not answer.
10	CONNECT 2400	Modem detected carrier at 2400 bps and gone online.
11	CONNECT 4800	Modem detected carrier at 4800 bps and gone online.
12	CONNECT 9600	Modem detected carrier at 9600 bps and gone online.
13	CONNECT 14400	Modem detected carrier at 14400 bps and gone online.
14	CONNECT 19200	Modem detected carrier at 19200 bps and gone online.
24	CONNECT 7200	Modem detected carrier at 7200 bps and gone online.
25	CONNECT 12000	Modem detected carrier at 12000 bps and gone online.
86	CONNECT 16800	Modem detected carrier at 16800 bps and gone online.
40	CONNECT 300	Modem detected carrier at 300 bps and gone online.
55	CONNECT 21600	Modem detected carrier at 21600 bps and gone online.
56	CONNECT 24000	Modem detected carrier at 24000 bps and gone online.
57	CONNECT 26400	Modem detected carrier at 26400 bps and gone online.
58	CONNECT 28800	Modem detected carrier at 28800 bps and gone online.
59	CONNECT 31200	Modem detected carrier at 31200 bps and gone online.
60	CONNECT 33600	Modem detected carrier at 33600 bps and gone online.
	CONNECT 45000	Modem detected carrier at 45000 bps and gone online.
	CONNECT 56000	Modem detected carrier at 56000 bps and gone online.
88	DELAYED	Delay is in effect for the dialed number.
89	BLACKLISTED	The dialed number is blacklisted.
90	BLACKLIST FULL	The blacklist is full.



**Extended Result Codes.** If the extended result codes configuration option is enabled, **EC** is added to the following result codes:

5	CONNECT 1200
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 14400
14	CONNECT 19200
24	CONNECT 7200
25	CONNECT 12000
86	CONNECT 16800
40	CONNECT 300
55	CONNECT 21600
56	CONNECT 24000
57	CONNECT 26400
58	CONNECT 28800
59	CONNECT 31200
60	CONNECT 33600
	CONNECT 45000
	CONNECT 56000

**EC** is replaced by one of the following codes, depending on the type of error control connection:

<b>Code</b>	<b>Error Correction</b>
V42bis	LAP-M V.42 error control and V.42bis data compression
V42	LAP-M V.42 error control only
MNP5	MNP4 error control and MNP 5 data compression
MNP4	MNP 4 error control only
NoEC	No error control protocol

## Appendix L: AT Command Summary (TA)

### How To Use AT Commands

Usually, your data communication software controls the ISIH-2S/2U terminal adapters for you. However, you may also want to use AT commands, which give you complete control over the TAs. Be careful using these commands because

lose its ability to control the TA. If you find that an AT command causes a problem, turn the computer off and then back on to reset AT commands to the factory default settings. You also can type **AT&F** to return to the factory default setting.

To use an AT command, you must first:

1. Run your communication software.
2. Configure the software for the appropriate COM port and IRQ settings, if necessary.
3. Enter Terminal mode (aka Command mode, Local mode, or Direct mode). This is the mode in which most datacommunication software packages start up. Type the AT command and press ENTER. For example, type **ATH0** and press ENTER to hang up the TA connection or **AT&V** and press ENTER to display current configuration.

Most AT commands can be entered in strings (on the same command line) without spaces between the individual commands. For example: **AT&VH0** <ENTER>.

The TA usually returns a response (or Result Code) at the next line if it understands the command. The response usually is OK or ERROR unless the AT command provides other (extended) messages.

#### COMMAND DESCRIPTION

##### **AT Attention Code**

The attention code precedes all command lines except **A/** and the escape sequence.

##### **RETURN Return key**

Press the RETURN (ENTER) key to execute most commands (sometimes abbreviated <cr>).

##### **+++AT<cr> In-Band Escape Code**

TA enters command mode (without disconnecting the call) when online with a remote device.

##### **<break>AT<cr> Out-of-Band Escape Code**

TA enters command mode while remaining online.

##### **A Answer Call**

Forces the TA to answer an incoming call. To cause the TA to autoanswer, set register *S0* to a value higher than 0.

COMMAND	DESCRIPTION
<b>D</b>	<b>Dial</b> Causes TA to dial a telephone number (e.g., ATD785-3500 <cr>).
<b>DSn</b>	<b>Dialing a Stored Telephone Number</b> <i>n</i> = 0–9 To dial a stored telephone number, type <i>ATDSn</i> in terminal mode, where <i>n</i> is the location of the number you want to dial. For example, typing <b>ATDS6 &lt;cr&gt;</b> dials a telephone stored in memory register 6 location.
<b>En</b>	<b>Command Mode Echo</b> <i>n</i> = 0 or 1 E0 Echo off E1 Echo on
<b>Hn</b>	<b>Hang Up</b> <i>n</i> = 0 or 1 Default: <i>H0</i> Forces TA to go off-hook (to take control of the telephone line) or to go on-hook (hang up). Since the TA goes off-hook automatically when it dials, <i>H</i> command normally is used only to hang up. To hang up, first you must escape to command mode (+++AT <cr>), then type ATH (or ATH0) <cr>. You also can include the hang up command in the escape sequence: +++ATH <cr>. <i>H0</i> Go on-hook (hang up). <i>H1</i> Go off-hook.
<b>In</b>	<b>Display Product Information</b> <i>n</i> = 0, 1, and 2 Default: none Displays the following TA product information: <i>I0</i> Product ID (e.g., 247) <i>I1</i> Firmware version number (e.g., 1.00) <i>I2</i> Model number
<b>L5 &amp; L6</b>	<b>List Active Profile</b> <i>n</i> = 5 or 6
<b>L8</b>	<b>Lists Low Level ISDN Status</b>
<b>O</b>	<b>Return Online</b> Returns TA to online mode from the online command mode. When the TA makes a data connection, it enters online data mode. The TA typically remains in this mode until it receives an escape sequence or until the call is ended. When it detects an escape sequence, the TA enters online command mode, in which it can accept AT commands while retaining the online connection. To return the TA to online mode from the online command mode, enter the command <i>ATO</i> and press ENTER.

**COMMAND DESCRIPTION****Qn Enable/Disable Result Codes***n* = 0, 1

Q0 Enable result codes

Q1 Disable result codes for applications such as computer-controlled auto dialing

**Vn Terse/Verbose Result Codes****Xn Connect Messages****Z Reset to Stored Profiles****%A97=*n* Dialing Method***n* = 0 or 1

%A97=0 En bloc sending

%A97=1 Overlap sending

**%En Escape Sequence Options***n* = 0–5

Default: %E1 and %E4

By default, the modem responds only to the +++ escape method. However, you can use the %E command to set the modem to respond only to the <break> method, to respond to either +++ or the <break> method, or to ignore both methods and not escape.

