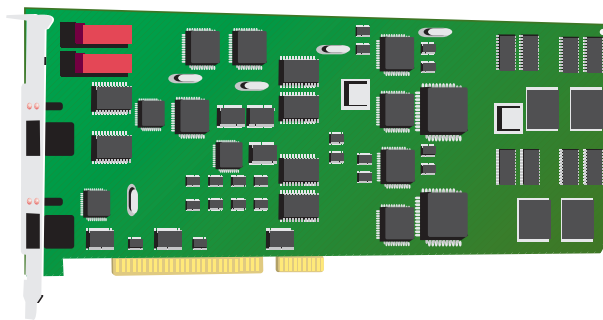

MultiModemISI

MultiModemISI Hybrid Series
Models ISIHP- 2S/2U/4S/4U/4SD



User Guide

MultiTech[®]
Systems 

MultiModemISI Hybrid Model ISIHP-2S/2U/4S4U4SD

User Guide

88311551Revision B

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B	Data for 4S/4U versions added (11/30/99)

Patents

This product is covered by one or more of the following U.S. Patent Numbers: 5.301.274, 5.309.562, 5.355.365, 5.355.653, 5.452.289, 5.453.986. Other patents Pending.

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Welcome to Multi-Tech's new MultiModemISI Hybrid Series,

models ISIHP-2S/2U and ISIHP-4S/4U, multiport hybrid ISDN cards that can be plugged into any PCI slot for applications that involve ISDN or modem calls over ISDN BRI lines. When the ISIHP is used with Remote Access Servers (RAS), remote users can call in using either modems or ISDN terminal adapters (TAs). For V.90 modem calls, a 56kbps download speed can be achieved without the expense of T1, E1, or ISDN PRI lines. This manual also describes the ISIHP-4SD, a serial interface card equipped with four terminal adapters only (no analog modems are present). The ISIHP-4SD is otherwise like the ISIHP-4S/4U models. S-models use the ISDN "S" interface; U-models use the ISDN "U" interface.

The ISIHP-2S/2U contains two terminal adapters and four V.90/K56flex modems. The ISIHP-2S/2U uses two ISDN BRI lines (each offering two B-channels) to connect to the telco and these connect to its two built-in terminal adapters. In addition to handling ISDN calls, each terminal adapter can detect analog modem and fax calls. When

analog calls are detected, they are automatically connected to one of the four V.90 modems on the ISIHP board. In this way, these hybrid cards can handle either ISDN calls or analog modem calls. Although the ISIHP-2S/2U contains four ISDN TA ports and four analog modem ports, only four ports can be active at any one time (because only four B-channels are present). See Figure 1-1.

The ISIHP-4S/4U works like the ISIHP-2S/2U but contains four terminal adapters and eight V.90/K56flex modems. The 4S and 4U models each accommodate four ISDN BRI lines. The configuration of modem and TA ports for the 4S and 4U models is shown in Figure 1-2.

The ISIHP-4SD contains four terminal adapters only (the daughter card containing the eight modems is absent). Since it accommodates four ISDN BRI lines (each offering two B-channels), it supports eight independent digital data connections.

Each terminal adapter appears as two ports to the server PC using the ISIHP card.

ISIHP cards also support dial-out applications via their modems or terminal adapters.

The ISIHP-2S/2U card offers eight RAS ports using two Basic Rate Interface (BRI) ISDN lines; the ISIHP-4S/4U has 16 ports using four BRI ISDN lines. For the ISIHP-2S/2U, its eight ports allow a server to accept any combination of analog modem and digital ISDN calls, making a maximum of four simultaneous independent data connections. For the ISIHP-4S/4U, its sixteen ports allow a server to accept any combination of analog modem and digital ISDN calls, making a maximum of eight simultaneous independent data connections. This arrangement gives the user the flexibility to customize the settings of the terminal adapters and modems. The terminal adapters on the ISIHP-4SD can make eight simultaneous independent connections.

Introduction

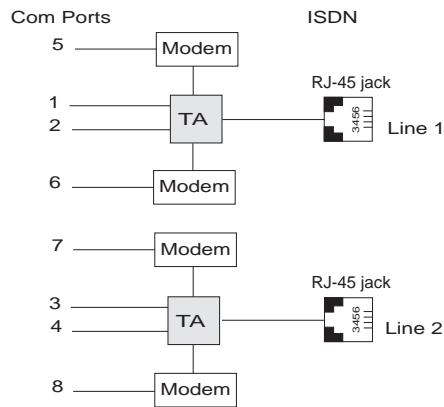


Figure 1-1: Modems and Terminal Adapters of ISIH-2S/2U

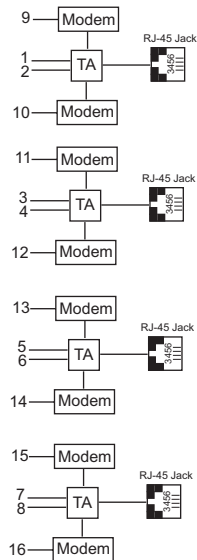


Figure 1-2: Modems and Terminal Adapters of ISIH-4S/4U (for ISIH-4SD, no modems are present)

From the perspective of the server PC, the ISIHP-2S/2U is an eight-port serial card with eight devices permanently attached to the serial ports (Figure 1-1). 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 following chart summarizes the correlation of ports and devices.

<u>2S/2U Port #</u>	<u>Device</u>	<u>ISDN Line Number</u>
1	TA	1
2	TA	1
3	TA	2
4	TA	2
5	Modem	1
6	Modem	1
7	Modem	2
8	Modem	2

From the perspective of the server PC, the ISIHP-4S/4U is a sixteen-port serial card with sixteen devices permanently attached to the serial ports (Figure 1-2). The first eight ports are the four terminal adapters, each of which appear as two ports. The remaining eight ports are the eight central site modems. The following chart summarizes the correlation of ports and devices. The ISIHP-4SD contains terminal adapters only; no modems are present.

Introduction

4S/4U Port #	Device	ISDN Line Number
1	TA	1
2	TA	1
3	TA	2
4	TA	2
5	TA	3
6	TA	3
7	TA	4
8	TA	4
9	Modem	1
10	Modem	1
11	Modem	2
12	Modem	2
13	Modem	3
14	Modem	3
15	Modem	4
16	Modem	4

This ISIHP Quick Start Guide contains installation instructions and technical support information. Because it's written for audiences with basic PC skills, step-by-step instructions for such basic operations as logging in and file editing are not included.

Peripheral Component Interconnect (PCI)

First developed by companies such as Intel™, AT&T™ and Digital Equipment Corporation™, the Peripheral Component Interconnect (PCI) bus used by your ISIHP card provides high performance and is easy to use. Because PCI devices contain registers with the device information required for configuration, full auto configuration of PCI Local Bus add-in boards and components is supported. Performance factors include a bus data path of 64 bits, clock speeds of 66 MHz, and bandwidth of 264 Mbs.

Communication Protocols for ISIHP Ports

Ports on the ISIHP card can be associated with different protocols, as follows:

Auto-Protocol. Modem or terminal adapter automatically negotiates with host to operate using the host's current protocol.

Central Site Modem. Common designation for analog modems built into the ISIHP card. These are V.90 modems. For the ISIHP-2S/2U, the last four modems should be designated as Central-Site modems; for the ISIHP-4S/4U, the last eight modems should be designated as Central-Site modems. (See Port/Device table on previous page.)

MultiLink PPP async. This protocol allows the functional bundling together of three WAN ports so they function as a single high-bandwidth data pipeline using only one IP address. Bundling occurs on demand when the needed bandwidth exceeds that available on a single circuit.

PPP async. (Point-to Point Protocol, asynchronous) Protocol allowing computers a dial-up connection to the Internet. PPP includes error detection, data compression and other improvements over Serial Line Internet Protocol (SLIP) connections.

V.120. Terminal rate adaptation protocols. These apply to ISDN B-channels when using a V interface. This protocol includes V.110.

X.75. An international standard that allows X.25 packet-switched networks to communicate with each other. X.75 is a gateway protocol for interconnection of X.25 public networks.

Introduction

Hardware Installation

Hardware Installation

Introduction

This section describes how to install the ISIHPC server card into the PCI bus on your personal computer, which involves

- Opening your PC
- Installing the card into the PC

Computer Requirements

- Pentium-based PC or compatible with PCI bus architecture
- Microsoft Windows 95, Windows 98, Windows NT version 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, 50K bytes for Novell

Shipping Contents

- ISIHPC card
- RJ-45 ISDN cords (2 for ISIHPC-2S/2U; 4 for ISIHPC-4S/4U)
- ISIHPC Driver Disk set
- ISDN TA Configuration Wizard disk
- Quick Start Guide
- User Guide (this online manual) on CD-ROM

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.
- 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 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 connected only to the same type on the other apparatus.

Hardware Installation Procedure

1. Before handling the ISIHP card, discharge any static in your body by touching a piece of grounded metal such as the computer chassis.
2. Carefully remove the ISIHP card 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 possible future use.)
3. Visually inspect the ISIHP-2S/2U/4S/4U/4SD. The 2S and 4SD models have only one daughter card, whereas the others have two. If you have any concerns about the condition of your ISIHP unit, call Technical Support at (612) 717-5863.

Hardware Installation

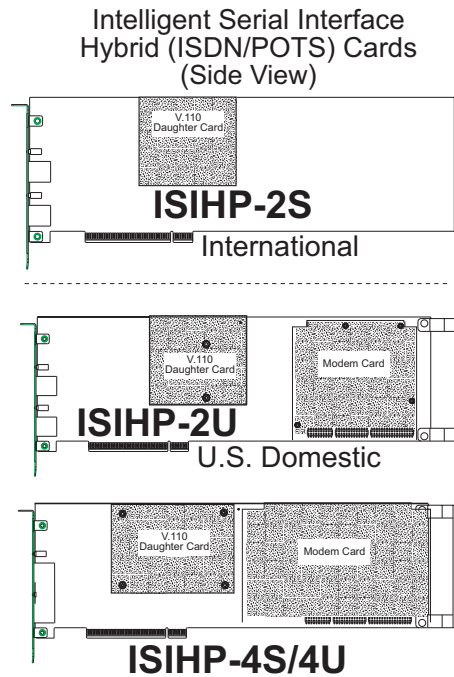


Figure 1-3: ISIHP Cards; Side View (on ISIHP-4SD, right daughter card is not present)

4. To avoid damaging the ISIHP-2S/2U and your PC, make sure your computer and any peripheral equipment connected to it are turned off. The ISIHP-2S/2U can be installed in a Pentium equivalent PCI bus computer.
5. Remove the cover of your computer as instructed in your computer's documentation.
6. Locate the unused PCI slot you will be using for your ISIHP-2S/2U card and remove the slot cover according to instructions in your computer's documentation.
7. Install the ISIHP-2S/2U card in the selected expansion slot in the same manner as any other add-on card according to your computer's documentation.
8. Fasten retaining bracket to computer chassis and replace the cover.

9. Connect the ISIHP-2S/2U to your ISDN telephone wall jack with the provided modular telephone cable.

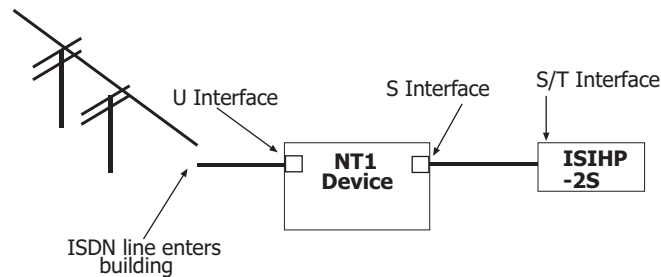


Figure 1-4: ISDN Interfaces at Customer Premises

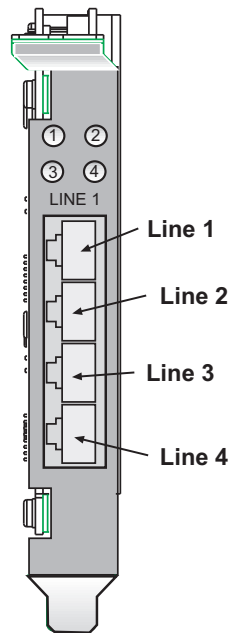
Note: The ISIHP communicates over ISDN lines. If you don't have a standard modular jack near your computer, you should install one or have one installed by your telephone company. In the US, installation kits and adapters are available wherever telephones are sold.

