COURIER™

I-modems with x2

Command Reference

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Overview

This chapter explains how to use this document.

What's this guide for?

Use this Courier I-modem *Command Reference Guide* for detailed information about AT commands and advanced operating system information.

For basic setup and installation information, including DIP switches, jumpers, and LEDs, see the Courier I-modem *Getting Started Guide*.

For more information

To do this	Contact
Download updated I-modem code	http://totalservice.usr.com
Visit the U.S. Robotics web site (U.S.)	http://www.usr.com
Visit the 3Com web site (U.S.)	http://www.3com.com
Visit the U.S. Robotics web site (Europe)	http://europe.usr.com
Visit the U.S. Robotics web site (France)	http:// www.usr.fr
Visit the U.S. Robotics web site (Germany)	http:// www.usr.de
Visit the U.S. Robotics web site (Italy)	http:// www.usr.it
Visit the U.S. Robotics web site (U.K.)	http:// www.usr.co.uk
Visit U.S. Robotics on Compuserve	GO USROBOTICS
Visit U.S. Robotics on America Online	Keyword: USROBOTICS

Documentation conventions

The following conventions are used in this document:

This convention	Means this
bold	You should type this command exactly as shown.
<number>	A number must be added as part of the command.

What's new in this release

Courier I-modem 2.1 has the following new features:

- Auto-Detection of Protocol from B-Channel Data
- Bandwidth On Demand
- Enhanced CAPI support (16 bit and 32 bit)
- Enhanced V.110
- New Configuration Manager
- Party Number Extensions
- T.70NL Protocol
- TurboPPP (Host and Client)
- x2 protocol
- XMODEM software downloads

Using the AT Command Set

This chapter explains:

- Basic AT command rules
- Configuring S-Registers
- Configuring bit mapped S-Registers

Overview

Configuring the I-modem

There are two ways configure the I-modem:

- AT commands
- The *Configuration Manager* (only available to computers running Windows 3.x, Windows 95, Windows NT, or Apple Macintosh)

Installing theI-modem

Before you can use AT commands to configure the I-modem, you must install the I-modem. See the Courier I-modem *Getting Started Guide* for
I-modem installation instructions.

Communications Software

Before you can send any AT commands to your I-modem, you need to put your communications software in Terminal Mode. In Terminal Mode, what you type is sent directly to the I-modem.

General Rules

- Type **AT** before each command and press **<Enter>** after each command. Exceptions: **A/**, **A>,** and **+++**, which require neither **AT** nor **<Enter>**.
- You can leave zeros off commands because a missing numeric parameter is assumed to be a zero. For example, **ATE**

<Enter> is equivalent to **ATE0 <Enter>**.

- You can create compound commands of up to 30 characters between **AT** and **<Enter>**. Spaces don't add to the count, but hyphens and parentheses do.

Here's an example:

AT&K3X2DT5551234 <Enter>

This	Means this
AT	Attention; a command follows.
AT&K3	Disable MNP5 data compression; use only V.42 *bis* compression.
ATX2	Use the X2 result code subset.
ATDT	Dial the following number using tone dialling.
AT<Enter>	Send the commands.

Basic AT Commands

To do this	Command
Reexecute the last-issued command. Do not type AT or press Enter.	**A/**
Repeat the last-issued command until canceled by pressing any key. Do not type AT or press Enter.	**A>**
Attention prefix: Informs the I-modem that a command is coming. AT must precede all commands except A/, A>, and **+++**.	**AT**

Using S-Registers

S-Registers are addresses of places in memory where various timing parameters, re-definitions of selected ASCII characters, and other configuration settings are stored.

Initially, the S-Register settings for each of the templates (&F0, &F1, and &F2) are the same. As with any setting stored in nonvolatile random access memory (NVRAM), however, you can overwrite an S-Register's stored value.

Displaying S-Register Settings

To display	Command	Example
All S-register settings in the NVRAM template	**ATI5**	**ATI5**
The S-Register settings in RAM (the current configuration)	**ATI4**	**ATI4**
The contents of one S-register	**ATS*r*?**	**ATS19?**

Setting an S-Register

To do this	Command	Where
Set S-Register value	**ATS*r*=*n***	· *r* is any S-Register, and · *n* is a decimal number between 0 and 255.
Alternative command for setting bit-mapped registers	**ATS*r*.*b*=*n***	• *r* is the bit-mapped register, and · *b* is the bit, · *n* is 0 (off) or 1 (on).

Important: If you do not follow an S-Register setting with &W, the setting will be retained only until the next reset or power-off.

Setting Bit-Mapped S-Registers

You can set bit-mapped S-Registers using either bits or decimal values.

See Appendix A for more detailed information about bit-mapped S-Registers.

Using Bits

To set S-Registers using bits, specify the S-Register that you want to set, and then indicate which bits you want to turn on (1) or off (0).

Using Decimal Values

To set bit-mapped S-Registers using decimals, add the decimal values of the bits and enter the total.

Displaying List of S-Registers

To do this	Command
Display a list of S-Registers	**ATS$**
View a list of S-Registers as part of the NVRAM's contents	**ATI5**

Dialling, Answering, and Hanging Up

This chapter explains how to:

- Dial with I-modem using AT commands
- Set the I-modem to answer calls using AT commands
- Hang up the I-modem when you want to terminate a connection

Overview

I-modems always make and receive calls over ISDN lines. Dialling, answering, and hanging up are done differently over ISDN than they are over analogue lines.

Differences between Analogue and ISDN Lines

Analogue dialling is done by sending tones or pulses over the line. ISDN devices dial by sending digital signals over the line. Analogue phones ring because they receive a burst of voltage through the line. ISDN devices know they are receiving a call when they receive certain digital signals.

Despite the differences between analogue and ISDN calling, you should not notice any change in the way you make or receive calls using I-modems. You can use commands just as you would when making analogue calls using a modem.

Dialling

To do this	Command	Example
Dial the specified phone number and execute *dial options*.	**ATD*n***	**ATD5551212**

Note: With the exception of the following Dial options, I-modems ignore any commands issued after the D in the same command string.

Setting Dial Options

Using Tone Dial

To make this type of call	Command
Tone dial.	**ATDT**
Pulse dial. Accepted but ignored.	**ATDP**

Note: Tone dial is ignored because it is not necessary for ISDN dialling, but it is accepted for compatibility with today's communication software packages.

Using Pause Dialling

To pause for	Command
The length of time specified by S-Register 8. The default is 2 seconds.	**AT**,
125 milliseconds.	**AT/**

Setting I-modem to Wait for Second Dial Tone

<table>
<tr><th colspan="2">To wait for</th><th>Command</th></tr>
<tr><td colspan="2">Five seconds of silence.
When the I-modem detects at least one ring, it waits for 5 seconds of silence at the other end of the call, and then continues.</td><td rowspan="5">AT@</td></tr>
<tr><th>If these X commands are set</th><th>The I-modem</th></tr>
<tr><td>X2 (or lower)</td><td>Modem returns an ERROR message when it encounters the @ command</td></tr>
<tr><td>X3, X4, or X7</td><td>Accepts the @ command</td></tr>
<tr><td>X5 or X6</td><td>Hangs up when it detects a voice answer</td></tr>
</table>

Return to Command Mode

To do this	Command
Return to Command mode after dialling.	**AT;**
Letters that follow (in an alphabetical phone number). **Note:** If you are including another command after the phone number, use closing quotation marks before the additional command.	**AT”**
Last-dialled number. Start a command with ATDL instead of using A / if you wish to send an I -modem non-Dial commands before dialling again.	**ATL**
The number stored in NVRAM at position *n*, where *n* = 0–9	**ATS*n***

Viewing the last-dialled number

To do this	Command
View the last-dialled number.	**ATL?**

Calling a Device that Can Only Originate Calls

To do this	Command
Reverse frequencies. **Note:** This command allows you to call a device that can only originate calls. It forces the I-modem to dial out at the answer frequency. You can put the R either before or after the number.	**ATR**

Displaying Different Sets of Result Codes

To set the I-modem to display	Command
Display different sets of result codes.	**ATXn**, where n is a value from 0 to 7

Note: See Chapter 6 for more information about the Xn command.

Canceling Dialling

To do this	Press
Stop dialling or stop repeating.	Any key

Redialling

To do this	Command
Reissue the last command. Don't type AT or press <Enter>	**A/**

Repeat Dialling

To do this	Command	Example
Dial a number, wait 60 seconds for a connection, and then hang up. Wait 2 seconds, then redials. Makes a maximum of 10 attempts. To stop the repeating, press any key during the pause between dial attempts. If you press any key while an I-modem is dialling, that dial attempt is canceled but the cycle will continue.	**AT>**	if you know that the device you are calling is frequently busy, include the Repeat command: **AT>DT1234567 <Enter>** or **ATDT1234567> <Enter>**
Dial the last-dialled number and repeat until connect; up to 10 attempts.	**A>**	

Answering Calls

Force Answer Mode

To do this	Command
Force an I-modem to go through the answer sequence when it hasn't received an incoming call.	**ATA**

Auto Answer

You can set an I-modem to receive calls unattended. Load your communications software as you normally do, and set the I-modem to Auto Answer. Also, set your communications software to save incoming messages and / or files.

To enable Auto Answer, send the following command (this example instructs an I-modem to pick up on the first ring):

ATS0=1 <Enter>

> **Note:** You can substitute a higher value. See the S-Register summary in Appendix A, Alphabetic Command Summary.