%E0 Modem won't escape

%E1 +++ escape method

%E2 &lt;BREAK&gt; escape method

%E3 Both +++ and &lt;BREAK&gt; escape methods

%E4 Disable OK response to +++

%E5 Enable OK response to +++

%E1 %E5 Enable +++ method and OK response to +++

%E3 %E5 Enable +++ or &lt;BREAK&gt; method and OK response to +++

**!C0=*n* Network Switch Type***n* = 0, 1, 2, or 5

!C0=0 AT&amp;T 5ESS

!C0=1 Northern Telecom DMS-100, International default

!C0=2 NET3 (Euro ISDN)

!C0=5 U.S. National ISDN-1 (NI-1), US factory default

**!C6=*n* Data SPID***n* = 0 to 20-character string**!D3=*n* SAPI-O Data TEI***n* = 0 to 63, 240 (auto), 241 (disable)

!D3=0–63 Sets TEI to a fixed value from 0 through 63

!D3=240 Sets data channel for dynamic TEI negotiation (factory default)

!D3=241 Disables TEI

**COMMAND DESCRIPTION**

- !L Display Network Configuration**  
Displays the status of the SPID configuration. If the configured SPID is approved by the central office, displays a SPID CORRECT status. If the configured SPID is not approved by the central office, displays a SPID INVALID status.
- !N1=*n* Directory Number 0**  
*n* = 24-character string  
!N1=*n* Sets DN for channel 0
- !Z=*n* Rate Adaption Protocol**  
!Z=5 V.120 protocol  
!Z=9 PPP protocol
- \*!C6=*n* Voice SPID**  
*n* = 0 to 20 character string
- \*!D3=*n* SAPI-O Voice TEI**  
*n* = 0 to 63, 240 (auto), 241 (disable)  
!D3=0–63 Sets TEI to a fixed value from 0 through 63  
!D3=240 Sets data channel for dynamic TEI negotiation (factory default)  
!D3=241 Disables TEI
- \*!N1=*n* Directory Number 1**  
*n* = 24-character string  
\*!N1=*n* Sets DN for channel 1
- \$D*n* Persistent DTR Dialing**  
*n* = 0, or 1  
Default: \$D0 (Disabled)  
Enables or disables persistent DTR dialing (PDD). PDD causes the terminal adapter to automatically and continually redial stored telephone number 0 when the port has no active calls and DTR is high.
- >D*n* Embedded Protocol Analyzer**  
*n* = 0, 1, 2, 3, 98, or 99  
>D0 Display B-channel traffic, decoded as V.120  
>D1 Display D-channel traffic, decoding layers 2 and 3 (Q.921 and Q.931)  
>D2 Display D-channel traffic, decoding layer 2 only (Q.921)  
>D3 Display D-channel traffic, decoding layer 3 only (Q.931)  
>D5 Display async PPP data  
>D6 Display sync PPP data  
>D98 Disable Embedded Protocol Analyzer, buffered data unchanged  
>D99 Enable Embedded Protocol Analyzer, clearing buffered data

COMMAND	DESCRIPTION
<b>#Xn</b>	<b>Send Single/Multiple Xoff Characters</b>
<b>&amp;Cn</b>	<b>DCD Control</b>
<b>&amp;Dn</b>	<b>DTR Control</b>
<b>&amp;En</b>	<b>Flow Control</b>
<b>&amp;Fn</b>	<b>Factory Profiles</b>
<b>&amp;R</b>	<b>CTS Control</b>
<b>&amp;Sn</b>	<b>DSR Control</b> <i>n</i> = 0, 1, or 2 <b>&amp;S0</b> DSR is always high. <b>&amp;S1</b> DSR acts normally (follows state of CD signal—goes high when the ISIH-2S/2U detects a carrier signal and goes low when carrier signal is lost) <b>&amp;S2</b> DSR always high except on disconnect when it drops for period of time set by S10; then goes high again
<b>&amp;Vn</b>	<b>View Port Parameters</b> <i>n</i> =0 Display port 0 parameters <i>n</i> =1 Display port 1 parameters <i>n</i> =2 Display port 2 parameters
<b>&amp;Wn</b>	<b>Store Active Profile</b> <i>n</i> = 0 or 1 <b>&amp;W0</b> Stores all current AT command and S-register values in nonvolatile random access memory (NVRAM) and configures TA to read custom settings in NVRAM when the modem is turned on or when it is reset with <b>Z</b> command. (The <b>&amp;F</b> reset command continues to read factory default settings in ROM.) <b>&amp;W1</b> Erases your custom settings in NVRAM the next time the TA is turned off or reset, causing the TA to read the factory default settings in ROM whenever it is turned on or reset.
<b>&amp;Zn=x</b>	<b>Store Telephone Number</b> <i>n</i> = 0–9; <i>x</i> = dial string Allows you to store a telephone number in a memory register for faster dialing. To store a number, type <b>&amp;Z</b> , the register number (0–9) where you want to store the number, the = character, and the dialing string you want stored. Then press ENTER. The dialing string can have up to 25 characters. To read a stored number, type <b>AT&amp;Zn?</b> (e.g., <b>AT&amp;Z4?</b> ) where <i>n</i> is the number of the register you want to read. To display a list of all numbers stored in memory, type <b>ATL</b> and press RETURN: 0      14082345678 1      16125551212

COMMAND	DESCRIPTION
2	14089876543
3	
4	6313551
5	
6	4258513
7	
8	16126313550
9	12138880123

### **@CONFIG Start ConfigMenu**

Starts TA's internal configuration utility, which you can then use to customize the TA's configuration for your particular application. You must enter the command while in your communication program's terminal mode.

### **@P3=*n* Parity at Power Up**

*n* = 0–4

Default: @P3=4 (none)

Use only to set the type of parity the TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to parity the computer is using.

@P3=0	Odd
@P3=1	Even
@P3=2	Mark
@P3=3	Space
@P3=4	None

### **@P4=*n* Data Bits**

*n* = 7 or 8

Default: @P4=8 (8 data bits)

Use only to set the number of data bits TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to number of data bits the computer is using.

@P4=7	7 data bits
@P4=8	8 data bits

### **@P6=*n* Stop Bits**

*n* = 1 or 2

Default: @P6=1 (1 stop bit)

Use only to set the number of stop bits the TA uses when turned on. Once the TA receives an AT command from the computer, it automatically adjusts to the number of stop bits the computer is using.