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 the NT1 device. If the S/T-interface model (ISIHP-2S, -4S, or 4SD) is used, then the S/T-interface must be connected to the S-interface on the NT1 device.

10. Turn on power to the computer. Now you are ready to install software.

LED Indicators

The mounting brackets for the four ISIH cards are similar, but the LEDs are labeled differently. Below, and on the next page, are graphics for each bracket along with descriptions of the LED indicators.



ISIHP-4U LEDs (one LED per BRI)

- Flashes between OFF and RED to indicate that neither SPID for that ISDN line has been verified.
- Flashes between RED and GREEN to indicate that one SPID is correct.
- A solid GREEN display indicates that both SPIDs are correct.

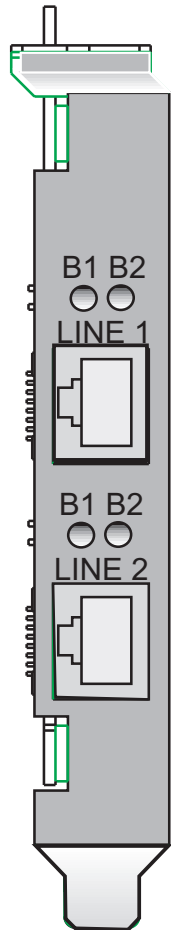
ISIHP-4S/4SD LEDs (one LED per BRI)

- Solid GREEN indicates normal operation.
- Flashes between RED and GREEN to indicate that the device has been reset.

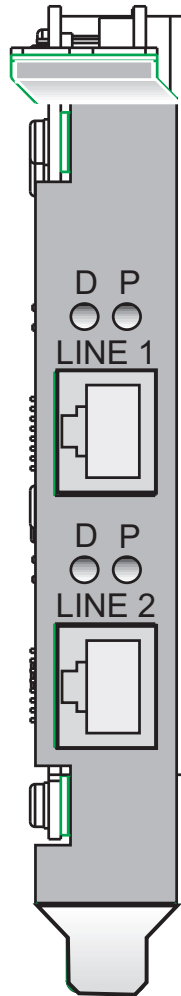
ISIHP-2S LED Indicators

B1 LED Indicator

- When lit, indicates active or voice connection on B-channel 1.
- When lit, indicates active or voice connection on B-channel 2.



ISIHP-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

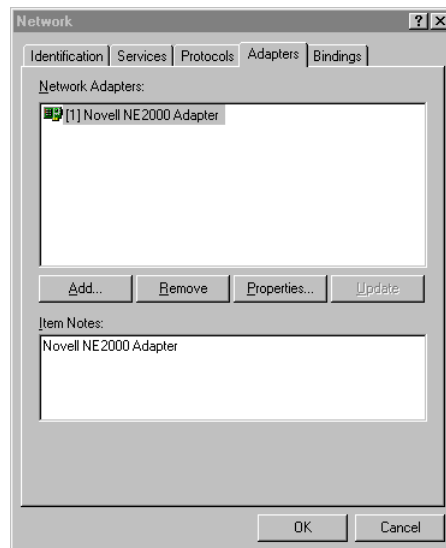
- Lights when the ISIHP-2S/2U is turned on.
- Flashes until SPIDs are verified with the central office switch; then remains lit without flashing.
- Indicates data link layer status.

Software Installation

Installing the ISIHP in Windows NT 3.51/4.0

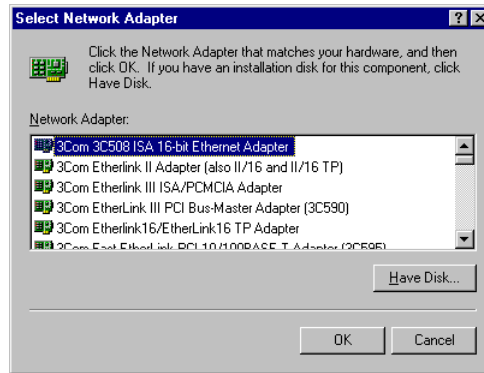
The following procedure describes how to install the ISIHP card in a system operating Microsoft Windows NT 3.51 or 4.0 for use with Remote Access Service (RAS) server and other communications/fax server type applications. These procedures refer to both 3.51 and 4.0.

1. Install the ISIHP in an available PCI slot as described in the installation section of this manual.
2. Turn on the computer.
3. Click **Start, Settings, Control Panel**, and then double-click **Network**. In the **Network** dialog box, click the **Adapters** tab. Then click **Add**.

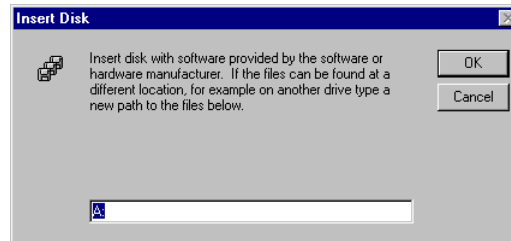


4. The **Select Network Adapter** dialog box appears. Click **Have Disk**.

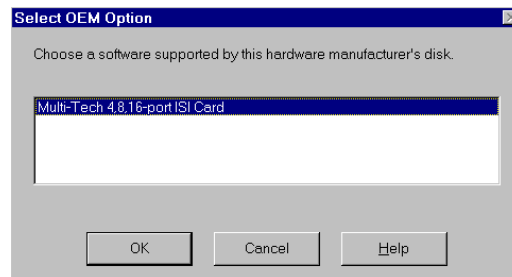
Software/Driver Installation (Windows NT)



5. The **Insert Disk** dialog box appears. Insert the *MultiModem ISI Driver for Windows NT* diskette and click **OK**.

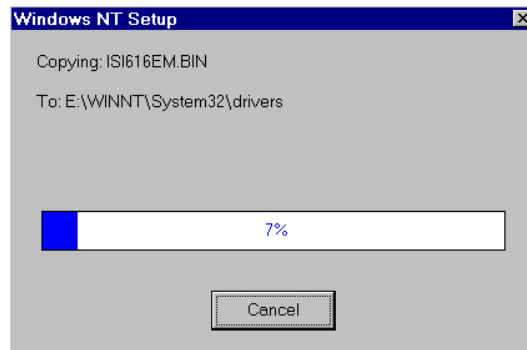


6. The **Select OEM Option** dialog box appears. Click **OK**.

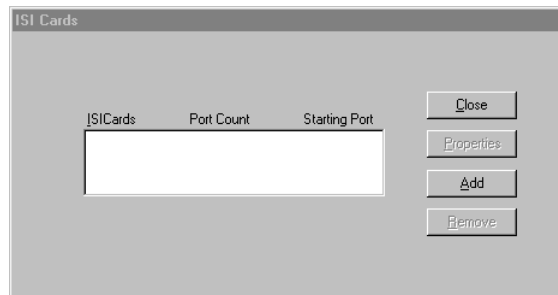


Software/Driver Installation (Windows NT)

A transient dialog box will appear while the setup program is loaded from the diskette to the PC hard drive.

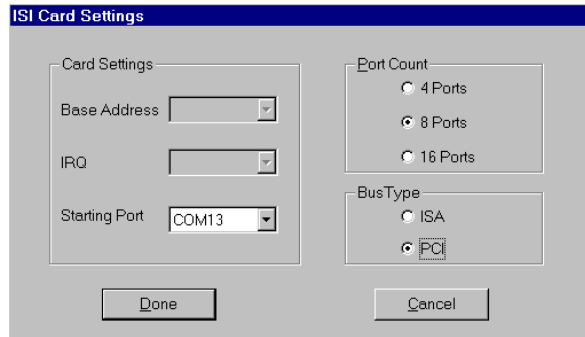


7. The **ISI Cards** dialog box appears. Click **Add**.

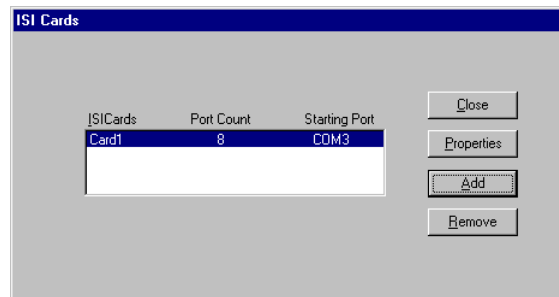


8. Then this **ISI Cards** dialog box appears. Select the starting port (usually port 3).

Software/Driver Installation (Windows NT)



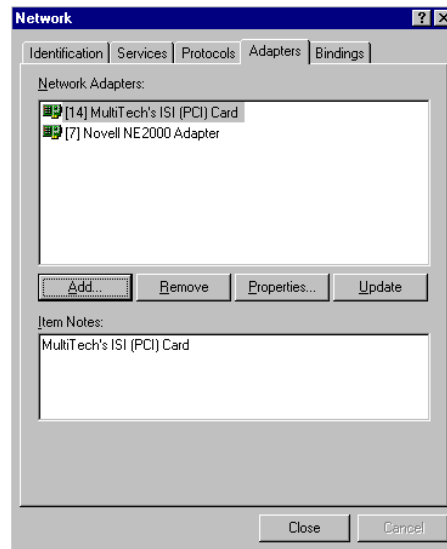
9. The **ISI Cards** dialog box appears again showing the port assignment. Click **Add** to add additional cards and repeat step 8.



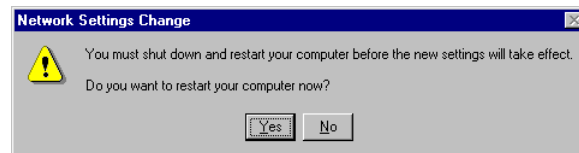
After the last ISIHIP card has been added, click **Close**.

Software/Driver Installation (Windows NT)

10. The file copies and **Multi-Tech ISIHP Adapter** appears in the **Network Adapters** box. Click **Close**.



11. When this dialog box appears, click **Yes** to reboot your system.



The ISIHP-2S/2U now is installed in Windows NT.

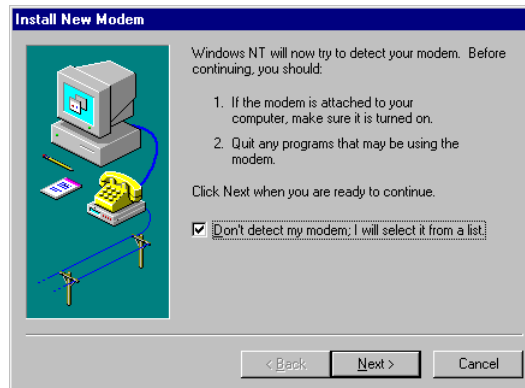
Installing TAs & Modems to COM Ports in Windows NT

To install terminal adapters:

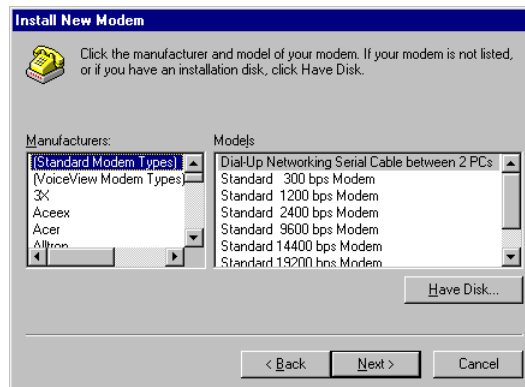
1. In the **Control Panel**, double-click the **Modems** icon.
2. The **Modem Properties** dialog box appears. Click **Add**.