When an I-modem senses a call coming in, it sends the result code RING to your computer, goes off hook, and negotiates for a connection. If there is no response within 60 seconds, the I-modem hangs up.

> **Note:** You can adjust the 60-second wait-for-connection time using S-Register 7.

If a connection is made, the I-modem sends a CONNECT result code. When the call is disconnected by you or the remote user, the I-modem hangs up and returns the NO CARRIER code.

> **Note:** If S0=0, Auto Answer will be disabled. Send ATI4 and be sure that S0=1–255.

Disabling Auto Answer

To disable Auto Answer, set an I-modem to answer on zero rings with the following command:

ATS0=0 <Enter>

Hanging Up

To end a connection with a remote device, type the following:

***(wait 1 sec)* +++ *(wait 1 sec)* ATH0 <Enter>**

Making International Calls

B*n* and &G*n* apply to analogue international calls above 1200 bps.

To set	**Use this command**
ITU-T answer sequence. This is required to answer all V.34-type calls. Default.	**ATB0**
Bell answer tone. This setting selects HST modulation, but should only be used if an I-modem is not required to answer V.34-type calls. This is used in the United States.	**ATB1**
No guard tone. This is used in the United States and Canada.	**AT&G0**
550-Hz guard tone This is required in some European countries.	**AT&G1**
1800-Hz guard tone. This is required in the U.K. and some Commonwealth countries. &G2 requires the B0 setting.	**AT&G2**

Note: Guard tone (&Gn) applies only to analogue overseas calls at 2400 or 1200 bps. British phone switching systems require devices to send an 1800 Hz guard tone after they send an answer tone. Some other European phone networks require a 550 Hz guard tone. Guard tones are not used in the United States or Canada.

Setting the Period Dial Modifier

The period ('.') dial modifier is used to send DTMF tones after the telephone number is dialled. The period dial modifier can be used with the comma (',') dial modifier to insert delay between the numbers as appropriate for the application. A typical application for the period dial modifier is use with PBX systems.

Example: **ATDT18479335200.980234**

In this example, 18479335200 will be dialled using ISDN signalling, then 980234 will be dialled using in band DTMF signalling.

Call Detection

I-modems support Call Detection, which allows them to recognize whether an incoming call is analogue data, Fax Class 1, or Fax Class 2.0. It is especially useful for BBSs because it automates recognition of different calls from multiple users.

Call Detection is an optional Service Class 2.0 feature and is also implemented by 3Com for Fax Class 1 applications.

For information on implementing Fax Class 2.0 Call Detection, see the standard listed above.

Working with Memory

This chapter explains:

- Working with memory (RAM, NVRAM, and Flash memory)
- Where information is stored
- Working with RAM, NVRAM, and Flash memory
- How to customize, change, reset NVRAM values

Overview

Each modem contains three types of memory that you can interact with:

- Random access memory (RAM)
- Non-volatile random access memory (NVRAM)
- Flash memory

RAM

RAM holds the settings that apply to the current configuration. Any changes that you make are active until you reset the modem.

NVRAM

NVRAM is *user-configurable*. You can store, retrieve, and change settings in NVRAM. Loss of power will not affect your settings.

Flash

Flash memory holds the modem's operating software. You can upgrade the software held in flash memory by performing a software download.

Where are Settings Stored?

Current Settings

Current settings are saved in working memory (RAM). Any settings that you change and do not save to the modem are active until you reset or power off a modem. View current settings by sending **ATI4**.

Saved Settings

Settings that you save to the modem are stored in non-volatile random access memory (NVRAM). View saved settings by sending **ATI5**.

Permanent Settings

Three templates of permanent settings are stored in Flash memory. For a complete listing of each, see tables 4-3 to 4-5. You can retrieve the permanent settings, and save them to NVRAM, but you cannot alter them.

Working with RAM

You can change any setting just for the current session, as in the following example. The NVRAM configuration remains intact.

ATX6 <Enter>

Working with NVRAM

If you want the new setting to be a default, write it to NVRAM at the same time, as in the following example. X6 is substituted for the X*n* value stored earlier. Any other setting that was changed and can be saved to NVRAM will also be saved.

ATX6&W<Enter>

> **Note:** When writing a different default configuration to NVRAM, insert any additions *after* the &F*n* command but *before* &W. Otherwise, they will be overwritten by &F*n*. Also, be aware that &F*n*&W copies the entire &F*n* template into NVRAM.

Saving a Phone Number to NVRAM

&Zn =s Write the phone number(s) to position (n) in memory. You can store up to ten phone numbers of up to 40 characters each in positions 0-9.

> **Important:** Do not include modem commands in *&Zn=s* .

For example, to store the phone number 555-6789 at position 2, type:

AT&Z2=555-6789 <Enter>

To dial the phone number you saved, type:

ATDS2 <Enter>

If the call requires a special setting, insert it in the command before the DS*n* command. In this example, &M0 (no error control) comes before DS2.

AT&M0DS2 <Enter>

> **Note:** The *&Zn=s* command functions differently when Dial Security is enabled. See Chapter 9, *Dial Security*, for more information.

To view the phone numbers you've saved, type:

ATI5 <Enter>

Saving a Command String to NVRAM

To do this	Command
Store command string *s* in NVRAM. The command string can be up to 30 characters long; spaces do not count.	**AT&ZC=*s***
Display the stored command string.	**AT&ZC?**

Displaying Saved Information

S-Register Value (S*r*?)

This command allows you to view the contents of a particular S-Register, as in the following example that requests the contents of Register S0:

ATS0? **<Enter>**

Phone Number (&Z*N*?)

At this command, the modem returns the phone number stored in NVRAM at position *n*, as in the following example that includes a sample response:

AT&Z3? **<Enter>**
5551234

Last-Dialled Number (DL?)

At this command the modem sends the number stored in the last-dialled number buffer:

ATDL? **<Enter>**

Working with Flash Memory

The modem has three configuration templates permanently stored or prepared sets of commands, in the modem's ROM. You can retrieve a template and load it into current memory using the **&F*n*** command.

&F0, &F1, and &F2 restore the default bold S-Registers in Table 0-1, Table 0-2, and Table 0-3.

This template	Allows this flow control	This template is recommended for
&F0	No flow control (low performance).	Compatibility with non-typical computers, older equipment, or software that cannot handle flow control and other features. (This is also known as the fail-safe template)
&F1	Hardware flow control. This template sets the modem to hardware flow control, a fixed serial- port rate, and the highest level result codes.	All systems and software that support Request to Send and Clear to Send, and a fixed serial port rate.
&F2	Software flow control. This template sets the modem to all of the &F1 defaults except hardware flow control. Instead, it substitutes software flow control (XON / XOFF).	Software that doesn't support hardware flow control.

Note: Loading a template into active memory returns *all* the current settings to those defined by the chosen template.

All of the settings in each template are given in Table 0-2, 4-4, and Table 0-1. The settings that change from template to template appear in **bold** type.

If DIP switch 1 is OFF when you power on or reset the I-modem, or if you load template &F0, the &F0 settings take effect.

Table 0-1. &F0 No Flow Control Template.

NVRAM Options	Setting	Description
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium
Speaker control	M1	ON during dial through connect
Result code subset	X1	Basic
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Guard tone	&G0	U.S. / Canada
Transmit data hardware flow control	&H0	Disabled
Rec'd data software flow control	&I0	Disabled
Analogue data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control / sync	&M4	Normal / error control
Link rate select	&N0	Variable
Rec'd data hardware flow control	&R1	Disabled
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Lowest possible connect speed	&U0	Connects at highest possible speed
Break handling	&Y1	Clear buffer, send immediately
Externals only: V.25*bis* clock speed	%N6	9600 bps
Word length*	7	
Parity*	1	Even
DTE rate* (kbps)	9600	_
Disable Party Number	#CID=0	Disabled

Table 0-2. &F1 Hardware Flow Control Template.

NVRAM Options	**Setting**	**Description**
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium
Speaker control	M1	ON during dial through connect
Result code subset	**X7**	Extended. Includes all codes except VOICE
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Guard tone	&G0	U.S./Canada
Transmit data hardware flow control	**&H1**	Hardware flow control
Rec'd data software flow control	**&I0**	Disabled
Analogue data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control/sync	&M4	Normal/error control
Link rate select	&N0	Variable
Rec'd data hardware flow control	**&R2**	Enabled
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Lowest possible connect speed	&U0	Connects at highest possible speed
Break handling	&Y1	Clear buffer, send immediately
EXTERNALS ONLY: Synch Clock Speed	%N6	9600 bps
Word length	**8**	
Parity	**0**	None
DTE rate (kbps)	**19.2**	_
Disable Party Number	#CID=0	Disabled

Table 0-3. &F2 Software Flow Control Template .

NVRAM Options	**Setting**	**Description**
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium
Speaker control	M1	ON during dial through connect
Result code subset	**X7**	Extended. Includes all codes except VOICE
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Guard tone	&G0	U.S. / Canada
Transmit data hardware flow control	**&H2**	Software flow control
Rec'd data software flow control	**&I2**	Enabled
Analogue data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control / sync	&M4	Normal / error control
Link rate select	&N0	Variable
Rec'd data hardware flow control	**&R2**	Enabled
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Lowest possible connect speed	&U0	Connects at highest possible speed
Break handling	&Y1	Clear buffer, send immediately
Externals only: V.25*bis* clock speed	%N6	9600 bps
Word length	**8**	
Parity	**0**	None
DTE rate (kbps)	**19.2**	_
Disable Party Number	#CID=0	Disabled

Saving ROM Templates to NVRAM

Each time the I-modem is turned on, it loads the default settings stored in NVRAM. The default NVRAM template is &F1, but may be changed to &F0 or &F2, based on your needs.