@P6=1	1 stop bit
@P6=2	2 stop bits

## Appendix M: S-Register Summary (TA)

S-REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
<b>S0</b>	1 ring	0–255	1	Sets number of rings before TA answers.
<b>S1</b>	1 ring	0–255	0	Counts the rings that have occurred.
<b>S2</b>	decimal	0–127	43 (+)	Sets ASCII code for the escape code character. Values greater than 1227 disable the escape sequence.
<b>S3</b>	decimal	0–127	13 (^M)	Sets ASCII code for the RETURN character.
<b>S4</b>	decimal	0–127	10 (^J)	Sets ASCII code for the LINE FEED character.
<b>S5</b>	decimal	0–32, 127	8 (^H)	Sets ASCII code for the BACKSPACE character. Values greater than 32 disable the backspace character.
<b>S7</b>	1 sec	0–255	45	Sets the time the modem waits for a carrier signal before aborting a call. Also sets the wait for silence time for the @ dial modifier.
<b>S10</b>	50 ms	0–254,255	20	Sets how long a carrier signal must be lost before modem disconnects
<b>S25</b>	100 ms	0, 1-255	5	Sets time that DTR must remain low before TA disconnects.
<b>S32</b>	100 ms	055	20	Sets the time allowed in an escape sequence from the receipt of the A in AT to the receipt of the carriage return.
<b>S50</b>	decimal	0 or 1	1	Sets whether the mechanism for identifying the two endpoints of a connection is enabled or disabled.
<b>S52</b>	decimal	0 or 1	1	Sets whether the mechanism for identifying V.120 or PPP operation is enabled or disabled.



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## Appendix N: Result Codes (TA)

<b>Terse</b>	<b>Verbose</b>
0	OK
1	CONNECT
1P	CONNECT/PPP
1PC	CONNECT/PPP COMPRESSED
1V	CONNECT/V.120
1VC	CONNECT/V.120 COMPRESSED
2	RING
3	NO CARRIER
4	ERROR
6	NO DIALTONE
7	BUSY
56	CONNECT 56000
56P	CONNECT 56000/PPP
56PC	CONNECT 56000/PPP COMPRESSED
56V	CONNECT 56000/V.120
56VC	CONNECT 56000/V.120 COMPRESSED
64	CONNECT 64000
64P	CONNECT 64000/PPP
64PC	CONNECT 64000/PPP COMPRESSED
64V	CONNECT 64000/V.120
64VC	CONNECT 64000/V.120 COMPRESSED
65	CONNECT MODEM

## Appendix O: Regulatory Agency Information

### FCC Part 68 Telecom

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. An 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 that is Part 68 compliant. See installation instructions for details.
4. 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. If advance notice is not practical, the telephone company will notify the customer as soon as possible.
5. The telephone company may make changes in its facilities, equipment, operation, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice to allow you to make necessary modifications to maintain uninterrupted service.
6. If trouble is experienced with this equipment (the model of which is indicated below), please contact Multi-Tech 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.
7. No repairs are to be made by you. Repairs are to be made only by Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty.
8. Manufacturer: Multi-Tech Systems, Inc.  
Trade name: MultiModemISI Hybrid  
Model number: ISIH-2U  
FCC registration number: AU7USA-25932-DD-E  
Facility interface code: 02IS5  
Modular jack (USOC): RJ-49C (8-pin with middle pins for T-R)  
Service center in USA: Multi-Tech Systems, Inc.  
2205 Woodale Drive  
Mounds View, MN 55112  
(612) 785-3500 Fax (612) 785-9874

## Federal Communications Commission Statement

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

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

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesired operation.

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**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.*

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## Industry Canada

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

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

## FCC Fax Warning

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 or 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, users must refer to their 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 on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 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.

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

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### EMC, Safety, and Terminal 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 98/13/EC of 12 March 1998 on the approximation of the laws of Member States concerning telecommunications terminal and Satellite earth station equipment.



# Glossary

## A

**AC** (alternating current)—A power source whose signal crosses a reference voltage (usually called ground or zero). Alternating between a maximum and minimum voltage, AC may be referred to as a bipolar signal. Contrast with DC.

**ACK** (ACKnowledgment code, pronounced *ack*)—A communications code sent from a receiving modem to a transmitting modem to indicate that it is ready to accept data. It is also used to acknowledge the error-free receipt of transmitted data. Contrast with NAK.

**ACS** (asynchronous communications server)—A communications server that manages a pool of modems for shared use over the LAN. It directs outgoing messages to the next available modem and directs incoming messages to the appropriate workstation. It also provides conversion between LAN packets and asynchronous format.

**address**—A numbered location inside a computer. It's how the computer addresses its resources, like a video card, serial ports, memory, etc.

**algorithm**—A set of ordered steps for solving a problem. This can be a mathematical formula or the instruction in a computer program.

**alphanumeric**—The basic character set which includes the letters A to Z (and a to z) and the digits 0 to 9.

**amplitude**—The difference between the maximum and minimum voltages of a waveform expressed as a *peak-to-peak* voltage.

**amplifier**—An active device within a circuit which increases the voltage level of all signals (desirable and undesirable).

**analog loopback**—A modem diagnostic used to test either the local analog loop (the modem's internal circuitry) or the remote analog loop (the telephone line). The local analog loop test is accomplished by activating the self-test mode and tying the modem's modulator to its demodulator and examining the return stream of data at the PC or terminal it services. The remote analog loopback can only be activated on four-wire leased line connections with a remote modem capable of performing the same test.

**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 implies continuous movement from point A to point B, as opposed to discrete jumps. For example, sound is continuously varying air vibrations and is converted into analogous electric signals to be carried on a telephone line.

**analog transmissions**—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.

**ANSI** (American National Standards Institute, pronounced *ansy*)—A U.S. standards organization supported by over 1000 companies and trade organizations. It is a nonprofit, nongovernment group that is the U.S. member of the ISO (International Standards Organization).

**ANSI character set**—An 8-bit character set that contains 256 characters. The first 128 characters are alphanumeric. The second 128 contain math and foreign language symbols.

**API** (application programming interface)—The language and message format used by a program to activate and interact with functions in another program or in the hardware. A software module which provides a uniform interface for otherwise incompatible 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.

**associate**—Establishing that all files with a given extension are usable by a certain application.

**asynchronous transmission**—The transmission of data in which each character is a self-contained unit with its own start and stop bits. This is a common method of transmission between a computer and a modem. One character at a time, encoded into a series of electrical pulses, is transmitted or received. This is the oldest method of data transfer. When it is used with error correcting software and data compression algorithms, along with the increase in maximum attainable speeds, it continues to be a viable alternative to synchronous transmission.

**ATM** (asynchronous transfer mode)—A high speed switching technique suitable for MAN's (metropolitan area network) and broadband ISDN transmission.