Software/Driver Installation (Windows NT)

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**.

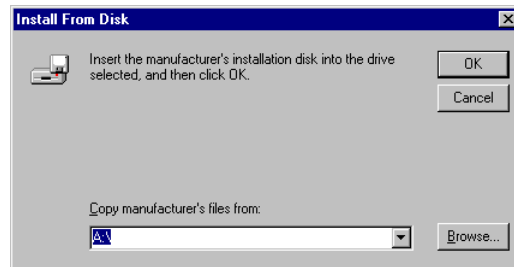


4. The **Install New Modem** dialog box appears. Click **Have Disk**.

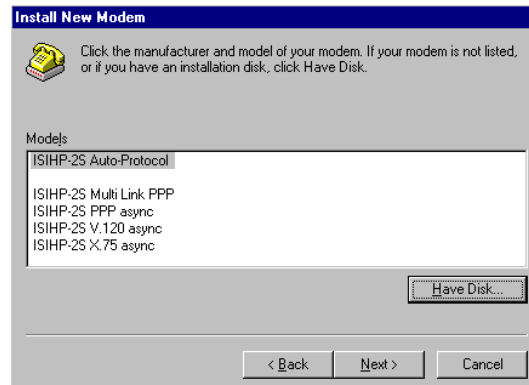


Software/Driver Installation (Windows NT)

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

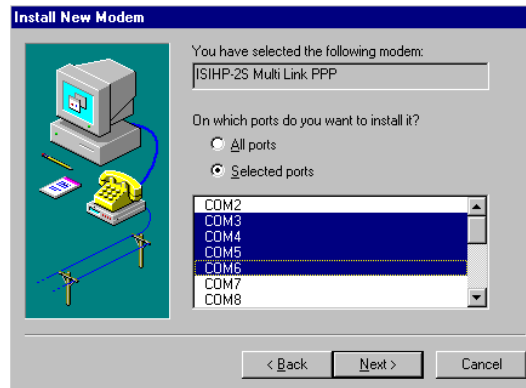


6. The **Install New Modem** dialog box appears. From the **Models** list, select an ISDN protocol (Auto-Protocol, ML-PPP, PPP, V.120, or X.75, depending on your application). (See description of protocols in the *Introduction* chapter of this manual.) Then click **Next**.



7. The **Install New Modem** dialog box appears. Select the ports that correspond to the first four ports of the ISIHP-2S/2U card, OR the first eight ports of the ISIHP-4S/4U. Any ports that existed prior to installing the ISIHP appear first in the list of available COM ports. Click **Next**. The terminal adapters (screen displays *modems*) install to the selected COM ports.

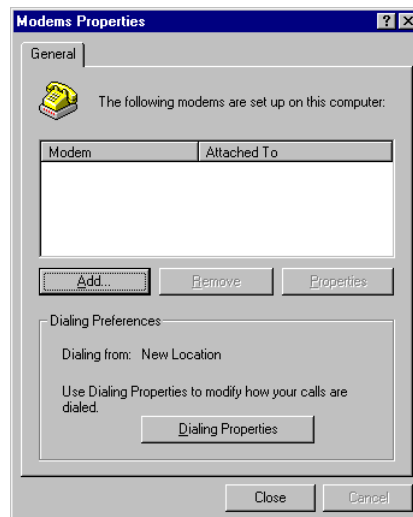
Software/Driver Installation (Windows NT)



8. After the terminal adapters 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 the modems.

To install modems: **{does not apply to -4SD}**

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

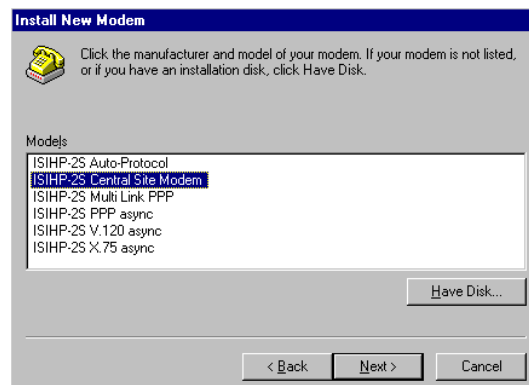


Software/Driver Installation (Windows NT)

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**.

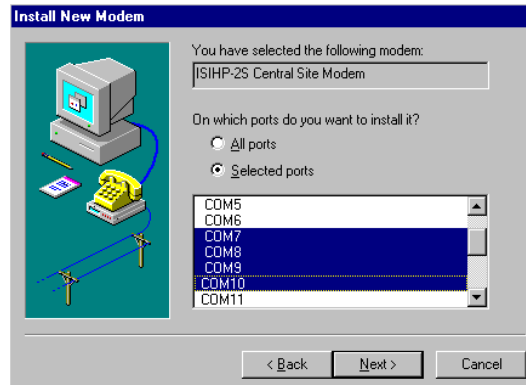


3. The **Install New Modem** dialog box appears. From the **Models** list, select **Central Site Modems** for the *modems*. Then click **Next**.

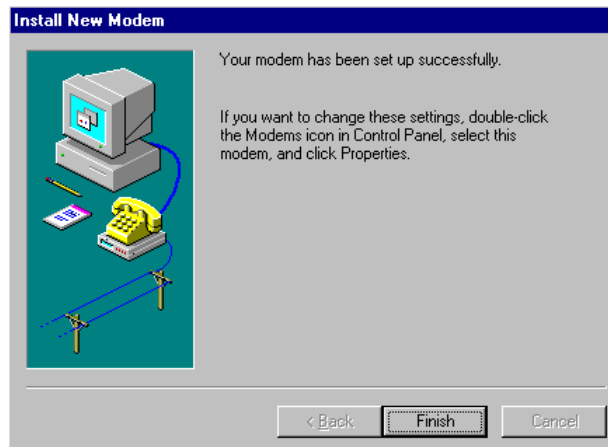


Software/Driver Installation (Windows NT)

4. Select the ports that correspond to the last four ports of the ISIH-2S/2U card OR the last eight ports of the ISIH-4S/4U card. Click **Next**. The modems install to the selected COM ports.

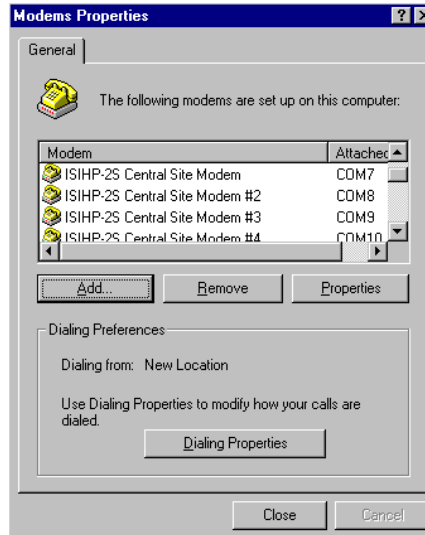


5. After the modems install to the ports, click **Finish** to return to the **General** tab.

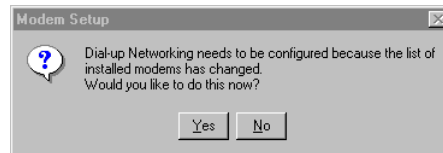


Software/Driver Installation (Windows NT)

6. To view COM port assignments and make necessary changes, use the Modem Properties dialog box.

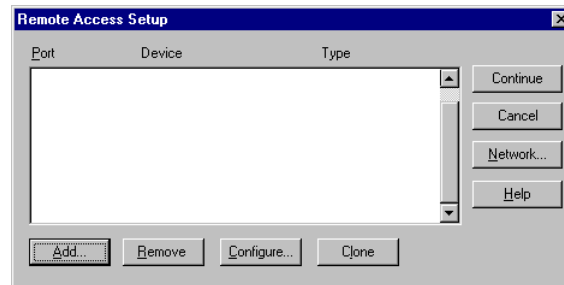


7. Close the **Modems Properties** dialog box. The message below appears asking if you want to configure dial-up networking. Click **Yes**.

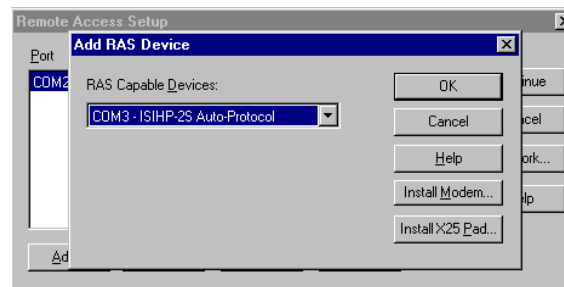


Software/Driver Installation (Windows NT)

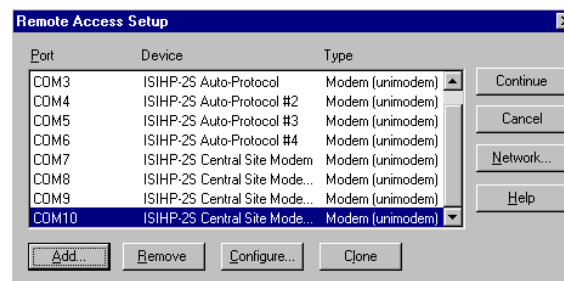
8. The **Remote Access Setup** dialog box appears. Click **Add**.



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

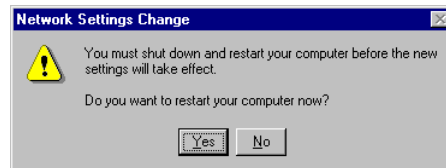


10. The **Remote Access Setup** dialog box displays again. Repeat steps 7 and 8 until all devices are added.
11. When all devices have been added, click **Continue**.

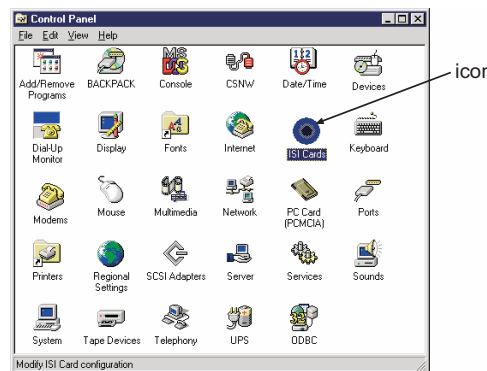


Software/Driver Installation (Windows NT)

12. After the bindings have been reviewed and stored, the message below appears, click **Yes**.



After re-booting, the **ISI Cards** icon appears in the **Control Panel**.



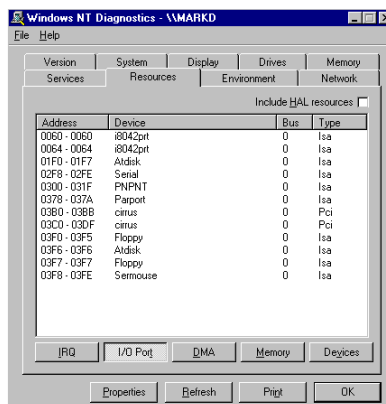
You are now ready to configure the terminal adapter. See the section, "Configuring the Terminal Adapter," on page 49.

I/O Addresses and IRQ Codes

Unlike many modem products, the ISIHP has no DIP switch for I/O addresses and no jumper to determine the IRQ code. The input/output address and the interrupt request code (IRQ) for the ISIHP are assigned automatically during driver installation. During any subsequent re-configuring of your PC, you may need to know the assigned I/O address and IRQ code. To determine the I/O address and IRQ assigned to the ISIHP:

Software/Driver Installation (Windows NT)

(for Windows NT) click on **Start, Settings, Control Panel** and select the **ISI Cards** icon; or click on **Start, Programs, Administrative Tools (Common), Windows NT Diagnostics, Resources**;



(for Windows 95) click on **Start, Settings, and Control Panel**. From the Control Panel, click on **System** icon and then the **Device Manager** tab. From there, click on the **Computer** icon at the top of the **Device Manager** window. The **Computer Properties** dialog box will appear. In the **View Resources** tab, click on either the **Interrupt Request (IRQ)** or **Input/Output (I/O)** radio buttons to view lists of both the IRQs and I/O memory addresses in use in the computer and what devices are currently using these resources.