Note: DIP switch settings override AT commands at power-on. Make sure DIP Switch 1 is ON, or the &F0 template will be loaded! If DIP switch 1 is OFF at power-on, the &F0 settings are loaded instead.

You can save any of the three templates as default or save modified versions of them.

To do this	Command
Save the current settings to NVRAM.	**AT&W**

Viewing NVRAM Settings

To view the NVRAM settings, enter **ATI5**.

Saving Templates in NVRAM

To do this	Example
Substitute a default template other than &F1.	To set &F2 as the default template use the following string: **AT&F2&W**
Save a new modified template to the default template.	To modify the default setting for S10 in the default template and save the new default setting to NVRAM, enter the following string: **ATS10=40&W**
Save a new modified template to &Fn.	To modify the default setting for &A in the &F2 template and save the new default setting to NVRAM, enter the following string: **AT&F2&A&W**

Resetting I-modems

To do this	Command
Reset and load the NVRAM settings (when DIP switch 1 is ON).	**ATZ or ATZ!**

Note: When you use ATZ or ATZ!, DIP switch settings take effect immediately.

Modes of Operation

This chapter explains how to use:

- Command Mode
- Online Mode
- Online Command Mode

Overview

You can use AT commands to change your modem settings. However you can only change these settings during certain modes of operation. There are three different modes of operation:

When I-modem is in	**You can**
Command Mode	Send AT commands to the modems while *not* connected to another device.
Online Mode	Not send AT commands to the modems while connected to another device.
Online Command Mode	Send AT commands to the modems while connected to another device.

In order to use AT commands, you must do two things:

1. Establish an EIA RS-232 serial connection with the modem.

2. Run a terminal program such as Hyperterminal, that allows you to communicate with the modems.

Warning: Most communications programs send an initialization string to the modem when you load the program. You should remove your software's initialization string so it does not interfere with the modem's power-on defaults.

Making Sure You Can See What You Can Type

After you establish a terminal session with the modem, type AT and press <enter>. If you do not see the command on the screen as you type or the OK reply from the modem after pressing <enter>, you may need to adjust your modem's local echo settings.

Adjusting Local Echo

To do this	**To do this**	**Use the following command:**
See what you type	Enable local echo (E1)and result codes (Q0).	**ATE1Q0**
Not be able to see what you type	Disable local echo (E0) and result codes (Q1).	**ATE0Q1, or reset the modem.**

Command Mode

The I-modem is in Command Mode when you begin your session.

When in Command Mode, you may enter AT commands.

Online Mode

The I-modem is in Online Mode when you are connected to another modem.

When in Online Mode, you may not enter AT commands.

Online Command Mode

Online Command Mode allows you to issue AT commands while the modem is connected to another modem or DCE.

Entering Online Command Mode

There are three ways to enter online command mode:

- Using the escape code (+++)
- Using DTR signalling

> **Note:** For all settings other than **AT&D1**, the I-modem drops the call if DTR is toggled.

- ATD; command

Entering Online Command Mode Using the Escape Code

Use the escape code (**+++**) to enter online command mode. The escape code must be preceded and followed by a wait time of at least one second of no data transmission. Do *not* use the AT prefix or press Enter.

> **Note:** You can change the characters used to revert to command mode or the wait time by resetting Register S2 or S12.

Entering Online Command Mode Using DTR Signalling

The modem enters online command mode during a call when DTR is toggled.

AT&D1

This parameter must be set *before* going online.

Enter Online Command Mode After Dialling

To have the modem go into online command mode after dialling (assuming that the modem connects) place a semi-colon (;) after the dial string, as in the following example:

ATDT1(847)982-5092;

Ensuring theI-modem will not Disconnect

The I-modem may either enter online command mode or hang up when you send the escape code. Use the chart below to ensure the I-modem will not hang up when you send the escape code:

To ensure that the I-modem will	**If bit 0 of S-Register 14 is set to**	**When you send the escape code, the I-modem will**
Not disconnect	0 (OFF)	Revert to Command mode
Disconnect	1 (ON)	Disconnect

Changing Operating Modes

Use the chart below to change the operating modes:

If you want the I-modem to	**To set bit 0 of S-Register 14**	**Enter this command**
Revert to command mode	OFF (0)	**ATS14.0=0** & W **<Enter>**
Disconnect	ON (1)	**ATS14.0=1** & W **<Enter>**

Leaving Online Command Mode and Returning to Online Mode

There are two ways to return online.

To do this	**Command**
Return online.	**ATO0**
Return online and retrain. **Note:** You might use ATO1 to resynchronize if you experienced errors during a non-ARQ data transfer.	**ATO1**

Controlling Local Echo

There are two *local echo* settings, one for command mode and one for online mode.

This local echo setting	Determines whether
The command-mode	The commands you type appear on your screen.
The online-mode	The data that the I-modem transmits to another device appears on your screen.

Command-Mode Local Echo

To do this	Enter this command
Disable command mode echo.	**ATE0**
Enable command mode echo.	**ATE1**

Online-Mode Local Echo

To do this	Enter this command
Online local echo ON. Sometimes called *half duplex*. As the modem transmits data to a remote system, it also sends a copy of the data to the screen.	**ATF0**
Online echo OFF. Sometimes called *full duplex*. Default.	**ATF1**

Switching Between Data and Fax Modes

To switch to this mode	If you want to set I-modem to make and receive calls from	Enter this command
Data mode	Other modems	**AT+FCLASS=0 <Enter>**
Fax mode (Class 1)	Analogue facsimile devices, such as fax modems and fax machines (handled by fax applications)	**AT+FCLASS=1 <Enter>**
Fax mode (Class 2.0)	Analogue facsimile devices, such as fax modems and fax machines (handled by hardware)	**AT+FCLASS=2.0 <Enter>**

Fax operations require facsimile-compatible communications software that can send or receive Group III faxes. Consult your fax software manual for more information.

The I-modem 's default operating mode is Data mode.

Determining If You're In Data or Fax Mode

To determine whether your I-modem is in Data or Fax mode, type the following command.

AT+FCLASS? <Enter>

The I-modem returns a value of

If the I-modem returns	The I-modem is in this mode
0	Data mode
1	Class 1 Fax mode
2.0	Class 2.0 Fax mode

Controlling Result Code Displays

This chapter explains how to control the display of result codes.

Overview

The following examples offer ways result codes may be used:

Accounting	Service providers may charge different rates to callers depending on the speed at which they connect. The result code is used to log the connect speed (9600, 14400, 19200, etc.) and the customer is charged accordingly
Performance logs	Extended result codes can be used to determine such performance issues as the average connect speed using V.34 modulation. A low average may indicate the need for better phone lines or transmitter level adjustment in the modems.
Statistics	Using result code logging, an administrator can generate statistics such as the number of callers using V.34 modems or the busiest hours during the work week.
Alarms	Using connect messages, a system administrator can be alerted to command errors, loss of dial tone, or unusually low connect rates.
Caller Identification	Using Called Party Number, you screen calls, keep a record of calls, or prevent unauthorized access to your network. Third-party database and telephony applications such as security, call logging, and black-listing applications exploit the caller ID information provided by the I-modem.

Types of Result Codes

When enabled, the modem returns result codes to the DTE or terminal display in response to various modem events:

These result codes	Are returned	Example
Command results	In response to AT commands.	OK and ERROR
Call progress reports	During originate and answer modes.	RINGING, RING, BUSY, NO ANSWER, and NO CARRIER
Connect messages	When the modem makes a connection.	CONNECT Optional settings allow the basic CONNECT message to be appended with various *indicators* that report connection diagnostics such as the speed at which the modems connect, protocol used, and whether the connection is under ARQ (error control).

See the Appendix F for a complete list of result codes.

Result Code Display Commands

The four commands listed below control whether result codes are displayed, and in what format they are displayed.

Command	Does this
Qn	Enables or suppresses the display of result codes.
Vn	Displays result codes in verbal or numeric form.
Xn	Uses a specified set of result codes.
&An	Uses additional specified sets of result codes.

Enabling Result Codes

By default, the I-modem has result codes enabled.

Since there may be some software incompatibility with result codes, you may need to adjust certain settings or contact your software manufacturer for support if you run into problems.

Enabling/Disabling Result Codes

To do this:	Command
Display result codes	**ATQ0**
Suppress result codes	**ATQ1**
Display result codes during originate mode only	**ATQ2**

Using Verbal or Numeric Result Codes

To display:	Command
Numeric result codes	**ATV0**
Verbal result codes	**ATV1**

Extended Connect Message Indicators

Use the &A*n* command to enable extended connect message indicators. The verbal result code is appended with an indicator according to the settings below.

To set this connect message	Command
No additional result code indicators. Use if there is a software incompatibility with these indicators.	**AT&A0**
ARQ indicator. If the modem is set to X0, displayed only if the connection is between 1200 and 21.6K bps. At the remaining connect rates, a setting of X1 or higher is required.	**AT&A1**
Additional V32 / HST modulation indicator.	**AT&A2**
Protocol indicator. Reports HST, LAPM, or MNP and V42BIS or MNP5, V110, V120, X75, SYNC, and NONE. There are no numeric result codes for &A3 protocol indicators. When set to &A3, the modem returns the same numeric result codes as &A2. (Default)	**AT&A3**

Result Code Sets for Xn Values

Most users do not need to change Xn values.