**auto answer**—A modem feature that enables the modem to go *off-hook* when it detects an incoming call.

**auto dial**—Some modems provide this feature for asynchronous dialing. This feature is a predefined macro that allows the user to enter the location of a phone number (i.e. N0 through N9) and have the modem go off-hook, dial and establish the connection. With the auto dial feature, an asynchronous terminal can establish a dialing directory without running a communication software package.

**AUTOEXEC.BAT** (AUTOMATIC EXECUTE BATch)—A DOS batch file that executes when the computer is started. This file contains the basic start-up commands that help configure the system.

**automatic dialer**—A device that is programmed to place a call to a predetermined number any time it is taken *off-hook*.

## B

**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. In Windows™, the area behind the active window. Compare with foreground.

**backup**—Additional resources or duplicate copies of data on different storage media for emergency purposes.

- band**—Range of frequencies between two defined endpoints.
- bandwidth**—The transmission capacity of a computer channel, communications line or bus. It is expressed in cycles per second (hertz), the bandwidth being the difference between the lowest and highest frequencies transmitted. The bandwidth of a phone line is about 3000 Hz with QAM, you get up to 14,400 bps. Bandwidth is often stated in bits or bytes per second.
- baseband signal**—An unmodulated signal which is transmitted at its original frequency and may be digital or analog.
- baud**—Rate, the signaling rate of a line, the switching speed, or the number of transitions (voltage or frequency changes) that are made per second. Transmission speeds are often expressed in baud, though bits per second is more accurate. The speed at which your computer talks to your modem.
- BCC (block check character)**—An error control method used in character-oriented or byte-synchronous protocols. Two 8-bit BCCs are used to create the CRC (cyclic redundancy check) field of a synchronous data packet.
- Bell 103**—The U.S. modulation standard for 300 bps full-duplex transmission over dial-up lines.
- Bell 201**—The U.S. modulation standard for 2400 bps half-duplex transmission over dial-up lines or full-duplex transmission over 4-wire lines. Primarily used in synchronous modems.
- Bell 202**—The U.S. modulation standard for 0-1200 bps, half-duplex transmission over 2-wire, or full-duplex transmission over 4-wire leased lines.
- Bell 208**—The U.S. modulation standard for 4800 bps, half-duplex transmission over dial-up lines, or full-duplex transmission over 4-wire lines. Primarily used in synchronous modems.
- Bell 212A**—The U.S. modulation standard for 1200 bps full-duplex transmission over dial-up lines.
- binary**—A numbering system based on two digits, 1 and 0, which is conducive to the two-state digital electronics used within computers. All input to a computer is encoded as a binary value. Binary also refers to a file format that uses 8-bit characters, to allow for control characters (i.e., all non-ASCII files).
- BSC (binary synchronous communications)**—Also called *bisync*, this communications protocol was the first synchronous data format used by IBM. It is still in use, but is rapidly being replaced by IBM's newer synchronous data link control (SDLC). Bisync is a byte-synchronous protocol that has longer delays and more overhead than the bit-synchronous SDLC. It uses two synchronization characters to head every packet.
- 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 represents some portion of usable information.
- bit-synchronous transmission**—A synchronous form of data transmission that focuses on a maximum packet size rather than the length of the characters the packet contains. SDLC is a bit-synchronous protocol.
- boot**—Starting or restarting your PC. This term originates from the saying *to pull oneself up by the bootstraps*.
- 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.
- break-out box**—An electronic device which is inserted between two RS232/V.24 connectors for the monitoring of pin activity and for the rerouting of lines (crossover).
- broadcast**—To send information simultaneously to a group of recipients.
- buffer**—A temporary storage register or random access memory (RAM) used in all aspects of data communications that 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. A buffer allows one device to dump data at a high speed and for the lower-speed device to accept it at its own pace. In this way, the high-speed device can continue to work without having to wait for its data transfer to end. Buffers are a way of preventing potential data loss.
- bus**—A common channel between hardware devices either internally between components in a computer, or externally, between stations in a communications network.
- 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 (PCs) can handle. A byte holds the equivalent of a single character, such as the letter *A*.

## C

- CAD (computer aided design, pronounced *kad*)**—A computerized system used to design products. CAD systems are high speed workstations or PCs that use CAD software and input devices, such as graphic tables and scanners.
- callback security**—A security feature available in some intelligent modems that stores phone numbers. When activated, the user calling the secured modem must furnish a recognized password and then provide a code that corresponds to one of the stored phone numbers. When these security measures are met, the secured modem hangs up on the caller and dials the appropriate number to establish a data communications link.
- capacitor**—An electronic device that stores an electrical charge. It comes in varying sizes for use in anything from power supplies to the tiny cells in dynamic RAM chips. When the device is powered down, it's capacitors lose their charge.
- 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.
- character set**—One of a number of coding schemes which uses binary digits to represent characters, numbers, punctuation, and/or control characters. Common character sets are ASCII, ANSI, and EBCDIC.

**checksum**—A control field found in synchronous data packets which contain the results of the error control algorithm used.

**chip**—Also called integrated circuits (IC), they are squares or rectangles that contain from a few dozen to a few million electronic components.

**CHKDSK** (pronounced *check disk*)—External DOS command that reports free memory and disk space. CHKDSK must be run directly from DOS or within a batch file.

**circuit**—Any closed path through which electrical current can flow.

**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.

**clipboard**—An electronic holding place for the most recent cut or copy made from a document. Whatever is on the clipboard can be pasted into the current document. Only one item may be on the clipboard at a time. When new copy is sent to the clipboard the existing copy is eliminated. When you shut down your computer, whatever is on the clipboard is lost.

**clock**—A timing signal generated by an oscillating circuit that is used to synchronize data transmissions.

**command**—An instruction that tells a computer to begin, continue, or end a specific operation.

**command mode**—One of two states of an intelligent (programmable) device. The mode in which commands can be issued to alter operating parameters.

**communications server**—Also known as the Async Gateway, it is a PC equipped with the appropriate hardware and software package so it can function as a gateway between a LAN and its modems or host connections.

**COMx port**—A serial communications port on a PC.

**CONFIG.SYS file** (pronounced *config dot sis*)—A text file that contains configuration commands used when you start your computer. Commands in the CONFIG.SYS file enable or disable system features, set limits or resources, and extend the operating system's purpose by loading device drivers.

**cooked data**—A term used in UNIX communications to identify the UNIX command-line data transmitted. This type of data is noted for a reduction in effective throughput because it has to be processed, or "cooked" prior to transmission. Compare with raw data.

**CPU** (central processing unit)—The computing part of the computer. It is made up of the control unit and the ALU (arithmetic logic unit). The CPU, clock and main memory make up a computer. When you turn on your computer, an electrical signal follows a permanently programmed path to the CPU to clear the leftover data from the chips' internal memory registers.