Removing ISIHP Card and Driver in Windows NT 3.51/4.0

1. Click **Start, Settings, Control Panel**, and then double-click **Network**.
2. The **Network** dialog box appears. Click the **Adapters** tab.
3. Select **Multi-Tech PCI ISI Card**, and then click **Remove**.

Note: To complete an uninstall, reboot your system.

Installing the ISIH in Windows 95 and Windows 98

This section describes how to install the ISIH in systems operating Microsoft Windows 95 or Windows 98 to use with a Remote Access Service (RAS) server and other communications/fax server type applications.

Windows 95 Installation

1. After installing the ISIH in an available PCI slot, turn on the computer.
2. Windows 95 automatically detects the ISIH card. A dialog box appears saying that Windows has found the new hardware and is locating the software for it.
3. The **Update Device Driver** dialog box appears. Insert the ISIH Windows 95 driver diskette and click **Next**.

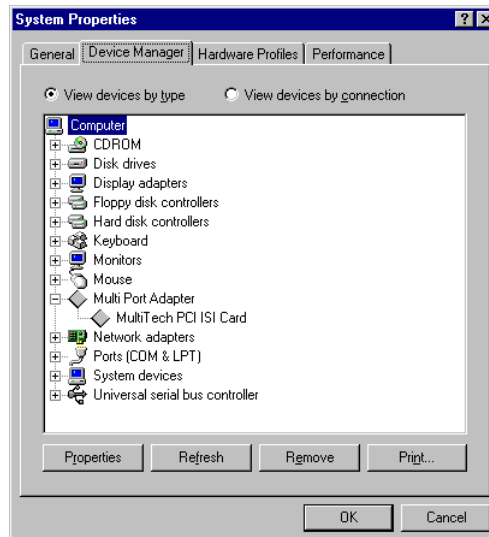


4. Windows 95 automatically searches for the unknown device and locates the MultiTech ISI Port. After the operating system goes through this process for every port added, click **Finish**.

Software/Driver Installation (Windows 95)



5. To view the COM ports, click **Control Panel** and double-click **System**. In the **System Properties** dialog box in **Device Manager**, the **MultiTech PCI ISI Card** appears under **Multi Port**. To view ports, click **Ports (COM & LPT)**. Click **OK** to close.



Software/Driver Installation (Windows 95)

To Remove the ISIHP Card & Drivers in Windows 95

To remove the ISIHP card:

1. Click **Start, Settings, Control Panel**, and then **System**.
2. The **System Properties** dialog box appears. Click the **Device Manager** tab.
3. Click **Multi Port Adapter** and select **MultiTech PCI ISI Card**, and then click **Remove**.

To remove the drivers:

1. Click **Start, Settings, Control Panel**, and then double-click **Add/Remove Programs**.
2. Select **MultiTech ISI Card** and then click **Add/Remove**.

Note: To complete an uninstall, reboot your system.

Windows 98 Installation

1. After installing the ISIHP card in an available PCI slot, turn on the computer.
2. Windows 98 automatically detects the ISIHP card. A dialog box appears saying that Windows has found the new hardware and is locating the software for it.
3. The **Add New Hardware Wizard** dialog box appears. Click **Next**.



Software/Driver Installation (Windows 98)

4. In the next Wizard dialog box, select **Search for the best driver for your device. (Recommended)**. Then click **Next**.



5. In the next Wizard dialog box, make sure **Floppy disk drives** is checked. Insert the *MultiModem ISI Driver for Windows 95/98* diskette. Then click **Next** and the system locates the file.



Software/Driver Installation (Windows 98)

6. When this Wizard dialog box appears, click **Next**.

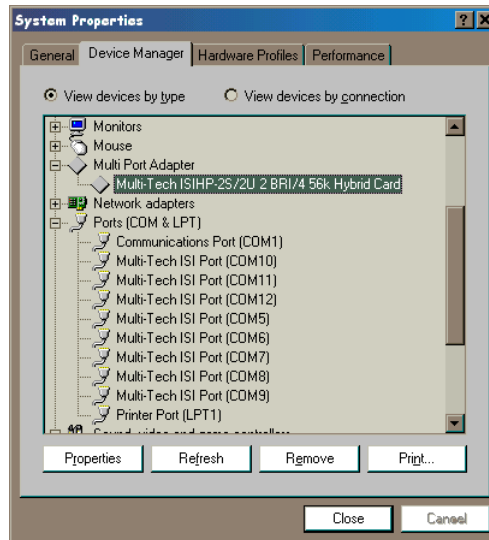


7. Windows then installs the device driver for the ISIHP card. When this dialog box appears, click **Finish**.



Windows 98 will now detect and create COM ports (for ISIHP-2S/2U/4SD, 8 ports are made; for ISIHP-4S/4U 16 ports are made).

8. After the COM parts have been created, you must re-boot your PC (remove the diskette from the floppy drive before re-booting).
9. To view the COM ports, click **Control Panel** and double-click **System**. The **System Properties** dialog box appears.



The **MultiTech PCI ISI Card** is located under **Multi Port Adapter**. Click **Ports (COM & LPT)** to view the ports. Click **OK** to close.

To Remove the ISIHP Card and Drivers in Windows 98

To remove the ISIHP card:

1. Re-boot your computer.
2. Click **Start, Settings, Control Panel**, and then **System**.
3. The **System Properties** dialog box appears . Click the **Device Manager** tab.
4. Click **Multi Port Adapter** and select **MultiTech ISIHP-2S/2U 2BRI/4 56K Hybrid Card**. Then click **Remove**.

To remove the drivers:

1. Click **Start, Settings, Control Panel**, and then double-click **Add/Remove Programs**.

Software/Driver Installation (Windows 98)

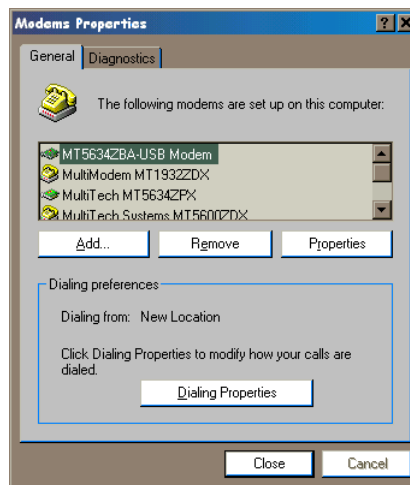
2. Select **MultiTech ISI Card** and then click **Add/Remove**.

Installing TAs & Modems to COM Ports in Windows 95 /98

To install terminal adapters:

1. Click **Start, Settings, Control Panel**, and then double-click the **Modems** icon.
2. If no modems are currently installed, 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**.

If other modems have been installed, the **Modems Properties** dialog box will appear.

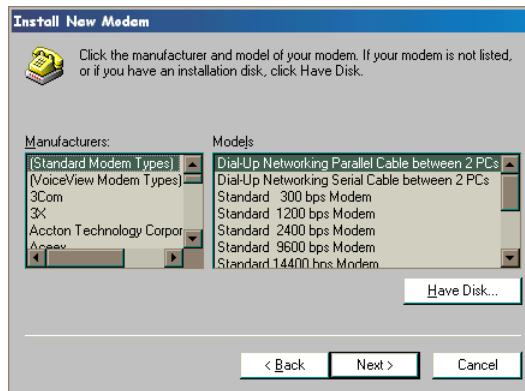


Software/Driver Installation (Windows 98)

Click **Add** and the **Install New Modem** dialog box will appear. 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 diskette labeled *MultiModem ISI Driver for Windows 95 & Netware AIO* and click **Have Disk**.

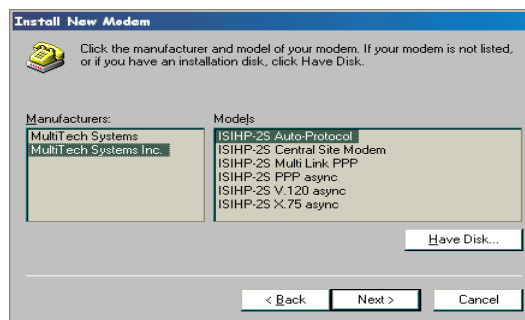


Software/Driver Installation (Windows 98)

4. The **Install From Disk** dialog box appears. Click **OK**.

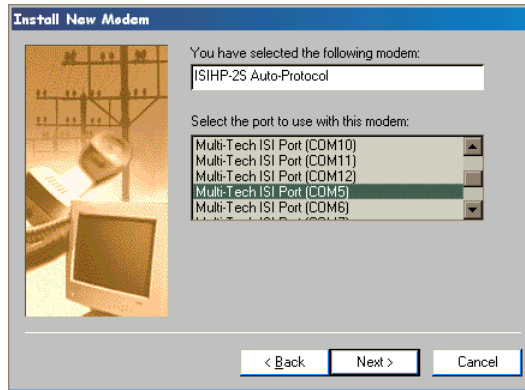


5. The **Install New Modem** dialog box appears. Select a protocol (depending on your application) from the **Models** list; then click **Next**.

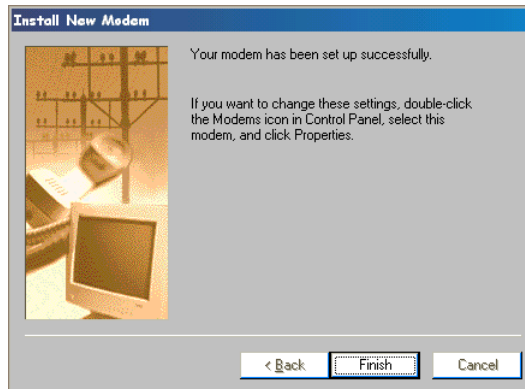


6. The **Install New Modem** dialog box appears. Select the port that corresponds to the lowest numbered port of the ISIH-2S card. Any ports that had been installed before installing the ISIH-2S card are numbered lower than the ports of the ISIH-2S card. Click **Next**.

Software/Driver Installation (Windows 98)

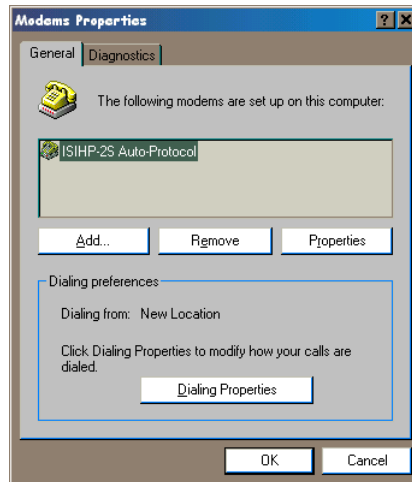


7. Windows will install the first terminal adapter. Click **Next**.

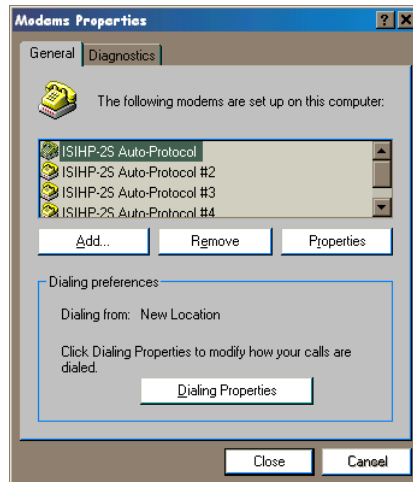


Software/Driver Installation (Windows 98)

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



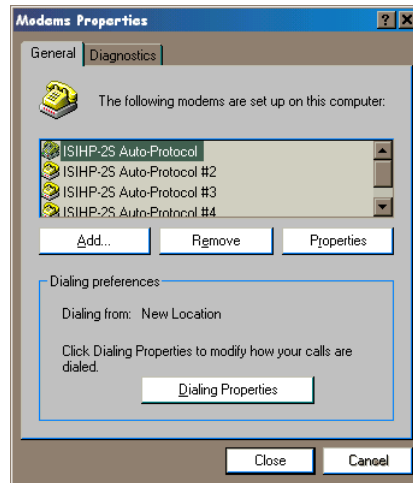
- Click **Add** and repeat installation steps 2–8 to install terminal adapters to the first four ports of the ISIHP-2S/2U (OR the first eight ports of the ISIHP-4S/4U/4SD). After the terminal adapters have been installed, you are ready to install the modems.