To do this	Command	Example
Display one of the following sets of result codes. (Default = X7)	**ATX*n***	While travelling, if you encounter an unusual dial tone, disable the NO DIAL TONE result code with **ATX5.**

If you encounter an unusual situation, such as an unusual dial tone or ringing (the ring signal in the UK sounds different than the ring signal in the United Stated), you may need to change your Xn settings.

	Setting							
Result Codes	**X0**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**
0/OK	•	•	•	•	•	•	•	•
1/CONNECT	•	•	•	•	•	•	•	•
2/RING	•	•	•	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•	•	•	•
4/ERROR	•	•	•	•	•	•	•	•
5/CONNECT 1200		•	•	•	•	•	•	•
6/NO DIAL TONE			•		•		•	•
7/BUSY				•	•	•	•	•
8/NO ANSWER				•	•	•	•	•
10/CONNECT 2400		•	•	•	•	•	•	•
11/RINGING						•	•	•
12/VOICE						•	•	
13/CONNECT 9600		•	•	•	•	•	•	•
18/CONNECT 4800		•	•	•	•	•	•	•
20/CONNECT 7200		•	•	•	•	•	•	•
21/CONNECT 12000		•	•	•	•	•	•	•
25/CONNECT 14400		•	•	•	•	•	•	•
43/CONNECT 16800		•	•	•	•	•	•	•
85/CONNECT 19200		•	•	•	•	•	•	•
91/CONNECT 21600		•	•	•	•	•	•	•
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•
151/CONNECT 31200		•	•	•	•	•	•	•
155/CONNECT 33600		•	•	•	•	•	•	•
162/CONNECT 56000		•	•	•	•	•	•	•
165/CONNECT 64000		•	•	•	•	•	•	•
Functions								
Wait for Answer (@)				•	•	•	•	•

Table 0-4. Common Result Code Meanings .

Result Code	Meaning
0 / OK	Command has been executed.
1 / CONNECT	Connection with another device.
2 / RING	Incoming ring detected.
3 / NO CARRIER	Carrier Detect has failed, or carrier has been dropped due to disconnect.
4 / ERROR	Command is invalid.
5 / CONNECT 1200	Connection at reported rate. Same meaning for results of 2400 (10), 4800 (18), 7200 (20), 9600 (13), 12000 (21), 14400 (25), 16800 (43), 19200 (85), 21600 (91), 24000 (99), 26400 (103), 28800 (107), 31200 (151), 33600 (155), 56000 (162), or 64000 (165) bps.
6 / NO DIAL TONE	Dial tone not detected during the default 2 seconds, set in Register S6.
7 / BUSY	Busy signal detect; I-modem hangs up.
8 / NO ANSWER	After waiting 5 seconds for an answer, I-modem hangs up; returned instead of NO CARRIER when the @ option is used.
11 / RINGING	The I-modem has dialled; remote phone line is ringing.
12 / VOICE	Voice answer at remote site; I -modem hangs up.

See the Appendix F for a complete list of result codes.

Controlling Rates

This chapter explains how to control serial port rates.

Overview

You can set the I-modem to use fixed or variable *serial port rates* and fixed or variable *connection rates*. Serial port rates pertain to data transferred between your computer and the I-modem. Connection rates pertain to data transferred between the I-modem and the device at the other end of a connection.

Serial Port Rates

Set a fixed serial port rate to get the highest possible throughput and the best performance. Set a variable rate to allow the I-modem to match the connection rate.

Your software must support fixed or variable serial port rates, and must be set to one of the two settings.

Setting 230 kbps DTE Rate Under Windows®

If you are using a Windows® 95 terminal program, you will be unable to set your transmission speed to 230 kbps.

Setting 230 kbps in External I-modems

The I-modem (external only) operates at 230 kbps when appropriate regardless of the transmission speed setting.

> **Note :** Windows does not display the actual data rate for internal I-modems.

To take advantage of the 230 kbps data rate, you may need to purchase a high speed (230 kbps) serial card.

> **Note :** Depending on the serial card you purchase, the actual data rate may not appear correctly in Windows. Consult the serial card documentation if this problem occurs.

Setting Serial Port Rates

Your software may use terms such as *locked serial port* (fixed rate) or *autobaud* (variable rate).

Setting a Variable Serial Port Rate

To set the serial port rate	Command
Variable rates	**AT&B0**

This command allows the I-modem to change its serial port rate to match the connection rate.

Setting a Fixed Serial Port Rate

To set the serial port rate	Command
Fixed rate The I-modem always communicates with an attached device at the rate at which you have set the terminal or software, regardless of the connection rate. The serial port rate must be equal to or higher than the &Nn rate.	**AT&B1**

> **Note :** For the greatest throughput, set the serial port to 230400 (external modem only) , 115200, 57600, or 38400 bps for high-speed calls, and to at least 9600 bps for 2400-bps calls.

Setting a ARQ-Dependent Serial Port Rate

To set the serial port rate	Command
Set the serial port rate as fixed for ARQ calls and variable for non-ARQ calls *when answering only*.	**AT&B2**

To implement this feature, first set your software to the desired rate. Then send the **AT&B2&W** command.

Note : Cooperating software is needed when using &B2.

When the I-modem connects in ARQ mode, it shifts its serial port rate to a rate that you specify using your communications software (for example, 38.4 kbps). If the connection is not under error control, I-modems behave as if they were set to &B0 and switch their serial port rates to match the connection rate of each call.

I-modems store the rate of the command in NVRAM along with the settings. The I-modem checks NVRAM for the specified serial port rate each time it makes an ARQ connection.

When sending subsequent configurations to NVRAM, be sure your software is set to your selected serial port rate so the correct rate is maintained.

Using x2 with I-modem

This chapter explains how to :

- Determine if x2 has been enabled in your I-modem
- Control x2 link speeds
- Control general x2 operation

Enhanced x2 Features

Your I-modem with x2™ has new result codes and the following new features.

To do this	Command
Detemine if x2 is enabled in your modem	**ATI7**
Disable or enable x2	**ATS58**

Note : New x2 features should be transparent to most users. If you are an advanced user, see the sections "Controlling x2" and "Controlling Link Speeds with &N and &U" later in this chapter for detailed information.

How to Tell if x2 is Enabled in Your I-modem

If you aren't sure whether x2 is enabled in your I-modem, use the **ATI7** command to display product configuration information. If x2 is enabled on your I-modem, the following information displays :

```
USRobotics I-modem Configuration Profile...
Copyright, 19xx-96, U.S. Robotics. All rights
reserved.

Product type           US/Canada External
Options                HST,V32bis,Terbo,VFC,V34+,x2
Fax Options            Class 1,Class 2.0
Clock Freq             {Clock Frequency}
Eprom                  256k
Ram                    32k

Supervisor date        06/30/97
DSP date               06/30/97

Supervisor rev         2.1.0
DSP rev                2.1.0

Serial Number          {serial number}

OK
```

Dates, serial numbers, revision numbers, and Clock Frequencies may vary. The most important line is the "Options" line, which lists support for x2.

Obtaining x2

For information about how x2 works, visit the x2 web site at http ://www.usr.com / x2.

UK web site is at http: / / www.usr.co.uk

How x2 Works

For information about how x2 works, visit the x2 web site at http ://www.usr.com / x2

Controlling x2

The I-modem allows you to communicate using x2 Server Mode and x2 Symmetric Mode.

X2 Server Mode

Using x2 Server Mode, you can accept calls from x2 client modems. Using this mode, the x2 client modem that connects to your I-modem can receive data at speeds up to 56 kbps and send data at V.34 speeds.

X2 Symmetric Mode

Using x2 Symmetric Mode, your I-modem can connect at speeds of 56 or 64 kbps in both directions over a 3.1 kHz voice call (*V2=3). For x2 Symmetric Mode to work, our I-modem must connect to a modem using x2 Symmetric Mode, such as another I-modem.

Note : In some areas, 3.1 kHz voice calls over ISDN are cheaper than data calls.

Use the following S58 settings to control x2 :

To do this	Command
Disable x2	**ATS58.0=1**
Force A-law mode	**ATS58.2=1**
Disable Symmetric Mode	**ATS58.3=1**

Controlling Link Speeds with &N and &U

You can use the &N and &U commands to control link speeds.

Note : You cannot use &N and &U to control speeds above 33.6 kbps.

Controlling Link Speeds

You can use the &N and &U commands to control the link speeds of your I-modem. Use the following table to determine how to use &N and &U commands :

To limit the	Use
Highest possible connect speed	**AT&N**
Lowest possible connect speed	**AT&U**
Range of possible connect speeds	**AT&N** and AT&U

The default values for &N and &U are 0. If you change these values, you will limit the speeds at which you can connect. 3Com recommends that you do not alter these values.

Limiting the Highest Possible Connect Speed

The &N command allows you to limit the highest possible connect speed. If a remote modem attempts to connect to your Courier with x2 at a speed higher than &N, your Courier with x2 will not allow it to connect.

To limit the	Command	Where x is
Highest possible connect speed	**AT&N=x**	**A value from 0 to 32**

Limiting the Lowest Possible Connect Speed

The &U command allows you to limit the lowest possible connect speed. If a remote modem attempts to connect to your Courier with x2 at a speed lower than &U, your Courier with x2 will not allow it to connect.