**CRC** (cyclic redundancy check)—A field used in packetized data that contains two 8-bit BCCs (block check characters) as the binary result of an algorithm performed on the data bits in the packet. A CRC is used for error detection by many synchronous protocols.

**CTS** (clear to send)—With communications between modems, an RS-232 signal sent from the modem to the DTE that indicates it is ready to accept data. Contrast with RTS.

## D

**DAA** (data access arrangement)—The circuitry to isolate any device from phone lines and their associated equipment.

**daisy chain**—A method of connecting multiple devices in a series, one after another.

**data compression**—The process of reducing the data bits necessary to represent useful information. By compressing files, less storage is required and higher throughputs are realized.

**data pump**—The DAC (digital-to-analog conversion) circuitry used within a modem.

**DB-25**—A very common 25-pin connector often referred to as an RS-232 connector because it is the connector over which the RS-232 interface commonly occurs.

**DB** (direct current)—Usually understood to mean a constant voltage supply that fluctuates only a nominal amount. An analog or digital signal that may vary in voltage level, but it never crosses the reference voltage (usually called ground). Contrast with AC.

**de facto standards**—A de facto standard is one of two types of voluntary standards recognized by a given market. It is introduced by a single vendor and becomes a standard by its widespread use and acceptance by other vendors. AT&T's Bell 212A, IBM's Binary Synchronous Protocol, or DEC's VT-100 terminal protocol are examples of de facto standards. Compare with de jure standards.

**de jure standards**—A de jure standard is one of two types of voluntary standards. It represents the collective consensus of the industry and users for a particular aspect of manufacturing. CCITT's V and X standards (V.32 and Xx.25) are examples of de jure standards. Compare with de facto standards.

**decibel** (dB)—A unit of measurement for signal strength based on logarithmic increments. A decibel is a relative measurement that is derived from an initial reference level and a final observed level.

**default**—A preset value or option in software packages or in hardware configuration that is used unless you specify otherwise.

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

**digital signal**—Digital devices, such as terminals and computers, transmit data as a series of electrical pulses that have discrete jumps rather than gradual changes.

**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.

**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).

**directory**—A logical subdivision of a computer's disk space used to organize a group of files. A directory can be thought of as a file drawer.

**DOS** (disk operating system, pronounced *daws*)—The software that allows all the hardware in a PC to interact. The basis for (DOS prompt) higher level applications.

**DOS prompt**—The > symbol displayed after the disk drive letter.

**DPSK** (differential phase shift keying)—A common form of phase modulation used in modems. It does not require complex demodulation circuitry and is not susceptible to random phase changes in the transmitted waveform, thus reducing errors during transmission.

**driver**—A software module that interfaces between the operating system and a specific hardware device, such as a color monitor, printer or hard disk. Also known as a device driver.

**DSR** (data set ready)—An RS-232 signal sent from the modem to the computer or terminal indicating that it is able to accept data. Contrast with DTR.

(data terminating equipment)—A term used to include any device in a network that generates, stores, or displays user information. DTE is a telecommunications term that usually refers to PCs, terminals, printers, etc.

**DTMF** (dual-tone multifrequency)—A generic push-button concept made popular by AT&T TouchTone.

**DTR** (data terminal ready)—An RS-232 signal sent from the computer or terminal to the modem indicating that it is able to accept data.

## E

**EBCDIC** (Extended Binary Coded Decimal Interchange Code, pronounced *eb suh dick*)—An IBM character code used in its mainframe and midrange computers. It is an 8-bit code (256 combinations) that stores one alphanumeric character or two decimal digits within a byte. EBCDIC and ASCII codes are the most common codes used to represent data.

**echo**—The reflection or duplication of a signal back toward its source. Echoing is useful when a terminal is transmitting data, in that the data can be echoed to the screen so the user can monitor what is being sent. Echoing is undesirable when it refers to the signal which results on a telephone line from impedance mismatches.

**echo cancellation**—a high speed modem technique that isolates and filters out unwanted signals caused by echoes from the main transmitted signal. This allows full-duplex modems to send and receive on the same frequency carrier.

**EIA** (Electronics Industries Association)—A membership organization founded in 1924 that includes manufacturers of electronic parts and systems. With over 1200 members, it

sponsors shows and seminars, gives awards for outstanding contributions in electronics, and sets electronic interface standards, such as RS-232.

**EISA** (Enhanced Industry Standard Architecture, pronounced *eesa*)—The purpose of the EISA bus was to provide a 32-bit bus for faster throughputs while maintaining backward compatibility with the classic ISA bus architecture.

**emulation**—The process of one type of device imitating another via a hardware or software package. Terminal emulation, for example, allows a PC to access a mainframe computer by generating and accepting data like a *dumb* terminal.

**environment**—A computer configuration that includes the CPU model and system software (operating system, data communications and database systems). It may also include the programming language used. It sets the standards for the applications that run in it.

**EPROM** (erasable programmable read only memory, pronounced *eeprom*)—A reusable PROM chip that holds its contents until erased under ultraviolet light.

**error correction**—The process of detecting distorted data bits and requesting a retransmission or interpretation to correct the error. Errors are introduced by bad line conditions or external interface.

## F

**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.

**fax card**—An expansion card that, with the appropriate software, allows a PC to operate as a fax transmitter/receiver. PC fax cards may be able to send and receive faxes from a file on the PC. If an external scanner is available, the PC can also transmit the scanned image via the fax card.

**fax/data modem**—A multifunctional device capable of transmitting either data or faxes. It is available as an external unit or expansion board. It includes a fax switch that routes the call to the fax or the data modem.

**fax server**—A network resource that allows workstation PCs to transmit faxes as though the PC had an internal fax card or a fax modem attached.

**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.

**flash memory**—A memory chip that holds its content without power, but must be erased in bulk. The term comes from its ability to be erased *in a flash*. Flash memory is derived from EEPROM, but is less expensive and provides higher bit densities.

**floppy disk**—Also called a diskette. It is a round disk with a hole in the middle, made of flexible material and housed in

a square envelope or cartridge. A disk drive holds the floppy disk through the hole in its center and spins it within its envelope. It can be used over and over again. Contrast with hard disk.

**flow control**—The process of regulating the speed at which data enters or leaves a serial port. Software flow control is implemented by communications software or by the user sending predefined characters or packets which are recognized as *pause* and *resume* indicators. Hardware flow control is achieved by using the RTS (request to send) and the CTS (clear to send) control lines of the RS-232 interface.

**footprint**—The desk or floor space that a piece of hardware occupies. Also referred to as *real estate*.

**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.

**format**—1. The way text is set up on a page. 2. To prepare a disk for holding information. Formatting a disk can delete all information on it. 3. The way information is structured in a file, often specific to one application or protocol.