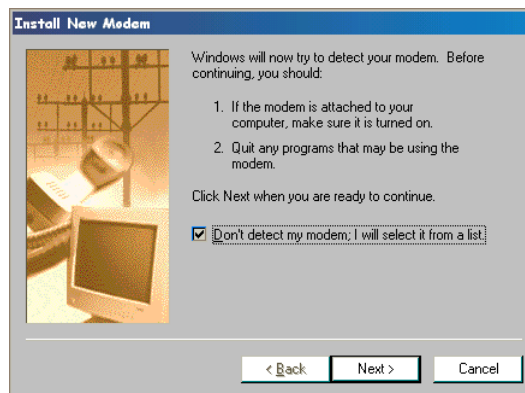
Software/Driver Installation (Windows 98)

To install modems (Windows 95/98): {not applicable to -4SD}

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

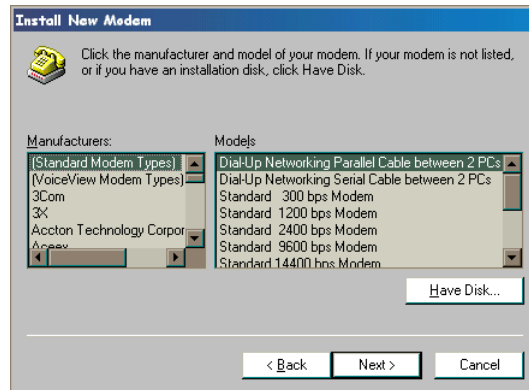


2. The **Install New Modem** dialog box appears. Check the box marked **Don't detect my modem; I will select it from a list**. Then click **Next**.

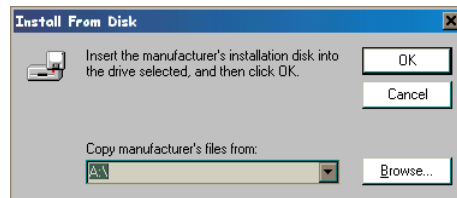


Software/Driver Installation (Windows 95/98)

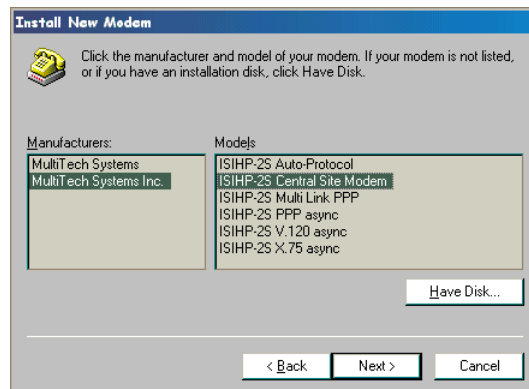
- The **Install New Modem** dialog box appears. Insert the driver diskette labeled *MultiModem ISI Driver for Windows NT*. Then click **Have Disk**.



- The **Install from Disk** dialog box appears. Click **OK**.

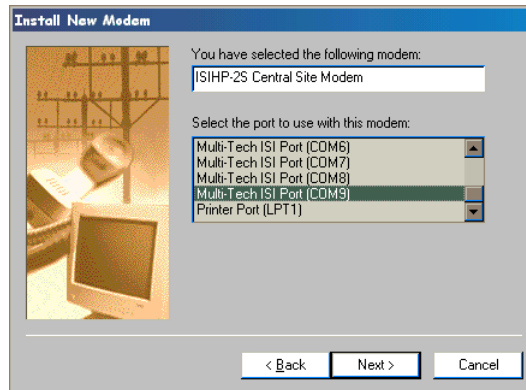


- The **Install New Modem** dialog box appears. From the **Models** list, select **Central Site Modems** for the *modems*. Then click **Next**.

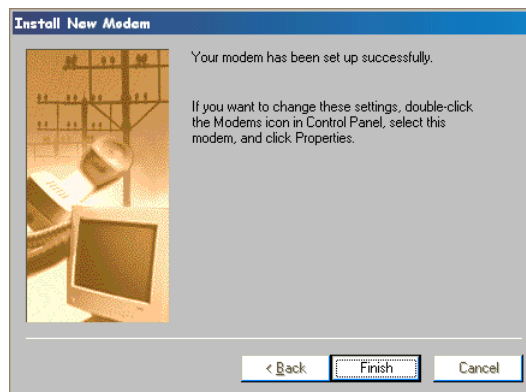


Software/Driver Installation (Windows 95/98)

- The **Install New Modem** dialog box appears. Select the numbered port corresponding to the first modem of the ISIHPCard. Click **Next**. The modem installs to the COM port.

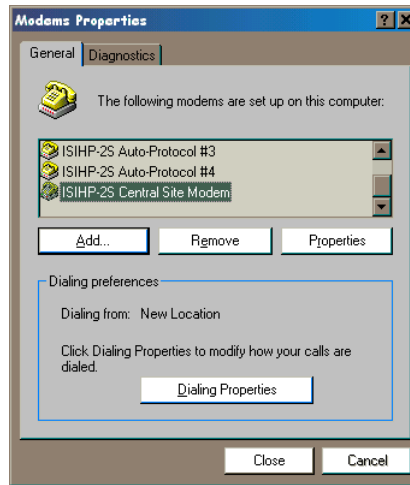


- After the modem installs to the port, click **Finish**.

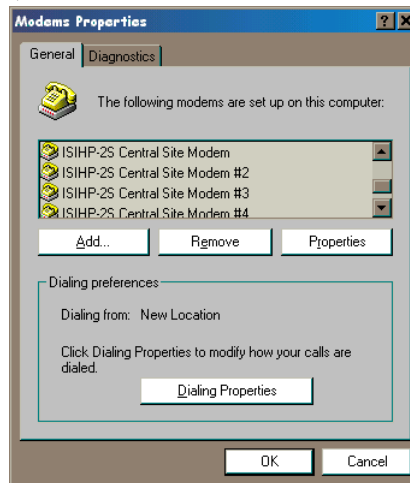


Software/Driver Installation (Windows 95/98)

- Return to the **General** tab to view COM port assignments (and make changes if necessary).



- Click **Add** and repeat installation steps 2–8 to install modems to the last three ports of the ISIHP-2S/2U (OR the last seven ports of the ISIHP-4S/4U).



Now you are ready to configure the terminal adapters.

Removing the Driver (Windows 95 only)

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 screen 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 the 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 95/98 and Windows NT.
- **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 online manual.

North American Users

Before you connect the ISIHHP-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

Software/Driver Installation (Windows 95/98)

central office. You can set the TA to NET3, AT&T 5ESS, NT DMS-100, or US National ISDN-1. 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!NI= and AT*!NI=*

Note: SPIDs only apply for North American switch types.

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 Settings” below.

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: SD*
- *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 adaptation 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.
V.110 Protocol— a rate adaptation protocol that adapts the rates of slower asynchronous terminals to the data rate of the ISDN B-channels. 9600 bps V.110 connections are supported by the ISIH products for compatibility with digital calls originating from GSM networks.

Software/Driver Installation

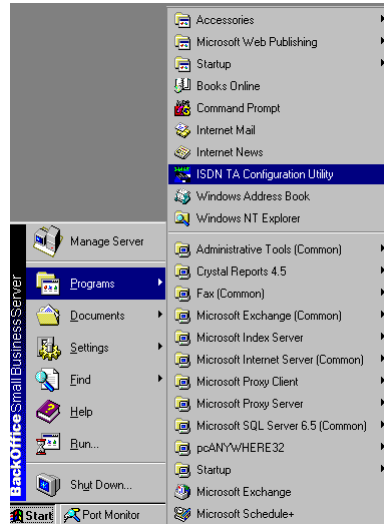
X.75 Protocol— The ISIH P uses layer 2 of the X.75 protocol as an error correction protocol on the B-channel.

- *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*

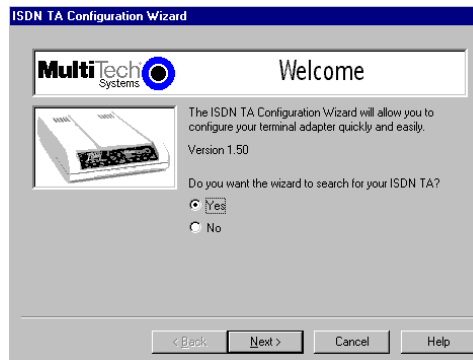
ISDN TA Configuration Utility

1. 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**.
2. Insert the Config Utility diskette into the floppy drive.
3. From the main desktop of your PC, select **Start, Settings, Control Panel**. Click on the **Add/Remove Programs** icon. Click **Install**.
4. The dialog box **Install Program** from Floppy Disk or CD-ROM appears. Click **Next**. The **Run Installation Program** dialog box appears. Click **Finish**.
5. The Welcome dialog box for the ISDN TA Configuration Utility Setup program appears. Click **Next**.
6. The **Choose Destination Location** dialog box appears.
7. The **Setup** dialog box appears.
8. The **Information** dialog box appears. Click **OK**.
9. Click **Start, Programs**, and then the **ISDN TA Configuration Utility** icon.

Software/Driver Installation

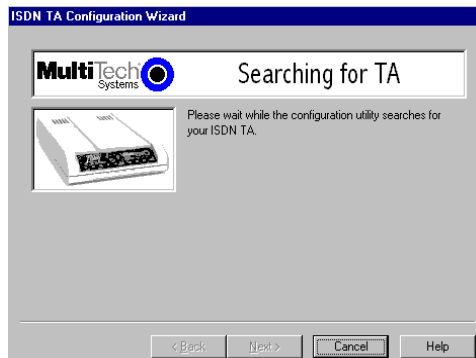


10. The **Welcome** dialog box appears. Click **Next**.

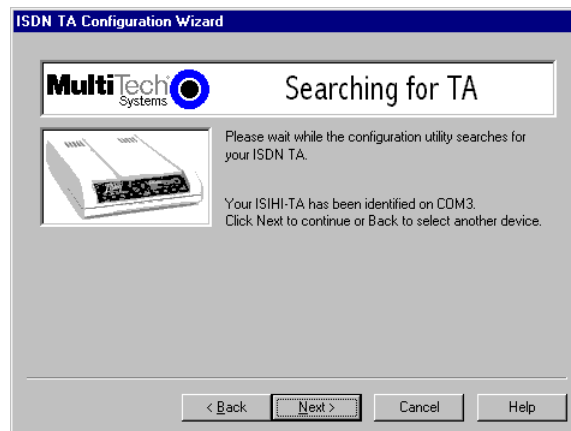


Software/Driver Installation

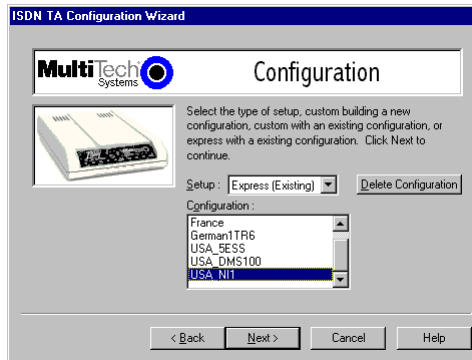
11. The **Searching for TA** dialog box appears. Click **Next**.