To limit the	Command	Where x is
Lowest possible connect speed	**AT&U=x**	**A value from 0 to 32**

Limiting a Range of Possible Connect Speeds

By setting &N and &U values, you can limit the range of speeds at which your Courier connects. If a remote modem does not connect to your Courier at a range between the speeds designated by the &N and &U commands, your Courier will not allow it to connect.

Note : The link speed associated with the &U argument cannot be greater than the link speed associated with &N argument.

Use the following table to understand the relationship between &U and &N commands :

If &U	And &N	Then your modem
Equals zero	Equals zero	Connects at the highest possible speed.
	Is greater than zero	Connects at the &N speed only.
Is greater than zero	Is greater than zero and greater than &U	Connects at the highest possible speed in the range from &U

&N and &U Command Values

Use the following table for a complete list of &N and &U link speeds and their associated indexes:

Link Speed	**Index**
Highest	0
300	1
1200	2
2400	3
4800	4
7200	5
9600	6
12000	7
14400	8

Link Speed	**Index**
16800	9
19200	10
2160028800	11
2400031200	12
2640033600	13
28800	14
31200	15
33600	16

Note: For x2-mode links, &N and &U are used to constrain the speed of the higher speed direction of the link.

Dial Security

Dial Security is designed to protect networks and data centers from unauthorized access.

Local	The device that is directly connected to the computer you are using.
Remote	The device at the other end of a telephone connection.
Host	The I-modem that receives calls from other devices and provides Dial Security.
Guest	The device that accesses the host.

You can configure up to 10 accounts: one administrative account for you and nine accounts for guest users. The account profiles are stored in the host I-modem's nonvolatile random access memory (NVRAM).

There are two forms of Dial Security; each will be explained later in this chapter:

- Autopass
- Password Prompting

Setting Up Dial Security

Here is a summary of the steps for setting up Dial Security:

1) Set up an account for yourself.

2) Identify your account as the Administrative Account.

3) Set up guest-user accounts.

4) Enable local (host) security.

5) Choose a Dial Security method.

6) Enable Dial Security.

7) Activate the Dial Security settings.

1 **Set up an account for yourself.**

Use any of the 10 available accounts (numbered 0–9) for your account.

Use the %A*n* command to set up user accounts. Figure 0.1 shows the five fields to concern yourself with.

Note: The %A*n* command is automatically written to NVRAM. It does not require you to send &W.

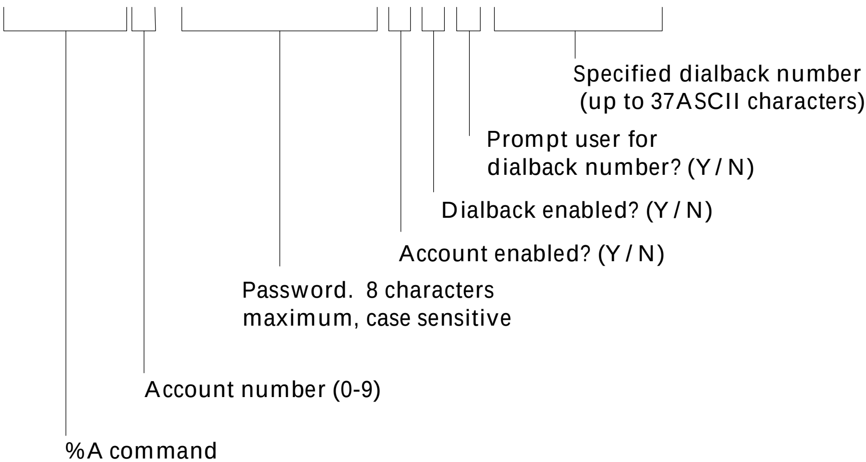


Figure 0.1 Adding Accounts: How to Format the %An command.

Dialback at a Specified Number

To make the host I-modem hang up and then dial back a guest device at a specified number, type:

AT%A0=nanook,y,y,n,17085555555 <Enter>

To enable Dialback, you must enable Dial Security with Prompting in step **6**.

Dialback at a New Number

To make the host I-modem prompt you to enter a number at which to dialback a device, and then have the I-modem dialback at device at that number, type:

AT%A0=nanook,y,y,y, <Enter>

To enable Dialback, you must enable Dial Security with Prompting in step **6**.

No Dialback

To disable dialback, type, for example:

AT%A0=nanook,y,n,, <Enter>

> **Note:** Count your commas! There should always be four commas in the %A command.

> **Warning:** Do not insert spaces between commas or between fields and commas. Spaces will invalidate the command.

2 Identify your account as the Administrative Account.

Identify your account as the Administrative Account using the %L command.

AT%L=PW0 <Enter>

This example sets account 0 as the Administrative Account.

Once you set the administrative password, you cannot view or modify the guest account profiles unless you enter the correct administrative password.

> **Warning:** Be sure to remember your administrative password. If you enable Dial Security and then forget your administrative password, you will be locked out of the I-modem.

3 Set up guest-user accounts.

Use the %A*n* command to set up guest-user accounts in the same way you set up your administrative account. You can set up nine guest accounts (see Figure 9.2).

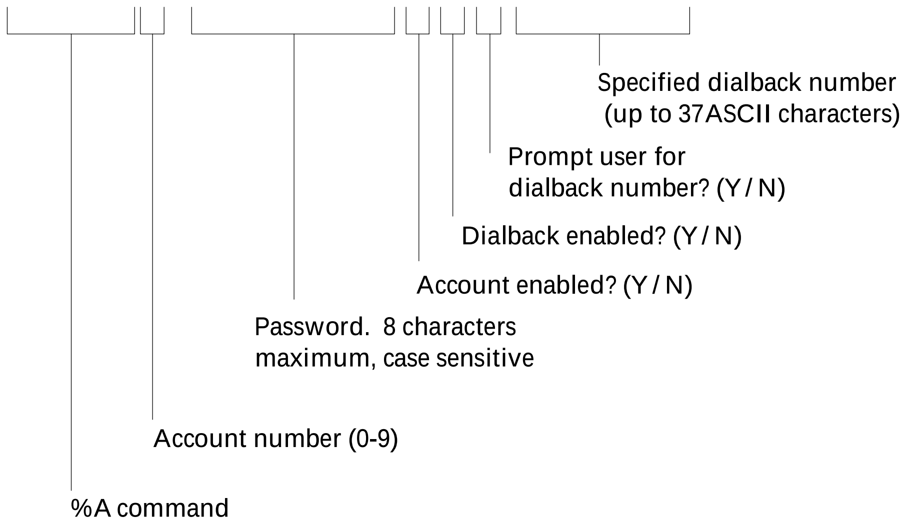


Figure 0.2 Adding Accounts: How to Format the A%n command.

After you have enabled the guest accounts, make sure the guest users know their passwords and the log-in procedure.

Modifying Accounts

After you have set up an account, you can modify each field independently. If a field is to remain as is, just insert a comma, as shown in the following command:

AT%A1=,,,Y, <Enter>

The command above allows the guest user to supply a dialback number that is different from the one stored in the original account record.

4 Enable Local Security.

If you do not enable Local Security, the Dial Security settings will not be protected and other users will be able to change or erase them. Once the administrative password is protected, when security commands are issued, the I-modem will reply [ACCESS DENIED].

ATS53.2=1&W **<Enter>**

5 Decide which Dial Security option to use.

You can choose from two types of Dial Security: **Autopass** and **Password Prompting**.

Autopass

Autopass is the default form of password protection. Autopass automates the process of logging in to the host modem, but it requires close cooperation between the guest and host devices.

Using Autopass requires that:

- Both the host and guest devices are made by 3Com and have Dial Security enabled.
- The connection between the I-modems or modems is under V.42 error control (that is, both modems must be set to &M4 or &M5).

> **Note:** Since V.42 error control is not available for V.120, X.75, clear channel and V.110 connections, Autopass is not available for calls that use those protocols.

When a guest device attempts an Autopass connection, the guest includes its password in its V.42 error-control request. The host modem checks all the enabled passwords in its security accounts for a match.

- **If the guest includes an invalid password**, the host sends an INVALID PASSWORD message and hangs up.
- **If the guest did not enable Dial Security**, the host will not accept the call unless prompting is enabled on the host I-modem.
- **If the guest includes a valid password**, the host permits a

secure connection.

Password Prompting

While the use of Autopass is restricted to 3Com devices with Dial Security, Password Prompting allows connections with any guest device, as long as the guest user knows the correct password.

When host has Password Prompting enabled, it asks guest users for a password. The host modem checks the received password against each of its active Security accounts.

- The host will always respond to a correct Autopass attempt, even if Password Prompting is enabled.
- **If the guest sends an invalid password**, the host prompts twice more before disconnecting.
- **If the guest does not send a password after 60 seconds**, the host disconnects.
- **If the guest sends a valid password within 60 seconds**, the host permits a secure connection.

> **Note:** There is no Password Prompting capability in analogue synchronous mode.

Password Prompting is more flexible than Autopass because:

- Password Prompting doesn't require guest devices to support U.S. Robotics Dial Security.
- Password Prompting doesn't require a V.42 error-control connection.

6 Enable Dial Security.

> **Warning:** Before you enable Dial Security, you must set up an administrative account and password. See Steps 1 & 2.

To enable **Autopass** Dial Security, type:

AT S53.0=1&W **<Enter>**

To enable Dial Security with **Password Prompting** (this also enables Autopass), type:

AT S53.0=1.1=1&W <Enter>

To enable **Dialback Security**, enable **Password Prompting** ***and*** enable Dialback in each guest account (see step **3**).