**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.

**FSK** (frequency shift keying)—A technology that establishes two frequencies used to represent binary values. This was the earliest type of modulation used by 300 bps modems.

**full-duplex**—Method of transmitting and receiving data simultaneously over a single pair of wires. Compare with half-duplex.

## G

**gateway**—A workstation that serves as a protocol converter (translator) between two or more dissimilar networks, providing incompatible systems.

## H

**half-duplex**—Transmission of data in both directions, but only one direction at a time. Compare with full-duplex.

**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.

**hard disk**—A metal disk covered with magnetic recording material. Some can hold up to several gigabytes of information. Contrast with floppy disk.

**hardware**—The equipment that makes up your computer system, including the keyboard, mouse, disk drives, and monitor.

**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* (as in *4CF h*, read as *four charley fox, hex*). The result is that one hex digit represents a four-bit value.

**host**—The computer that is designated as retaining information or processing power to service the needs of other computers or terminal. Mainframes and mid-range computers are hosts, as well as PCs with powerful microprocessors. Often a PC on a LAN will be set up as a host to provide LAN access for remote users.

## I

**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.

**initialize**—To begin anew and establish start-up parameters. This typically involves clearing all or some part of the device's memory or disk space.

**interface**—A common meeting ground supplied by hardware or software to facilitate a compatible connection and operation between two devices or programs. For example, when two PCs are connected they use a common interface across the physical connectors so that the signals being sent and received are accurately interpreted. With software, an interface is a module created to be *written to*. That is, if two programs are written to the same interface, they can be successfully linked together.

**IPX** (Internet Packet Exchange)—A data transport protocol developed by Novell used to route messages from one node to another. Application programs that manage their own client/server or peer-to-peer communications in a Novell network can access IPX directly. IPX does not guarantee the delivery of a message. Compare with SPX.

**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.

**ISA** (Industry Standards Architecture, pronounced *ice a*)—The classic 8- or 16-bit architecture introduced with IBM's PC-AT computer. Due to speed constraints, IBM introduced a restructured Micro Channel Architecture with a 32-bit bus and increased addressing capabilities.

**ISDN** (Integrated Services Digital Network)—International telecommunications standard for transmitting voice, video, and data over a digital communications line.

**ISI** (intelligent serial interface)—Multi-Tech's multiport serial card with an on-board processor and 50K or RAM for data buffering. The ISI does more than provide additional serial ports; it enhances serial port performance with the data buffering, and it holds the data it receives until an entire block can be transferred to the processor. This allows the computer's processor to be interrupted less often, so it can perform more efficiently.

## J

**job**—The unit of work being processed by the computer.

## K

**kermit**—An asynchronous file transfer protocol noted for its accuracy over noisy lines.

**kernel**—The core of an operating system that interacts directly with the system hardware. While most operating systems are based on the concept of a kernel, the term is best recognized as a fundamental of the UNIX operating system. Kernels have been expanded to include commonly used utilities, but with the advent of the *micro kernel*, the original modular design of UNIX is being revived.

**kilobit**—One thousand bits, a unit of measure for digital data rates.

**kilobyte**—One thousand bytes. A unit of measure for digital data rates. Not to be confused with *K*, which stands for  $z^{10}$  bytes of storage space, either in memory or on disk. 1K of disk space is actually 1024 bytes. 16K is 65,536 bytes, and 1M (meg) is 1,048,576 bytes.

## L

**LAM** (line adapter module)—The cabling that connects the phone line to the PCMCIA modem card.

**LAN card**—An IC Card that complies with the PCMCIA Card Services Interface Specification, Release 2.0. LAN cards can be connected to laptops or palmtop computers which, in turn, can be interconnected to local LAN services.

**leased line**—A private, dedicated communications channel that connects two locations. This connection lasts for the duration of the subscription. Leased lines can be conditioned to improve line quality over that of dial-up lines.

**line conditioning**—An additional cost option offered by the telephone company for their leased, voice-grade lines. The service provides a careful balance of line enhancements to improve the frequency response and to reduce distortion.

**LPTx** (line printer)—The parallel port interface on a PC. It provides a 25-pin connector for parallel transfer of data and printer controls, commonly used for parallel printers. A maximum of four I/O addresses are set with DOS parameters LPT1, LPT2, LPT3 and LPT4.

**LRC** (longitudinal redundancy check)—An error checking method that generates a parity bit from the specified string of bits on a longitudinal track. In a row and column format such as on magnetic tape, LRC is often used with VRC, which creates a parity bit for each character.

## M

**macro**—A series of keystrokes, commands, and/or menu selections that have been recorded and assigned a key or key combination. When those keys are pressed, the macro is carried out from beginning to end.

**magnetic disk**—A nonvolatile computer storage device that uses one or more magnetic-coated disk platters that can be recorded over again. Hard disks, minifloppies (5-1/4") and microfloppies (3-1/2") are examples of magnetic disks.

**mainframe**—A large, powerful computer used to centralize a data processing environment. It has hundreds of gigabytes of storage space. It uses a front end processor to connect

directly to the communications channels that interconnect terminals and computers.

**megabyte**—One million bytes, when describing a data rate. 1M of disk space may actually mean 1,048,576 bytes.

**mid-range computer**—A term coined by IBM, referring to any of their Advanced Business Systems computers. This product line was originally called their minicomputers, but as the number of supported users approached mainframe capabilities, the term *mid-range* caught on.

**MI/MIC** (mode indicate/mode indicate common interface)—A user definable feature that defines various combinations of edge or level detection in originate or answer mode, with the ring indicator (RI) pulse enabled or disabled.

**mnemonics**—A term assigned to a complex idea, value, or list of information that is representative of that information. Computer commands are almost entirely mnemonics. Mnemonics are used as memory aids for people.

**MNP** (Microcom Networking Protocol)—A family of communications protocols from Microcom that have become de facto standards for error correction and data compression.

**MNP Class 3 & 4**—The de facto error correction standard from Microcom.

**MNP Class 5**—The most widely used data compression scheme before *V.42bis*. MNP5 offers *2-to-1* data compression.

**MNP Class 7**—MNP's *3-to-1* data compression scheme. MNP7 never became a de facto standard because of *V.42bis 4-to-1* compression.

**modem**—A communications device that enables a computer to transmit information over a telephone line. It converts the computer's digital signals into analog signals to send over a telephone 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.

**modulation**—The process of encoding information from one signal (called the source) into another (called the carrier) by modifying some characteristic(s) of the carrier. It is often used in telecommunications when one type of signal must be converted for transmission over an otherwise incompatible medium.

**multiplexer** (mux)—A device that merges several signals into one composite signal for transmission over a single medium or channel. A de-multiplexer (usually built into a mux) reverses the process at the receiving end.