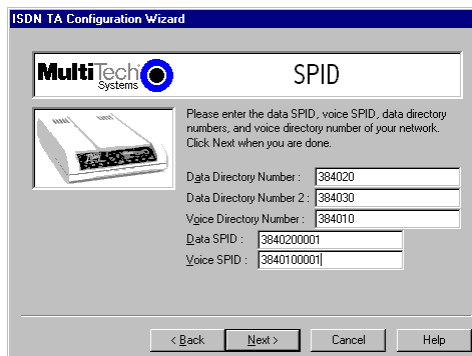
The next dialog box specifies the TA that has been identified.



12. The **Configuration** dialog box appears. If you have questions about choices, click **Help**. After entering information in each dialog box, click **Next**.

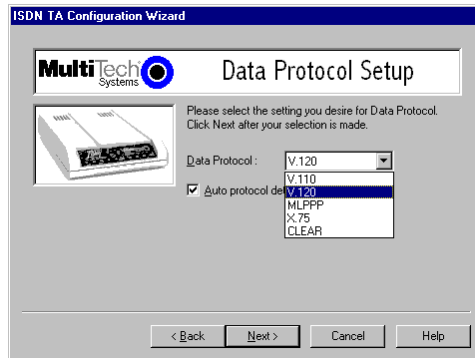


13. The **SPID** dialog box appears (North America only). Referring to your network configuration notes, enter the appropriate information; then click **Next**.

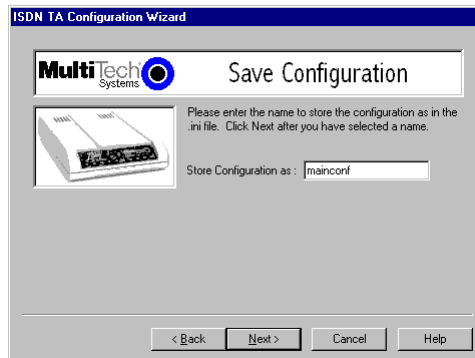


Software/Driver Installation

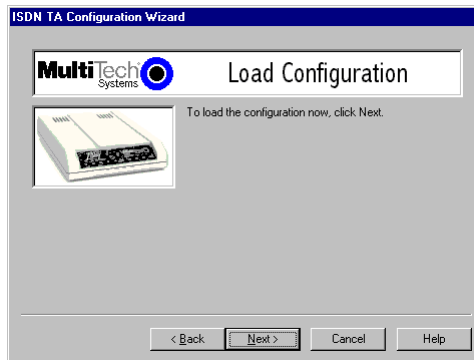
14. The **Data Protocol Setup** dialog box appears. Referring to your network configuration notes, enter the appropriate information; then click **Next**.



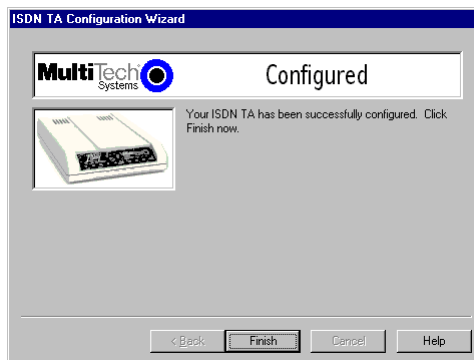
15. In the **Save Configuration** dialog box, enter a name to store the configuration. Then click **Next**.



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



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



Software/Driver Installation

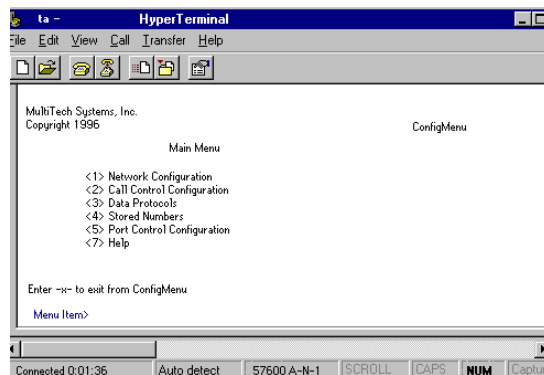
18. The first TA now is configured. Click **Back** to return to the **Configuration** dialog box and repeat steps 4 through 9 to configure the remaining TA(s). If you install multiple ISIHP cards in the same PC, you must configure two TAs per 2S or 2U card installed or four TAs per 4S or 4U card. For example, if you install four ISIHP-2S/2U cards in one PC, you have to configure eight TAs (two per card).
29. After all TAs are configured, close the ISDN TA Configuration utility.

ConfigMenu Configuration Utility

The ConfigMenu configuration utility can be used as another means of configuring the TA. 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 by typing **x** and pressing **Enter**.
5. You will be prompted to decide whether to save the configuration when you exit the ConfigMenu program. Type **y** to have ConfigMenu automatically save the configuration.

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 Protocol Menu—changes 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 ISIHIP's firmware version numbers.

Terminal Adapter 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. Start a data communication program and select the first and third COM ports to be configured.
2. Referring to records made for your system, enter AT commands in the terminal window of the data communications program.

Software/Driver Installation

3. When you finish, use the **&W** command to save your new configuration and to select it to load automatically when the ISIHP is turned on.
4. Close the data communications program.

For more information, see the chapter on *AT Commands and S-Registers* in this manual.

NetWare Connect (Novell) Driver Installation *{2S/2U models only}*

Multi-Tech Systems provides AIO drivers for the ISIHP-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, you can use the following command:

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

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

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

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

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)

In 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 describes 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. Insert the driver diskette into a floppy drive. 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 specify 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**. (**Comsco** is a sample server name.)
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 that you are installing the Multi-Tech Serial Card Driver and prompts you to select the type of installation.
7. (A) In version 5.0.2, select **Full Installation** and press **ENTER** to continue. The following messages appear:
Extracting Files...
Executing Multi-Tech Serial Card
Driver Init Script...
(B) In versions 5.0.4 and 5.0.5, press **ENTER** twice, or tab down to 'install' and press **ENTER**.
8. When installation finishes, this prompt appears:
Do you wish to continue (y / n / q) : ?
Type **Y** and press **ENTER**. A message appears and you can begin configuring your system with the MultiTech Installation Script.

MultiTech Installation Script

The Multi-Tech Installation Script for SCO Open Server 5 systems requests information about how many boards you want to install, designations for communication ports and printer ports, and how many pseudo devices you want to create for Multi_View utility. Based on this information, the appropriate driver files will be installed and linked with your system's kernel.

1. This text appears on the screen:

```
You can install up to 4 ISA/PCI cards in a
system. The PCI cards will be autodetected on
bootup. Enter the number of ISA cards you
want to install and configure on your system
(0-4) :
```

Select 0 , which indicates that your computer has a PCI bus and can autodetect the ISI cards.

2. The following text appears on the screen:

```
Multi_View is a utility which will allow you
to have multiple sessions on terminals that
have multiple pages of physical memory. In
order for this utility to work with
MultiTech's serial cards, pseudo devices have
to be created in your /dev directory. These
devices are system-wide resources.
```

```
Enter the number of pseudo-devices to be
created for the use of Multi_View utility
(1 - 256) .
```

The Multi_View utility initializes the multiple-page capability of terminals with multiple pages of memory. The number specified here is the total number of devices (between 1 and 256) available to all Multi-Tech terminals and it's the number of pseudo devices available to the Multi_View utility.

Specify 8 pseudo devices for each ISIH-2S or -2U card installed; specify 16 for each ISIH-4S or -4U card installed.

For example, if the computer contains three ISIH-4S cards, you would enter 48.

Software/Driver Installation

3. This text appears on the screen and relates to the “/dev” directory.

```
This script also creates the devices in your
system to communicate with the ports of
ISICOM. The default prefix for the tty ports
is ttyl. The default prefix for the printer
is prnl. Is this acceptable? (y/n/q).
```

For most users, it's best to select **y**, which entails accepting the default values. Then proceed to step 4.

Details for use of non-default port/printer values. 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 with other devices known to your system. If a device name has already been assigned to an existing device and the operator assigns that name to a new device, then the existing device will be *deleted* when the ISI port using its name is created.

- a. To use a non-default base name, type **N** and then enter a basename having less than five characters. The base name you select will be used for all ports on each card you install. ISI port designations will have this form:

[basename prefix][board number][port letter].

basename: Length is one to four characters.

board number: Values will be 1, 2, 3, or 4, depending on how many ISI cards are installed in your computer.

port letter: Use letters A through H.

In SCO UNIX, values A-H indicate modem ports.

Device basename selected: _____

- b. After you select a device basename, 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). Specify a unique printer base name (printer parameters are outlined in the Multi_Setup Utility section in this manual).

Printer base name selected: _____

When you have specified the device base name and the printer base name, press **Enter** to continue.

4. The confirmation screen lists the values you have selected. The following text appears on the screen (default values are shown):

```
You have chosen the following setup
The tty prefix is ttyl.
The printer prefix is prnl.
Number of Multi_View pseudo devices
[user-specified number].
```

If these values are correct, type **Y** and the installation process will continue. If there is an error in any of the values displayed, type **N** and the first screen displays. Then re-enter 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. After the terminals have been added to the Terminal Control database, and when the display says “**Press <Enter> to continue:**”, then press **ENTER**. When **Installation complete** displays, press **ENTER** again.

5. Select **Host** and press **ENTER** . Remove the diskette from the drive.
6. Select **Exit** and press **ENTER** .
7. To reboot the system (required), enter the following commands:

```
Type shutdown -g0-y and press ENTER
```

OR

```
Type init 6 and press ENTER .
```

Driver installation for the ISIHPC 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

Software/Driver Installation

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 and verify that the firmware for each ISIHP loads successfully. If the firmware for a given ISIHP card does not load, none of its ports will be accessible. (If this happens, see *Multi-Tech's Administrative Utility* section in this manual.)
2. Type the complete name of the first device you want to create in `usr/lib/uucp/Devices`. Substitute the specific base name, board number, and port letter for the generic parameters in the expression `ttylbx`. 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. Example: `tty12A` denotes the second ISI card (2) and the first port on that card (A). The port status can be altered later, but one setting must be selected at this time. The ACU line would read as follows:
`ACU ttylbX - 9600 dialer name`. Replace `b`, `X` and `dialer-name` with appropriate values.
3. Repeat this process for each port on each board you have installed. **Record the setting you select for each port.**
4. Using device names created in the previous section, type the following command for each port you want to activate: **enable ttylbx**
5. 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 `tty1a` and then enable `tty1A`. To change the status of a port, disable the current status (disable `tty1a`) and then enable it for the desired status (enable `tty1A`).

Removing the Driver (SCO Open Server 5)

To remove the Multi-Tech Serial Card Driver, enter the configuration utility (e.g., custom for SCO Open Server 5) and follow 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.

Note: Remove the driver before permanently removing the ISI card from the computer.