> **Note:** You must use the &W command to save the settings in NVRAM. If you don't, the next time you reset or power off the I-modem, Dial Security will be disabled.

```
ati10
USRobotics Courier I -Modem with ISDN/V.34

                            DIAL SECURITY STATUS

    DIAL SECURITY ENABLED:[N]  S53.0=1      LOCAL SECURITY ENABLED:[N]  S53.2=1

    PROMPTING ENABLED:[N]  S53.1=1         FORCED AUTOPASS:[N]  S53.0=1

    LOCAL ACCESS PASSWORD:[NO PSW]  %L=PWn  AUTOPASS PASSWORD:[NO PSW]  %V=PWn


ACCOUNT   PSW       PHONE #                        ACCT/E   DIAL/B   NEW_#
   %A      %A          %A                               %A        %A        %A
   #0                                               [N]      [N]      [N]
   #1                                               [N]      [N]      [N]
   #2                                               [N]      [N]      [N]
   #3                                               [N]      [N]      [N]
   #4                                               [N]      [N]      [N]
   #5                                               [N]      [N]      [N]
   #6                                               [N]      [N]      [N]
   #7                                               [N]      [N]      [N]
   #8                                               [N]      [N]      [N]
   #9                                               [N]      [N]      [N]
OK
```

Figure 0.1 The ATI10 Screen. Bold Characters Indicate the Commands Used to Control the Adjacent Fields.

7 Send ATZ or ATZ! to activate the Dial Security settings!

> **Note:** Make sure that DIP switch 1 is ON, which tells the I-modem to load the settings stored in NVRAM. If DIP switch 1 is OFF, the settings in ROM (**&F0**) are loaded, disabling Dial Security.
>
> You can retrieve the Dial Security settings by setting DIP switch 1 ON and then resetting the I-modem using ATZ or **ATZ!** or by powering off the I-modem and powering it back on.

Maintaining Security Accounts

Once the administrative password is set and Dial Security is enabled, the administrator is the only one who can access account information.

To modify or change account information, use the %S= and %E= commands described on the next page.

Accessing Account Information (%S)

Once Dial Security is enabled, you can access accounts by entering the local access password using the %S= command, which allows access to the accounts by disabling local security.

AT%S=*administrative password*<Enter>

> **Note:** The device echoes the administrative password, which is case-sensitive. I-modems will accept an invalid password entry, but will lock out users from the security commands.

For example, if the password is Green, but you enter GREEN, an OK is displayed. However, if you try to type a security command (for example, ATI10 <Enter> to view accounts), an [ACCESS DENIED] message is displayed.

Account Status

Once access has been granted, you can view account information by typing:

ATI10 <Enter>

Remote users may only use this command during a remote-access session if local-access security is disabled.

Erasing Account Information

To set the I-modem to	Command
Erase local-access password.	**AT%E=1**
Erase Autopass password.	**AT%E=2**
Erase passwords in accounts 0–9.	**AT%E=3**
Erase phone numbers in accounts 0–9.	**AT%E=4**
Disable Account, Dialback, and New Number fields in accounts 0–9.	**AT%E=5**

To edit or overwrite an individual account or an individual account field, use the %A*n*= command described in *Setting Up Dial Security* on page 47.

Remote Configuration

Dial Security accounts may be configured remotely. (See *Configuring Dial Security Remotely* at the end of this chapter.)

What the Guest User Needs to Do

When guest users want to call in to the host (assuming you have enabled Dial Security by entering ATS53.0=1),

- They must know the password.
- If you have enabled Dialback, they must set their device to auto-answer.

1 If the host has security enabled, get a password from the host's administrator. The password is case-sensitive, so be sure to copy it correctly.

If the host has prompting enabled and the host operator enables Dialback for your account, skip to Step 3.

2 For guest users with Courier modems only:

a Create a security account using the password the host's administrator asked you to use. (See *Setting Up Dial Security*, earlier in this chapter, for instructions.)

b Using the %V command, assign the password as your Autopass password. Enter the following command, where *n* is the number of the account you set up:

AT%V=PW*n* <Enter>

c Check to see that you've set your Autopass password correctly by typing the following command:

ATI10 <Enter>

Your Autopass password appears beside AUTOPASS PASSWORD.

d Once the Autopass password is set, enable ***your*** Courier's Dial Security by sending the following command:

ATS53.0=1&W <Enter>

3 If Dialback is enabled at the host I-modem's site, set your modem to answer the host I-modem when it dials back.

To set your modem to answer the Dialback call, send the following command:

AT S0=1 <Enter>

4 Call the host.

5 To disable Auto Answer, type the following command after the call ends:

AT S0=0 <Enter>

Configuring Dial Security Remotely

The host administrator can configure the host's security settings remotely.

> **Note:** At the host device, you must have previously enabled remote access and assigned a remote-access password that allows view-and-change privileges (see Chapter 8, *Remote Access*). You may want to use your administrative password as your remote-access password.

Dialling In From the Remote Site

1 From the remote site, connect to the host using Dial Security. Once a connection is made, follow the instructions for beginning a remote-access session as described in Chapter 8, *Remote Access*.

2 When remote access has been granted, use the %S= command to access the Dial Security accounts.

You can view the security account information by typing:

ATI10 <Enter>

3 Make any configuration changes and execute them immediately by typing:

AT%C2<Enter>

4 To end the remote session and reactivate Dial Security on the host, reset the guest device by typing:

ATZ <Enter>

> **Warning:** If you do not use the **ATZ** command to end a remote-access session, Dial Security will remain disabled at the host, and anyone dialling in to the host for remote access will have access to the I10 screen and all Dial Security accounts.

Flow Control

The I-modem has two *buffers*, one for data transmitted from your computer, and one for data received from the phone line. Buffers are data-storage areas of variable size.

Flow control provides a system for stopping and starting transmission depending on how full the buffers are. Its goal is to prevent overfilling the buffers and losing data.

There are two kinds of flow control: hardware and software. I-modems support both, but your computer and communications software must also support the kind of flow control you choose.

Note: We recommend that you use hardware flow control. If you do, depending on your communications software, you may also need to *disable* your communications software's software flow control.

Hardware and Software Flow Control

Hardware Flow Control

I-modems implement hardware flow control by detecting that a buffer is 90% full and then interrupting the Clear to Send (CTS) signal to stop the flow of data. When the buffer is 50% full, the I-modem sends CTS to restart the flow of data.

Software Flow Control

I-modems implement software flow control by detecting that a buffer is 90% full and then sending special characters in the data stream to stop the flow of data. When the buffer is 50% full, the I-modem sends special characters in the data stream to restart the flow of data.

The problem with software flow control is that the characters used to stop (<Ctrl>Q) and start (<Ctrl>S) the flow of data can occur naturally in the data flow. Enabling software flow control instructs the I-modem to recognize and act on these characters, even if they are not intended to control the data flow.

Using software flow control *may* prove satisfactory if you're transferring text files only.

If you use software flow control and are transferring non-text (binary) files or using an XMODEM-type protocol, disable flow control entirely using the &R1 and &I0 commands described in this section. In addition, set the serial port and connection rates equal using the &B0 and &N0 commands described in Chapter 7, *Controlling Data Rates*.

The start command is called XON (for transmit on) and the stop command is called XOFF (transmit off). You can change the characters used. See Registers S22 and S23 in Appendix A, *Alphabetic Command Summary*. Appendix B includes an ASCII chart, which you may find helpful when setting the S-Registers.

Received and Transmit Data Flow Control

Received-Data Flow Control

The default flow control settings are &R2 &I0, which turns hardware flow control on and software flow control off for received data.

Altering hardware flow control for received data

To set I-modem to	Command
After sending the Request to Send (RTS) signal, pause before sending CTS. The delay is required by some synchronous mainframes and does not apply to asynchronous calls.	**AT&R0**
Ignore the RTS signal. &R1 is required if your computer or software does not support RTS.	**AT&R1**
Default. Hardware flow control enabled. The I-modem sends data to your computer only upon receipt of the RTS signal.	**AT&R2**

Altering software flow control for received data

To set the I-modem to	Command
Disable software (XON / XOFF) flow control. Recommended for non-ARQ (Normal mode) calls, but see &I5. While the I-modem is online, the only characters it recognizes are **+++**, the escape code.	**AT&I0**
Enable software (XON / XOFF) flow control. Use in ARQ mode only. Keep in mind that the XON / XOFF characters sent to the remote computer may interfere with XON / XOFF signalling between the remote computer and remote device. See &I2.	**AT&I1**
The I-modem acts on your XON / XOFF commands, but removes them from the data stream instead of passing them to the remote computer. This ensures that the remote computer does not confuse your XON / XOFF characters with those from its attached device. This is the recommended setting for ARQ mode. If the call is not in ARQ mode, there is no flow control on the link. If you send an XOFF to your modem and it stops passing data, it has no way to tell the remote computer and modem to stop sending for a while, and the I-modem's buffer may overflow. For more reliable control in non ARQ mode, see &I5.	**AT&I2**
Hewlett Packard–Host mode. Applies only to I-modems attached to an HP mainframe that uses the ENQ / ACK protocol. Use in ARQ mode only.	**AT&I3**
Hewlett Packard–Terminal mode. Applies only to I-modems attached to terminals in an HP system that uses the ENQ / ACK protocol. Use in ARQ mode only.	**AT&I4**

To set the I-modem to	**Command**
Enable flow control when the connection is not under error control. For this to work, the remote device must also have &I5 capability.	**AT&I5**
In ARQ mode, an I-modem set to &I5 operates the same as it does when set to &I2. It acts on your XON/XOFF commands, but does not pass them to the remote system. The error-control protocol enables the devices to control the flow of data on the phone link.	
In non-ARQ mode, an I-modem set to &I5 operates as though flow control were disabled (&I0); it does not look for your typed XON/XOFF commands. However, it does look for XON/XOFF characters *coming in over the phone link.* When the remote device sends XON/XOFF commands, the I-modem either resumes or stops transmitting data over the link and drops the characters from the data stream.	
If both devices are set to &I5, operators at each end can signal the remote device to stop sending, thereby controlling the data flow on the phone link and preventing their own device's buffer from overflowing. At the computer/device interfaces, the devices independently control the flow of data through their Transmit Data (&H) settings.	