## N

**NAK** (negative acknowledgment)—Communications code used to indicate that a message wasn't properly received or that a terminal doesn't want to transmit. Contrast with ACK.

**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.

**NIC** (network interface card, pronounced *nick*)—A printed

circuit board that provides the physical and electrical connection between a PC and a network device (like a file server) via a network media (like Arcnet UTP).

**node**—Any point within a network that has been assigned an address.

**normal mode**—In modem operation, this refers to a mode of operation without error correction active.

## O

**OCR** (optical character recognition)—The recognition of printed characters and subsequent translation into character code for use on a computer. OCR systems can recognize many different fonts, as well as typewriter and computer-printed characters. Advanced OCR systems can recognize hand printing.

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

**OS** (operating system)—The master control program that runs a computing system. It is the first program loaded when the computer is turned on. Its main part is called the kernel and resides in the memory at all times.

## P

**parameter**—1. A *place holder* in a command that should be substituted with useful information. 2. The list of acceptable values for a given option or command.

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

**PCB** (printed circuit board)—A flat board that holds chips and other electronic components. The board is *printed* with electrically conductive pathways between components. The main PCB in a system is called a motherboard and the smaller PCBs that plug into the slots in the motherboard are called daughter boards or cards.

**PCMCIA** (Personal Computer Memory Card International Association)—An organization of U.S. and Japanese companies set up to standardize memory cards and other architecture-independent expansion devices. These cards typically are used in laptop computers.

**phase**—The timing of a signal based upon the starting point of each cycle in another signal. To be detected, phase requires the comparing of two signals. If the cycle of two signals begin at the same point, they are said to be *in-phase*. In-phase signals add, while out-of-phase signals tend to cancel each other.

**port**—A location for input or output data exchange. Computers, muxes, etc., have ports for various purposes.

**print server**—A computer in a network that controls one or more printers. It stores the print image output from all users of the system and feeds it to the printer one job at a time. The print server may be part of the network operating system or an add-on utility.

**program**—A collection of computer instructions that tell the

computer what to do.

**PROM** (programmable read only memory)—A permanent memory chip that can be programmed or filled by the customer after the manufacturer sets initial values. Contrast with ROM.

**prompt**—A request for information from the PC that provides required input or information.

**protocol**—A set of rules that defines how computing devices communicate with each other. The rules governing the transmitting and receiving of data.

**PSK** (phase shift keying)—A modulation technique that establishes two-bit elements, called *dibits*, yielding four possible combinations: 00,01,10,11. These elements then are represented by 90, 180 and 270 degree angles. PSK produces the appropriate shift in phase relative to the original carrier. Differential PSK replaces this technology because it is less prone to error. Modems using PSK normally operate at 1200 bps.

**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.

**pulse dialing**—One of two methods of dialing a telephone, usually associated with rotary dial phones. Compare with tone dialing.

**pulse-width**—Pertaining to a digital signal. Pulse width refers to the duration of one state between clocking signals. Pulse width roughly corresponds to an analog signal's wavelength.

## Q

**QAM** (quadrature amplitude modulation)—A complex method of modulation that establishes twelve phase angles and four amplitudes, designating sixteen possible combinations. QAM encodes hexadecimal values (also called quadbits) into one cycle of the carrier. Using a 1800 bps carrier frequency and a 2400 baud signaling rate, QAM provides a 9600 bps modulation speed. However, because it uses amplitude modulation, QAM is susceptible to noise.

**queue**—A set of activities that are waiting in chronological order for an action, such as printing, to be performed.

## R

**rack**—A frame or cabinet into which components are mounted. The industry standard rack is 19" wide and has variable depth and height.

**rackmount**—A packaging style available for many types of electronic equipment which enables the installer to mount the equipment in an industry standardized enclosure. Rackmount equipment is fitted with brackets, rather than being packaged in its own enclosure. Rackmounting conserves disk and floor space (real estate) and often conserves power outlets.

**RAM** (random access memory)—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.
- reboot**—Restarting your PC by turning off the power and then turning it back on, or by pressing Alt, Ctrl., and Del keys at the same time. Warm boot=Ctrl+Alt+Del (soft boot) or Cold boot=Power switch (hard boot).
- repeater**—A device that amplifies or regenerates the data signal in order to extend the distance of the transmission. This can be used with both analog and digital signals and is used extensively in long distance transmission to keep signals from losing their strength.
- resolution**—Indicates the number of dots that make up an image on a screen or printer. The more dots, the higher the resolution, and the finer and smoother the images can appear when displayed at a given size.
- 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.
- ROM** (read only memory)—A memory chip that permanently stores instructions and data. Its contents are created at the time it is manufactured and cannot be altered. ROM is used to store control routines in PCs and peripheral controllers. It is also used in plug-in cartridges for printers and video games. A set of ROM chips contains the basic input/output system (BIOS).
- RS232-C**—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 RS232 standard defines the purposes, electrical characteristics and timing of the signals for each of the 25 lines.
- RTS** (request to send)—With communications between modems, an RS232 signal sent from the DTE to the modem requesting permission to transmit. Contrast with CTS.
- S**
- scanner**—A hardware device that can *read* a photograph or other piece of artwork and transforms it into a collection of dots that can be stored as a bit-mapped file on a hard drive. It then can be manipulated into various software programs and placed electronically in a page layout program.
- SDLC** (Synchronous Data Link Control)—In IBM's SNA networks, this is the primary data link protocol.
- serial port**—The connector on a PC used to attach a serial device (a device that needs to receive data one bit after another), such as a mouse, printer or modem. It consists of a 9- or 25-pin connector that sends data in sequence. Serial ports are referred to as COMx ports, where x is 1 to 4 (COM1 through COM4). A serial port contains a conversion chip called a UART, which translates between internal parallel and external serial formats.
- server**—A computer that provides disk space, printer access, or other shared services, to computers over a network.
- software**—The set of instructions that make computer hardware perform tasks. Programs, operating systems, device drivers and applications are all software.
- spoofing**—A command recognized by modems which have been manufactured specifically for use within the UNIX UUCP (UNIX to UNIX Copy) facility. Spoofing is the process of transparently disabling the g protocol used by UUCP and substituting the modem's own error correction protocol for data integrity. The process *spoofs* the UNIX host into transmitting data faster than normal because acknowledgments are actually sent by the modem instead of the remote UNIX computer.
- spooling** (simultaneous peripheral operations online)—Overlapping a low-speed operation with normal processing, such as printing a file or document in the background while creating a new document in the foreground.
- SPX** (Sequenced Packet Exchange)—A data transport protocol developed by Novell used for interprocess communications. It guarantees that an entire message arrives intact and uses the NetWare IPX protocol as its delivery mechanism.
- switch line**—In communications, a physical channel established by dynamically connecting one or more discreet segments. This connection lasts for the duration of the call after which each segment may 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 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.
- T**
- T1 transmission**—A standard transmission speed of 1.544M bps that may be used in its full bandwidth or as narrower channels called *fractional T1* carriers.
- TCM** (trellis coded modulation)—An error correction method that allows the receiving modem to tell if a signal element is in error, based on the value of the preceding signal elements. Each signal element is assigned a coded binary value representing the element's phase and amplitude.
- terminal**—The screen and keyboard device used in a centralized computing environment for interactive data entry. Terminals have no *box*, which is to say they have no file storage or processing capabilities.
- terminal emulation**—Allows a PC to access a mainframe computer by generating and accepting data like a "dumb" terminal.
- threshold**—A value or condition which, when reached, triggers an event.
- toggle**—Alternate back and forth between two states.