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 file **isicom.tar** 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 ISIHP 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 Linux Driver Installation
```

ISIBasex and Irqx represent the base I/O address and IRQ that are passed to the driver at module loading time. See 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 ISIHPCards 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, enter:

cat /proc/ioports

To view busy IRQs, enter:

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, enter **rmmod isicom**. This removes the driver only if no ISI ports are in use.

Software/Driver Installation

Warranty & Service Information

Upgrades and Support

You can access updated versions of firmware, drivers, flash utility programs and other software-related support for ISIHPC server cards via the MultiTech web site and/or the MultiTech FTP site.

www.multitech.com (click Support; click Updates --Modem and ISI Drivers; select operating system; then see **Multiport Card PCI Bus**)

<ftp://ftp.multitech.com> (see Directory ISI Cards)

Service

Multi-Tech has an excellent technical support staff available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this product, call Technical Support at (612) 717-5863. Model and serial numbers are located on the Multi-Tech label on the component side of the ISIHPC. To display the firmware version, type ATII in terminal mode. Software versions are printed on the diskette labels. Before calling Technical Support, note the status of your equipment, including screen messages, diagnostic test results, problems with a specific application, etc.

Warranty and Service Information

Limited Warranty

Multi-Tech Systems, Inc. (MTS) warrants that its products will be free from defects in material or workmanship for a period of two years from the date of purchase, or if proof of purchase is not provided, two 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.

AT Commands and S-Registers

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Modem AT Commands

ISIHP 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

Modem AT Commands & S-Registers

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. 79	D	Dial
Dial Modifiers , p. 79	H	On-hook/off-hook
	L, P, T, W	Command accepted, but has no function
	,	Command accepted, but has no function
	;	Command accepted, but has no function

Modem AT Commands & S-Registers

	! \$ @ ^	Command accepted, but has no function
Phone Number Memory , p. 80	&Z	Store a phone number
	DS	Dial a stored number
Configuration Storage & Recall , p. 81	&W	Store configuration
	&F	Load factory default configuration
	Z	Reset modem
	&Y	Select stored configuration on power-up
Modem Responses (Result Codes) , p. 82	E	Echo command mode characters
	Q	Result codes: enable/disable
	V	Result codes: verbose/terse
	\V	Protocol result code
	X	Result codes and call progress
	&Q	Select asynchronous communications mode
Online Connection , p. 84	B	Answer tone
	C	Carrier control
	F	Echo online data characters
	&G	Guard tones
	-C	Data calling tone
	N	Modulation handshake
	\T	Disable inactivity timer
	Y	Long space disconnect

Modem AT Commands & S-Registers

RS-232 Interface Controls , p. 86	&C	Carrier Detect control	
	&D	Data Terminal Ready control	
	&S	Data Set Ready control	
Error Correction & Data Compression , p. 89	\N0 or &Q6	Non-error correction mode	
	\N3	Auto-reliable mode	
	\N2	Reliable mode	
	%C0	Data compression disabled	
	%C1	Data compression enabled	
Immediate Action , p. 89	A/	Repeat last command I Information request	
	&B	V.32 auto retrain	
	&V	View current configuration	
	&M0	Asynchronous mode	
	&K0 or \Q0	Flow control disabled	
Flow Control , p. 90	&K3 or \Q3	Hardware flow control	
	&K4 or \Q1	XON/XOFF flow control	
	\X0	XON/XOFF no pass-through	
	&J	Auxiliary relay control	
	\J	Enable data buffer control	
	\G	Modem port flow control	
	\K	Set break control	
	Escape Sequences , p. 92	+++AT<cr>	Default in-band escape sequence
		A	Force answer mode

O 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

ISIHP-2S/2U/4S/4U 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:

L	Redial Last Number
P, T	Pulse or Tone Dialing
W	Wait for New Dial Tone
,	Dialing Pause
;	Return to Command Mode After Dialing

Modem AT Commands & S-Registers

!	Flash On-Hook
\$	Detect Call Card Tone
@	Quiet Answer
^	Disable Data Calling Tone Transmission

Phone Number Memory Commands

ISIHP 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 ISIHP-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**

ISIHP-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.

Modem AT Commands & S-Registers

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

Modem Response (Result Code) Commands

ISIHP 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 1
Default: **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 1
Default: **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 1
Default: **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, 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

Modem AT Commands & S-Registers

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, 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, 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

Modem AT Commands & S-Registers

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 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, 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.

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Nn Modulation Handshake

n = 0 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 ISIHP-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.

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&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, 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

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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

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$n = 0$

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**.)

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&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),

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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.

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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.*

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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.

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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

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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 (pulse code modulation) 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 ISIHP'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 ISIHP 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 ISIHP 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.

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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.

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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

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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:

Code	Error Correction
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 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

Terminal Adapter AT Commands & S-Registers

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 ISIH 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 Implementation, p. 107	AT	Attention code
	Return	Command execution

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	+++AT<cr>	In-band escape code
	<break>AT<cr>	Out-of-band escape code
Switch Configuration, p. 108	%A97	Dialing method
	!C0	Switch type
	!C6	SPID 1
	*!C6	SPID 2
	!D3	SAPI-0 data TEI
	*!D3	SAPI-0 voice TEI
	!L	List DN, SPID, TEI,
Data		protocol & switch type
	>Dn	Embedded Protocol Analyzer
	!N1, !N2, !DN1, !DN2, !EN1, !EN2	Data DN/MSN
	*!N1, *!N2, *!DN1, *!DN2, *!EN1, *!EN2	Modem DN/MSN
	!Z=n	Rate adaptation protocol
Serial Port Configuration, p. 114	En	Command mode echo
	L	List telephone numbers
	L5	List current operating parameters
	L6	List S-register values
	L8	Display low level ISDN status
	Qn	Status displays
	Sr=n	Set S-register
	Sr?	Read S-register
	Vn	Terse/verbose result codes
	Xn	Connect messages
	Z	Restore parameters to current power-up profile
	&Cn	DCD (Data Carrier Detect) control

Terminal Adapter AT Commands & S-Registers

	&Dn	DTR (Data Terminal Ready) control
	&En	Flow control
	#Xn	Send Single Multiple Xoff Characters
	&Fn	Load quick setup factory profile
	&Rn	CTS (Clear To Send) control
	&Sn	DSR (Data Set Ready) control
	&V	View port configuration
	&Wn	Store active profile
	&Zn=	Store telephone number
	DSn	Dial a Stored telephone number
	SDn	Persistent DTR dialing
	%En	Escape sequence options
	@P3=	Parity
	@P4=	Data bits
	@P6=	Stop bits
	\$MBn	V.110 Network Rate
Data Call Commands, p. 124	A	Answer
	D	Dial
	H	Hang up
	In	Display product information
	O	Return online
	@Config	Start ConfigMenu

Terminal Adapter AT Commands & S-Registers

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)

Terminal Adapter AT Commands & S-Registers

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 ISIHP-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

Terminal Adapter AT Commands & S-Registers

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.

Terminal Adapter AT Commands & S-Registers

***!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

Terminal Adapter AT Commands & S-Registers

!N1=n DN0

Sets the Data Directory Number /Multiple Subscriber Number (DN/MSN) for data ports 1 and 2. The DN/MSN is a number assigned to the BRI at subscription time by the ISDN service provider. The DN/MSN is a string of up to 25 characters; valid characters are 0-9, the * character, and the # character. If used as an MSN, a subaddress can be added to the number (if one is needed) by using the : character followed by the subaddress number.

!N1=n sets the Data DN/MSN for port 1

!N2=n sets the Data DN/MSN for port 2

Usage: !N1=n

Function: Data DN/MSN

Values: n = 25-character string

Default: null string

Description: Data DN/MSN 1 can be set to the same value as Data DN/MSN 2 and it can also be set to the same value as Modem DN/MSN 1 and/or 2. A call accepted by Data DN/MSN 1 will be routed to TA port 1.

Usage: !N2=n

Function: Data DN/MSN 2

Values: n=25-character string

Default: null string

Description: Data DN/MSN 2 can be set to the same value as Data DN/MSN 1 and it can also be set to the same value as Modem DN/MSN 1 and/or 2. A call accepted by Data DN/MSN 2 will be routed to TA port 2.

Usage: !DNn

Function: Disable Data DN/MSN n

Values: n=1 (disable Data DN/MSN 1),
n=2 (disable Data DN/MSN 2)

Default: All ports are enabled by default

Description: !DNn disables a Data DN/MSN which will effectively disable the associated TA port from receiving any data calls. However, the port will still be able to

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originate data calls. This is useful for applications where a specific port is for dial-out only.

Usage: !ENn
Function: Enable Data DN/MSN n
Values: n=1 (enable Data DN/MSN 1),
 n=2 (enable Data DN/MSN 2)
Default: All ports are enabled by default
Description: !ENn enables a Data DN/MSN which will put it back in service for accepting and originating data calls.

***!N1=n DN 1**

Sets the Modem Directory Number /Multiple Subscriber Number (Modem DN/MSN) for modem ports 1 and 2. The Modem DN/MSN is a number assigned to the BRI at subscription time by the ISDN service provider. The Modem DN/MSN is a string of up to 25 characters; valid characters are 0-9, the * character, and the # character. If used as an MSN, a subaddress can be added to the number (if one is needed) by using the : character followed by the subaddress number.”

*!N1=n sets the Modem DN/MSN for port 1

*!N2=n sets the Modem DN/MSN for port 2

Usage: *!N1=n
Function: Modem DN/MSN 1
Values: n=25-character string
Default: null string
Description: Modem DN/MSN 1 can be set to the same value as Modem DN/MSN 2 and it can also be set to the same value as Data DN/MSN 1 and/or 2. A call accepted by Modem DN/MSN 1 will be routed to the first modem.

Usage: *!N2=n
Function: Modem DN/MSN 2
Values: n=25-character string
Default: null string
Description: Modem DN/MSN 2 can be set to the same value as Modem DN/MSN 1 and it can also be set to the

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same value as Data DN/MSN 1 and/or 2. A call accepted by Modem DN/MSN 2 will be routed to the second modem.

Usage: ***!DNn**
Function: Disable Modem DN/MSN n
Values: n=1 (disable Modem DN/MSN 1),
n=2 (disable Modem DN/MSN 2)
Default: All ports are enabled by default
Description: ***!DNn** disables a Modem DN/MSN which will effectively disable the associated modem port from receiving any modem calls. However, the port will still be able to originate modem calls. This is useful for applications where a specific port is for dial-out only.

Usage: ***!ENn**
Function: Enable Modem DN/MSN n
Values: n=1 (enable Modem DN/MSN 1),
n=2 (enable Modem DN/MSN 2)
Default: All ports are enabled by default
Description: ***!ENn** enables a Modem DN/MSN which will put it back in service for accepting and originating modem calls.

***!Z=n* Rate Adaptation Protocol**

Values: n = 5, 6, 9, or 12
Default: **!Z=9** (PPP)

Selects the rate adaptation 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=6	V.110 protocol
!Z=9	PPP protocol
!Z=12	X.75 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.

***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, 8, 10, 25, 32, 34, 50, 52-57, 75-77, 80; n varies

Default: None

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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.

***Sr?* Read S-Register**

Values: *r* = 0–5 (S1 is read only), 7, 8, 10, 25, 32, 34,
50, 52-57, 75-77, 80; *n* varies

Default: None

Reads the value of an S-register, where *r* is the number of the S-register.

***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* = 0-5

Default: *X2* (Enable all messages) and
(Disable printing CLI with CONNECT message)

Selects the result code messages that 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).

X4 Disables printing Calling Line Identification (CLI) at the end of the *CONNECT* message line. This command does not affect *X0*, *X1*, nor *X2*.

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X5 Enables printing Calling Line Identification (CLI) at the end of the CONNECT message line. This command does not affect X0, X1, nor X2.

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)

Terminal Adapter AT Commands & S-Registers

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.
- &D4*** &D4 will ignore DTR only when answering a data call. If DTR is low when an incoming data call is present, the TA will answer the call. If DTR goes high during that call, nothing will happen. However, if DTR goes high and then drops for the minimum time specified by S25, then the call will be disconnected just as it would with &D1. &D4 is the same as &D1, except that &D4 can answer a data call without DTR and DTR can remain low for the duration of the call. But if DTR goes high, then &D4 will behave like &D1.

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***

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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.
-

Terminal Adapter AT Commands & S-Registers

#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 = 0-4

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.

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

&F1 Profile 1 — V.110 async operation

&F2 Profile 2 — V.120 async operation

&F3 Profile 3 — X.75 async operation

&F4 Profile 4 — PPP async operation

&Rn CTS Control

Values: n = 0, 1, or 2

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

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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 ISIHP-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.

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***&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
```

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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.

SDn Persistent DTR Dialing

Values: n = 0, or 1
Default: *SD0* (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.

SMBn

%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

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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

Terminal Adapter AT Commands & S-Registers

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)
S8	Pause Time for Comma
S10	DCD Drop Time
S25	DTR Drop Time

Terminal Adapter AT Commands & S-Registers

S30	Online Inactivity
S32	Escape sequence timeout
S34	Maximum escape sequence length
S50	Caller line ID (CLI)
S52	Auto-protocol detection
S54	Forces 56KBps B-Channel Data Rate
S55	POTS Port Call Control
S56	Calling Party Number IE Settings
S57	Called Party Number IE Settings
S75	Maximum V110 Network Rate
S76	V110 Network Rate
S77	V110 Network Rate Control
S80	Persistent DTR Dialing Delay

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 (+)

Terminal Adapter AT Commands & S-Registers

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.