Transmit-Data Flow Control

This type of flow control is for data transmitted to the I-modem by its attached computer.

Non-ARQ connections allow the use of error control file transfer protocols, such as XMODEM and YMODEM without flow control.

Altering the transmit-data flow control

To set I-modem to	Command
Disable transmit data flow control.	**AT&H0**
Hardware flow control. Requires that your computer and software support Clear to Send (CTS) at the EIA-232 interface.	**AT&H1**
Software flow control. Requires that your software support XON / XOFF signalling.	**AT&H2**
Use both hardware and software flow control. If you are unsure about what your equipment supports, select this option.	**AT&H3**

Querying

Each channel in the I-modem can display information such as the current settings, product code, and call duration.

The most commonly used inquiry commands are:

To view this information	Command
Current settings	**ATI4**
NVRAM settings	**ATI5**
Link diagnostics summary	**ATI6**
ISDN configuration summary	**ATI12**
Party Number Identification	ATI15

Displaying the Results of a Query

Displaying the Four-Digit Product Code

ATI0 You may need to use **ATI0**, if you have a problem and you call 3Com' Technical Support Department.

```
ati0
6401

OK
```

Figure 0.2 Product Code Command (I0)

Perform a checksum of the ROM

ATI1 Perform a checksum of the I-modem's read-only memory (ROM) and display the results. (This function is used only in factory testing.) The I-modem should always display the same number.

```
ati1
DF90

OK
```

Figure 0.3 Checksum ROM Command (I1)

Testing the RAM

ATI2 Perform a test of the I-modem's random-access memory (RAM) and display either OK (0) or ERROR (4), followed by OK when the test is completed. You may want to use this command if the I-modem appears to be malfunctioning.

Displaying the Banner

ATI3 Display the I-modem's banner, or product title.

```
ati3
USRobotics Courier I-Modem with ISDN/V.34

OK
```

Figure 0.4 Banner Command (I3)

Displaying the Current Configuration

ATI4 Display the I-modem's current configuration

```
ati4
   B0  C1  E1  F1  L2  M1  Q0  V1  X7
   SPEED=115200 PARITY=N  WORDLEN=8
   DIAL=PULSE  OFF LINE   TIMER

   &A3  &B1  &C1  &D2  &H1  &I0  &K1  &L0  &M4  &N0  &R2  &S0
   &T5  &U0  &X0  &Y1  %N6  *C4  *V1=0  *V2=0  *X0=2048  *X1=7
   #CID=0

   S00=001  S01=000  S02=043  S03=013  S04=010  S05=008  S06=002  S07=060
   S08=002  S09=006  S10=014  S11=070  S12=050  S13=000  S14=000  S15=000
   S16=000  S17=000  S18=000  S19=000  S20=000  S21=010  S22=017  S23=019
   S24=150  S25=005  S26=001  S27=001  S28=008  S29=020  S30=000  S31=000
   S32=009  S33=000  S34=000  S35=000  S36=000  S37=000  S38=000  S39=009
   S40=000  S41=000  S42=126  S43=200  S44=015  S45=000  S46=255  S47=000
   S48=000  S49=016  S50=100  S51=000  S52=005  S53=000  S54=064  S55=000
   S56=000  S57=000  S58=000  S59=000  S60=000  S61=000  S62=000  S63=000
   S64=000  S65=000  S66=000  S67=014  S68=000  S69=255  S70=000  S71=000
   S72=000  S73=000  S74=000  S75=000  S76=000  S77=000  S78=000  S79=000
   S80=000  S81=001  S82=001  S83=000

   LAST DIALLED #:

OK
```

Figure 0.5 Current Configuration Command (I4)

Displaying NVRAM Configuration

ATI5 — Display the configuration saved in nonvolatile random access memory (NVRAM). If your I-modem connects to a device that has USR Dial Security and local access enabled, you cannot view the stored phone numbers.

```
ati5
USRobotics Courier I-Modem with ISDN/V.34 NVRAM Settings...

   DIAL=PULSE  B0  E1  F1  L2  M1  Q0  V1  X7
   SPEED=115200 PARITY=N  WORDLEN=8

   &A3  &B1  &C1  &D2  &H1  &I0  &K1  &L0  &M4  &N0  &R2  &S0
   &T5  &U0  &X0  &Y1  %N6  *C4  *V1=0  *V2=0 *X0=2048  *X1=7
   #CID=0

   S00=001  S02=043  S03=013  S04=010  S05=008  S06=002  S07=060  S08=002
   S09=006  S10=014  S11=070  S12=050  S13=000  S14=000  S15=000  S19=000
   S21=010  S22=017  S23=019  S24=150  S25=005  S26=001  S27=001  S28=008
   S29=020  S31=000  S32=009  S33=000  S34=000  S35=000  S36=000  S37=000
   S38=000  S39=009  S40=000  S41=000  S42=126  S43=200  S44=015  S45=000
   S46=255  S47=000  S48=000  S49=016  S50=100  S51=000  S52=005  S53=000
   S54=064  S55=000  S56=000  S57=000  S58=000  S59=000  S60=000  S61=000
   S62=000  S63=000  S67=014  S68=000  S69=255  S79=000  S80=000  S81=001
   S82=001  S83=000

      STORED PHONE NUMBERS
0:                                       1:

2:                                       3:

4:                                       5:

6:                                       7:

8:                                       9:


OK
```

Figure 0.6 Saved (NVRAM) Configuration (I5)

Displaying a Diagnostic Summary

ATI6

Display a diagnostic summary. During a connection, the I-modem monitors and stores information about link operations. When the call is ended, you can request a diagnostic summary.

The duration of the last call or the real time is displayed, depending on the K*n* setting.

For calls under data compression, the number of characters sent may be less than the number of octets sent, due to buffering operations.

```
ati6
USRobotics Courier I-Modem Link Diagnostics...

Chars sent                    0      Chars Received              0
Chars lost                    0
Octets sent                   0      Octets Received             0
Blocks sent                   0      Blocks Received             0
Blocks resent                 0

Retrains Requested            0      Retrains Granted            0
Line Reversals                0      Blers                       0
Link Timeouts                 0      Link Naks                   0

Data Compression       NONE
Equalisation           Long
Fallback               Disabled
Last Call              00:00:00

No Connection
OK
```

Figure 0.7 Link Diagnostics Screen (I6)

Link Diagnostics Settings

Term Used in I6	Meaning
Octets	Compressed data units. If the number of octets is greater than the number of characters sent, the devices probably used MNP5 compression on an already compressed file, and the result was expanded data.
Line Reversals	The number of times HST-mode devices switched the high- and low-speed channels.
Blers	Errors in data and protocol blocks. If there were many block errors, your receiver may have experienced problems on the line.
Blocks Resent	These represent blocks the remote device re-sent due to Blers.
Link Timeouts	Protocol detection problems: Communications were severed momentarily, and the devices probably recovered. This does not indicate the retry timeout.
Link NAKs	Negative acknowledgments (one or more blocks).
Data Compression	Indicates the type of data compression negotiated for the call (V42BIS or MNP5) or NONE. A V42BIS response includes the size of the dictionary and the maximum string length used, for example, 2048/32.
Equalization Long/Short	Status of S15 bit 0; long if bit 0=0, short if bit 0=1.
Fallback	Enabled/Disabled: Indicates whether or not the I-modems negotiated online fallback during the connection sequence. Only reported Enabled when in HST-mode.
Protocol	Indicates the error-control protocol negotiated (LAPM, HST, MNP, or NONE) or SYNC for a synchronous call.
Speed	The rate at which the receiver and transmitter were last operating before disconnecting.
Disconnect Reason	Possible reasons the I-modem hung up. (See Appendix F, Result Codes and Disconnect Reasons, for a complete list of Disconnect Reasons)

Term Used in I6	Meaning
Dial Security Disconnect Reason	Possible reasons the answering I-modem may have hung up during a Dial Security session. (See Appendix F, Result Codes and Disconnect Reasons, for a complete list of Dial Security Disconnect Reasons)

Display the Product Configuration

ATI7 — If you have a problem and call 3Com' Technical Support staff, you may be asked to read this screen.

```
ati7
USRobotics Courier I-Modem Configuration Profile...

Product type           UK ( Country) External
Options                HST,V32bis,Terbo,V.FC,V34+,x2
Fax Options            Class 1/Class 2.0
Clock Freq             20.16Mhz
Eprom                  768k
Ram                    256k

Supervisor date        06/02/97
DSP date               05/17/97

Supervisor rev         2.1.90
DSP rev                2.1.3

Serial Number          219DB337FDKF

OK
```