**tone dialing**—One of two methods of dialing a telephone, usually associated with push button phones. Compare with pulse dialing.

**transistor**—A semiconductor device used to amplify a signal, or open and close a circuit. In digital computers, it functions as an electronic switch.

**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.

**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.

## U

**UART (universal asynchronous receiver/transmitter)**—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.

**UNIX**—A multiuser, multitasking operating system, first developed by AT&T in the 1970s. It now runs on a wide variety of computer systems from micro to mainframe and is controlled by UNIX System Laboratories (USL).

**UTP (unshielded twisted pair)**—Telephone type wiring.

## V

**V.21**—The CCITT modulation standard for 300 bps, full-duplex transmission over dial-up lines.

**V.22**—The CCITT modulation standard for 1200 bps, full-duplex transmission over a dial-up or 2-wire leased line. This is not common in North America.

**V.22bis**—The CCITT modulation standard for 2400 bps, full-duplex transmission over a dial-up or a 2-wire leased line.

**V.23**—The CCITT modulation standard for 75/1200 bps, half-duplex transmission over dial-up lines. This is not common in North America.

**V.24**—The CCITT hardware interface specification for interchange circuits between the DTE and DCE.

**V.25bis**—A dialing command set developed by the CCITT for both synchronous and asynchronous devices. Since *V.25bis* does not provide any modem configuration commands, it is primarily used for its synchronous dialing commands, while the *AT* commands are used for asynchronous dialing and for modem configuration.

**V.26**—The CCITT modulation standard for 2400 bps, full-duplex transmission over 4-wire leased lines. Primarily for synchronous use. Not common in North America.

**V.27**—The CCITT modulation standard for 4800 bps, full or half-duplex transmission. Primarily for synchronous use. Not common in North America. *V.27ter* is used by Group 2 fax-modems for 4800 bps fax transmission.

**V.29**—The CCITT modulation standard for 9600 bps, 2-wire (half-duplex) or 4-wire (full-duplex) transmissions, primarily over leased lines (synchronous or asynchronous).

*V.29* is used for Group 3 fax transmissions.

**V.32**—The CCITT modulation standard for synchronous or asynchronous input to be transmitted at 9600 bps over the PSTN. *V.32* operates in half- or full-duplex mode.

**V.32bis**—The CCITT modulation standard for synchronous or asynchronous input to be transmitted at 14,400 bps over the PSTN. *V.32bis* operates in half- or full-duplex mode.

**V.32terbo**—An AT&T recommendation for synchronous or asynchronous input to be transmitted at 14,400 bps over the PSTN. *V.32terbo* operates in half- or full-duplex mode.

**V.32**—The CCITT modulation standard for synchronous or asynchronous input to be transmitted at 9600 bps over the PSTN. *V.32* operates in half- or full-duplex mode.

**V.33**—A CCITT modulation standard for 14,400 bps synchronous transmission over a 40-wire leased line.

**V.35**—The CCITT hardware interface specification commonly used by DSU/CSUs and other high-speed devices.

**V.42**—A CCITT recommendation for error-control hardware on a modem that accepts asynchronous input. *V.42* recommends for manufactures to implement LAP-M and makes a provision for MNP-5 as a alternative because of its popularity. Most modem makers provide both.

**V.42bis**—A CCITT recommendation for data compressing hardware on a modem that accepts asynchronous input. *V.42bis* is based on a dynamically updated dictionary that looks up common strings and replaces the strings with code words. This reduces the amount of characters actually transmitted. *V.42bis* has been found to be most effective for file transfers that contain long strings of repetitive information and least effective for short strings of unique data.

**V.54**—The CCITT recommendation to standardize Bit Error Rate Testing (BERT) and Loopback testing (Local Analog and Digital Loopback, as well as Remote Analog and Digital Loopback).

**VRC (vertical redundancy check)**—An error checking method that generates and tests a parity bit for each byte of data that is moved or transmitted.

## W

**WATS (Wide Area Telephone Service)**—A discounted long-distance calling plan that allows calls in or out. The popular 800 numbers are WATS lines in. The calls are charges to the holder of the 800 number at a discounted rate.

**Workstation**—Traditionally, a dumb terminal connected to a host. However, with the advent of LANS and WANS, PCs that are connected to a LAN are now called workstations too, even though they are capable of independent processing. A workstation is simply an input/display device through which a user accesses a resource.

## X

**X.121**—CCITT's recommendation for unique addressing of each DTE connected to a communications network throughout the world. *X.121* uses fifteen digits: a one-digit prefix, a four-digit DNIC number (which identifies the

country and PDN), and a ten-digit national terminal number.

**X.21**—CCITT's recommendation for a 15-pin, digital interface. It is not widely accepted, because of the analog loops still prevalent in data communications. For this reason, CCITT introduced the *X21bis* standard for use with synchronous modems.

**X.25**—CCITT's definition of a three-level packet-switching protocol to be used between packet-mode DTEs and network DCEs. X.25 corresponds with the lower three/four layers of the seven layer OSI model.

**X.28**—CCITT's definition of asynchronous commands used by a local ASCII terminal to configure an X.25 PAD.

**X.29**—CCITT's definition of packetized commands sent to configure a remote PAD via an X.25 link.

**XModem**—A widely used asynchronous file transfer protocol. Programs typically use both the older version, checksum, and the new version, CRC method, to detect errors. If CRC is not present at the other end of a file transfer, then it will use checksum.

## Y

**YModem**—An asynchronous file transfer protocol that improves speed by transmitting 1,024-byte (1K) blocks and batch file transfer.

## Z

**ZModem**—An asynchronous file transfer protocol that is more efficient than XModem. It sends file name, date and size first, and responds well to changing line conditions due to its variable length blocks. It uses CRC error correction and is effective in delay-induced satellite transmission.







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