S8 Pause Time for Comma

Unit: 1 second

Range: n=0-255

Default: 2 (= 2 seconds)

S8 sets the length of the pause caused by a comma inserted in a dialing command. The default setting is 2 seconds, where each unit is one second.

S8 may be set for up to 255 seconds.

Terminal Adapter AT Commands & S-Registers

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.

S30 On-line Inactivity Timer

Unit: 1 minute
Range: n=0 Does not disconnect
n=1–255
Default: 0 (does not disconnect)

Makes the TA disconnect a data connection if no data is transmitted or received for the specified time. It will NOT cause a POTS call (voice/modem/fax) to disconnect. The timer restarts any time a data character passes through the serial port (either sent or received). Disable the inactivity timer by setting S30=0, which is the factory default setting. S30 currently works for + all protocols EXCEPT V.110.

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.

Terminal Adapter AT Commands & S-Registers

S34 Maximum Escape Sequence Length

Unit: Decimal ASCII code

Range: 0–10

Default: 2

Sets the maximum character length of the escape sequence, not including +++AT. For example, a character length of S34=2 allows two characters after +++AT (e.g., +++ATH0). Conversely, an invalid escape sequence (too many characters placed in the command string) passes through as data (e.g., +++atili2). The maximum length of the escape sequence is 10 characters.

S50 Caller Line ID CLI

Unit: Decimal ASCII code

Range: 0 or 1

Default: 0 (disable CLI)

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

Usage: S52=n; S52?

Function: Auto-Protocol Detection

Unit: Decimal ASCII code

Terminal Adapter AT Commands & S-Registers

Range: n=0—Disable,
n=1—Detect,
n=2—Detect and Select

Default: 1 (Detect)

Enables or disables the ability to identify the reception of V.110, V.120, X.75, or PPP data calls. The TA determines the type of call by checking for protocol information in the SETUP message or by matching protocol information received on the B-channel once connected if no protocol information is available in the SETUP message. Once the protocol is determined, the TA will switch its data protocol to match. Upon disconnect the TA will revert its data protocol selection back to the protocol that was selected before the call was received when S52=1 “Detect”. If S52=2 “Detect and Select”, then the TA will not revert the protocol selection, rather it will keep the detected data protocol as the new protocol selection. “Detect and Select” is useful for applications where the TA receives a call and then the software performs callback. Callback calls should be made with the same protocol that was used by the client so “Detect and Select” enables this possibility. However, if an initialization string or &Fn command is given to the TA that changes the protocol after the disconnection, then “Detect and Select” will not be effective. Make sure no commands are given to the TA that will change the data protocol when using “Detect and Select” if callback is involved to ensure that the callback call uses the correct data protocol.

S54 Force 56 Kbps B-Channel Data Rate

Unit: Decimal ASCII code

Range: n=56 (Kbps) or 64 (Kbps)

Default: 64 (Kbps)

S54 can be used to force a 56 Kbps B-channel data rate in order to make 56 Kbps data calls.

S55 POTS Port Call Control

Unit: Decimal ASCII code

Range: 1, 2, 17, 18

Default: 1

Allows you to set the type of information transfer capability for calls placed from the POTS port either by a telephone, modem, or fax. Some Central Office (CO) switches keep track of the type of line each customer has, and if that line is labeled as a data line (modem or fax), it will not accept a

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speech call originated on that line. However, 3.1 kHz audio information transfer capability is allowed on data lines (modem or fax) by most switches. S55 also lets you define whether a progress indicator information element (which indicates that the origination address of the POTS call is non-ISDN) is sent with the SETUP message for the POTS port call. This may help POTS port calls get through certain CO switches.

- S1** Speech, no progress indicator
- S2** 3.1 kHz Audio, no progress indicator
- S17** Speech, origination address is non-ISDN
- S18** 3.1 kHz Audio, origination address is non-ISDN

S56 Calling Party Number IE Settings

(applies to NET3 [!C0=2] switch type only)

Unit: decimal ASCII code

Range: 128 Disable

Type of Number

0 Unknown,

16 International

32 National

48 Network specific

64 Subscriber

96 Abbreviated

Numbering Plan

0 Unknown

1 ISDN/telephony

3 Data

4 Telex

8 National standard

9 Private

Default: 128 (disabled)

Modifies the value of Octet 3 of the Calling Party Number Information Element that is sent within the SETUP message for data and POTS port (voice/modem/fax) calls. To set a specific number type and numbering plan, select an option from the Type of Number section above and add its value to the value of an option in the Numbering Plan section above. For example, a National/ISDN Calling Party Number IE would be S56=33, where 32 (National) + 1 (ISDN/telephony) = 33 (National/ISDN). If there is no Data Directory Number (for data calls) nor Voice Directory Number (for voice/modem/fax calls), no Calling Party Number IE is sent. By

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default S56=128, which means no Calling Party Number IE is sent.

S57 Called Party Number IE Settings

(applies to NET3 [!C0=2] switch type only)

Unit: decimal ASCII code

Range: 128 Disable

Type of Number

0 Unknown,

16 International

32 National

48 Network specific

64 Subscriber

96 Abbreviated

Numbering Plan

0 Unknown

1 ISDN/telephony

3 Data

4 Telex

8 National standard

9 Private

Default: 128 (disabled)

Modifies the value of Octet 3 of the Called Party Number Information Element that is sent within the SETUP message for a data call and within each INFORMATION message that is sent when dialing from the POTS port. To set a specific number type and numbering plan, select an option from the Type of Number section above and add its value to the value of an option in the Numbering Plan section above. For example, a National/ISDN Called Party Number IE would be S57=33, where 32 (National) + 1 (ISDN/telephony) = 33 (National/ISDN). By default S57=128, which means no Called Party Number IE is sent.

S75 Maximum V.110 Buffer Size

Unit: 1 byte

Range: n=0 (256 bytes),
n=64-255

Default: 0 (256 bytes)

S75 allows the maximum V.110 buffer size to be customized. An adjustable packet size can provide higher compatibility with devices that cannot handle a large delay. Reducing the V.110 buffer size reduces delay.

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S76 V.110 Network Rate

Unit: decimal

Range: n=1—600 bps,
n=2—1200 bps,
n=3—2400 bps,
n=4—4800 bps,
n=5—9600 bps,
n=6—19200 bps,

Default: 6 (19200 bps)

If S77=1, then the network rate of the V.110 connection will match that of S76 (\$MB). If a V.110 call is received and S77=1, then the incoming V.110 network rate must match S76 (\$MB) or the connection will fail. If S77=2 and a V.110 call is received, then the setting of S76 (\$MB) will have no effect on the network rate of that call (see S77 for a description for this case). The value of S76 will change if \$MB is changed and the value of \$MB will change if S76 is changed.

S77 V.110 Network Rate Control

Unit: decimal

Range: n=1 (use \$MB (S76)),
n=2 (use \$MB (S76)) or Auto Sync on Answer)

Default: 2 (use \$MB(S76) or Auto Sync on Answer)

The Network Rate for an originated V.110 call will be determined by S76 (\$MB) for both S77=1 and S77=2. If the Network Rate of the originated call does not match that of the peer device, then the connection will fail if the peer does not support automatic rate synchronization. If the terminal adapter answers a V.110 call, and if S77=1, then the incoming V.110 Network Rate must match that of the S76 register (\$MB) or else the connection will fail. If S77=2, then the terminal adapter will auto-synchronize on the incoming V.110 Network Rate.

S80 Persistent DTR Dialing Delay

Usage: S80=n; S80?

Unit: 1 second

Range: n=1-255 (1-255 seconds)

Default: 5 (= 5 seconds)

Once DTR is detected as present (active high) and other conditions required for the TA to dial are met, a delay of S80 seconds will occur before stored number 0 is dialed. Some conditions include the TA not being in the

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@CONFIG menu, not having a data call present at the time, and Persistent DTR Dialing must be enabled. By default the TA will delay for 5 seconds before dialing when all conditions are satisfied.

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.

Terse	Verbose
0	OK
1	CONNECT
1P	CONNECT/PPP
1PC	CONNECT/PPP COMPRESSED
1T	CONNECT/V.110
1V	CONNECT/V.120
1VC	CONNECT/V.120 COMPRESSED
2	RING
3	NO CARRIER
4	ERROR
5T	CONNECT 1200/V.110
6	NO DIALTONE
7	BUSY
9T	CONNECT 600/V.110
10T	CONNECT 2400/V.110

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11T	CONNECT 4800/V.110
12T	CONNECT 9600/V.110
14T	CONNECT 19200/V.110
28T	CONNECT 38400/V.110
56	CONNECT 56000
56P	CONNECT 56000/PPP
56PC	CONNECT 56000/PPP COMPRESSED
56V	CONNECT 56000/V.120
56VC	CONNECT 56000/V.120 COMPRESSED
56X	CONNECT 56000/X.75
56XC	CONNECT 56000/X.75 COMPRESSED
64	CONNECT 64000
64P	CONNECT 64000/PPP
64PC	CONNECT 64000/PPP COMPRESSED
64V	CONNECT 64000/V.120
64VC	CONNECT 64000/V.120 COMPRESSED
64X	CONNECT 64000/X.75
64XC	CONNECT 64000/X.75 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

Terminal Adapter AT Commands & S-Registers

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 **ATDxxxxxx<cr>**, where xxxxxx 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>

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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.*

Answering Using Call Steering

Call Steering lets you set up the Data DN/MSN numbers and/or Modem DN/MSN numbers so that calls to specific numbers will be “steered” to the respective Data or Modem port. If a DN/MSN is left blank, then the TA assumes the port can accept a call to any number. A port that is given a specific DN/MSN has priority over a port that has a blank DN/MSN. If a port with a specific DN/MSN is busy, then the call will be “steered” to another available port if that port’s DN/MSN matches or is blank.

Otherwise if a port is busy and there is no other available port or no other port that matches the called number, then the TA will report a busy. Data DN/MSN 1 will “steer” calls to the first Data (TA) port. Data DN/MSN 2 will “steer” calls to the second Data (TA) port. Modem DN/MSN 1 will “steer” calls to the first Modem port. Modem DN/MSN 2 will “steer” calls to the second Modem port. Call Steering is useful for applications where specific ports are tied to specific types of applications or equipment. For example, fax software attached to the second modem port should only receive fax calls (and not dial-up calls). To do this one would set Modem DN/MSN 2 to the desired number that will only receive fax calls. If Modem DN/MSN 1 is left blank and the second port is busy, then fax calls will be “steered” to port 1. If this is not desired, then set Modem DN/MSN 1 to a number other than that of the number used for faxes.

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>**.

Terminal Adapter AT Commands & S-Registers

140 MultiModemISI Hybrid Series, ISIH-2S/2U/4S/4U/4SD

Troubleshooting

Troubleshooting

This chapter covers common problems you may have with your ISIHHP and how to solve them. The ISIHHP 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

Troubleshooting

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 ISIHP-2S/2U/4S/4U 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

Troubleshooting

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 ATSO=1 to your TA in terminal mode.

Note: To accept calls while DTR is low, configure the TA to ignore DTR by entering AT&D0<cr>. Configured this way, the TA accepts calls while DTR is low. Otherwise the TA rejects incoming calls until DTR is high while the calls come 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. communicating and set your communications software to use the same parity as the remote communicating and set your communications software to use the same parity as the remote system.

Regulatory Information

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

Regulatory Information

Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty.

8. Manufacturer: Multi-Tech Systems, Inc.
Trade name: MultiModemISI Hybrid
Model number: ISIHI-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.

Regulatory Information

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

Industry Canada

This Class 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.

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

Regulatory Information



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.

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