Figure 0.8 Product Configuration Command (I7)

Displaying Dial Security Account status

I10 For security administrators only, unless local security is disabled (S53=0 or S53.2=0).

```
ati10
USRobotics Courier I-Modem

                            DIAL SECURITY STATUS

    DIAL SECURITY ENABLED:[N]                  LOCAL SECURITY ENABLED:[N]

    PROMPTING ENABLED:[N]                      FORCED AUTOPASS:[N]

    LOCAL ACCESS PASSWORD:[NO PSW]             AUTOPASS PASSWORD:[NO PSW]

ACCOUNT   PSW       PHONE #                              ACCT/E   DIAL/B
NEW_#

   #0     [NO PSW]                                        [N]      [N]
[N]
   #1     [NO PSW]                                        [N]      [N]
[N]
   #2     [NO PSW]                                        [N]      [N]
[N]
   #3     [NO PSW]                                        [N]      [N]
[N]
   #4     [NO PSW]                                        [N]      [N]
[N]
   #5     [NO PSW]                                        [N]      [N]
[N]
   #6     [NO PSW]                                        [N]      [N]
[N]
   #7     [NO PSW]                                        [N]      [N]
[N]
   #8     [NO PSW]                                        [N]      [N]
[N]
   #9     [NO PSW]                                        [N]      [N]
[N]
OK
```

Figure 0.9 Dial Security Account Status Screen (I10)

Displaying a Connection Report

ATI11 3Com Technical Support representatives use to help you solve problems.

```
ati11
USRobotics Courier I-Modem Link Diagnostics...

Modulation                Unknown Speed
Carrier Freq (Hz)         0/0
Symbol Rate               0/0
Trellis Code
Nonlinear Encoding
Precoding
Shaping
Preemphasis (-dB)
Recv/Xmit Level (-dB)     0/0
Roundtrip Delay (msec)
Timing Offset   ( ppm)
Carrier Offset  ( ppm)
x2 Signature

OK
```

Figure 0.10 Dial Security Account Status Screen (I11)

Displaying the ISDN settings

ATI12 Displays the ISDN settings that are stored in NVRAM and gives the current status of the ISDN physical interface and the data link layer.

```
ati12
USRobotics Courier I-Modem ISDN Switch Settings...

   Switch Protocol *W   4                     ETSI NET3
   Multipoint      *M   1                     Multi-point
   Dialling Mode    *O   1                     Overlap Sending mode
   Directory No.   *P1                        Voice Directory Number (DN1)
                   *P2                        Data Directory Number (DN2)
   TEI             *T1  00                    Automatic TEI
                   *T2  00                    Automatic TEI

   Physical Interface:  Inactive
   Data Link Layer   :  Inactive

OK
```

Figure 0.11 ISDN Settings Screen (I12)

Displaying Calling Party Number Status

ATI15 Displays Calling Party Number status.

```
ati15
USRobotics Courier I-Modem Party Number Status...

Calling Party
  Type of Number:
  Numbering Plan:
  Number:

Party Called
  Type of Number:
  Numbering Plan:
  Number:

Charge Advice:

Date:
Time:

Display:
OK
```

Figure 0.12 Calling Party Number Status (I15)

Displaying TurboPPP Settings

ATI16 Displays TurboPPP Settings.

```
ati16
USRobotics Courier I-Modem Turbo PPP Settings...

  *D0=0  *D1=255  *D2=255  *D3=255  *D4=255  *K=1   *P=3  *T=1

   PPP mode                        *P    3    Multi Link Turbo PPP

   Dynamic BW Allocation           *D0   0    Enabled
      2nd link up sample time      *D1   1275 Seconds
      2nd link down sample time    *D2   1275 Seconds
      2nd link up threshold        *D3   255  %
      2nd link down threshold      *D4   255  %

   Compression mode                *K    1    Auto Compression

   Multi Link Tone                 *T    1    Disabled

   *** For PPP set *V2=5. I-Modem is not set for PPP now.***

OK
```

Figure 0.13 TurboPPP Settings (I16)

Displaying Help Screens

I-modems provide seven help, or command summary, screens: basic AT command set, ampersand (&) command set, percent (%) command set, asterisk (*) command set, dial command options (D), octothorpe command set (#) and S-Registers (S).

> **External I-Modems Only:** Help screens are not available when an I-modem makes a synchronous connection using &M1, &M6, or &M7.

Stop/Restart Display

Hold down the Control key and type "S" to stop the display. Press any key to restart the display.

Cancel Display

Hold down the Control key and type “C” or “K” to cancel the display.

Basic Command Set ($)

When you send AT$, the I-modem displays a screen that shows a partial summary of the basic command set. (See Figure 14.1)

```
at$
HELP,  Command Quick Reference (CTRL-S to Stop, CTRL-C to
Cancel)

#$    HELP, Octothorpe Commands      Kn    n=0  Call Duration
Mode
*$    HELP, Star Commands                  n=1  Real Time
Clock Mode
&$    HELP, Ampersand Commands       Ln    n=0  Lowest Speaker
Volume
%$    HELP, Percent Commands               n=1  Low Speaker
Volume
A/    Repeat Last Command                  n=2  Med Speaker
Volume
AT    Command Mode Prefix                  n=3  Hi Speaker
Volume
A     Answer Call                    Mn    n=0  Speaker Off
Bn    n=0  V.32 originate mode             n=1  Speaker On
Until CD
      n=1  HST originate mode              n=2  Speaker Always
On
Cn    n=0  Transmitter Off                 n=3  Speaker Off
During Dial
      n=1  Transmitter On            On    n=0  Return Online
Dn    Dial a Telephone Number              n=1  Return Online
& Retrain
      n=0..9#*TPR,;W@()-                   n=2  Return Online
& Speed Shift
DL    Dial Last Phone Number         P     Pulse Dial
DSn   Dial Stored Phone Number       Qn    n=0  Result Codes
Sent
D$    HELP, Dial Commands                  n=1  Quiet (No
Result Codes)
En    n=0  No Command Echo                 n=2  Verbose/Quiet
On Answer
      n=1  Echo Command Chars        Sr=n  Sets Register "r"
to "n"
Fn    n=0  Online Echo               Sr?   Query Register "r"
      n=1  No Online Echo            S$    HELP, S Registers
Hn    n=0  Off Line (Hang Up)        T     Tone Dial
      n=1  On Line                   Vn    n=0  Numeric
Responses
In    n=0  Product Code                    n=1  Verbal
Responses
```

```
    n=1  Checksum                  Xn    n=0  Basic Result
Codes
      n=2  RAM Test                        n=1  Extended
Result Codes
      n=3  Modem Identification            n=2-7  Advanced
Result Codes
      n=4  Current Settings         Z     Software Reset
      n=5  NVRAM Settings           Z!    Hardware Reset
      n=6  Link Diagnostics         +++   Escape Code
      n=7  Product Configuration    $     HELP,  Command
Summary
      n=10 Dial Security Status
      n=11 V.FC Link Screen
      n=12 ISDN Configuration
      n=15 Party Number Status
      n=16 PPP Configuration

OK
```

Figure 0.1 Basic Commands Help Screen (AT$).

Ampersand Command Set (&$)

When you send AT&$, the I-modem displays a screen that shows a partial summary of the ampersand command set. A second screen, which is activated when you press any key, shows the remaining commands. (See Figure 14.2)

```
at&$
HELP, Ampersand Commands (CTRL-S to Stop, CTRL-C to Cancel)

&An   n=0  Disable /ARQ Result Codes   &Rn   n=0  CTS Follows
RTS
      n=1  Enable /ARQ Result Codes          n=1  Ignore RTS
      n=2  Enable /Modulation Codes          n=2  RX to
DTE/RTS high
      n=3  Enable /Extra Result Codes  &Sn   n=0  DSR Always
On
&Bn   n=0  Floating DTE Speed                n=1  Modem
Controls DSR
      n=1  Fixed DTE Speed                   n=2  Pulse DSR,
CTS=CD
      n=2  DTE Speed Fixed When ARQ          n=3  Pulse DSR
&Cn   n=0  CD Always On                      n=4  DSR = DCD
      n=1  Modem Controls CD                 n=5  DSR Normal
CTS=CD
&Dn   n=0  Ignore DTR                  &Tn   n=0  End Test
      n=1  On-Line Command Mode              n=1  Analogue
Loopback (ALB)
      n=2  DTE Controls DTR                  n=3  Digital
Loopback (DLB)
&Fn   n=0  Load Factory Configuration        n=4  Grant Remote
DLB
      n=1  Hardware Flow Control Cnfg.       n=5  Deny Remote
DLB
      n=2  Software Flow Control Cnfg.       n=6  Remote
Digital Loopback
&Hn   n=0  Disable TX Flow Control           n=7  Remote DLB
With Self Test
      n=1  CTS                               n=8  Reserved
      n=2  Xon/Xoff                    &Un   Lowest Link Speed
Limit
      n=3  CTS and Xon/Xoff                  n=0  Disabled
&In   n=0  Disable RX Flow Control           n=1  300 bps
      n=1  Xon/Xoff                          n=2  1200 bps
      n=2  Xon/Xoff Chars Filtered           n=3  2400 bps
      n=3  HP Enq/Ack Host Mode              n=4  4800 bps
      n=4  HP Enq/Ack Terminal Mode          n=5  7200 bps
      n=5  Xon/Xoff for non-ARQ Mode         n=6  9600 bps
&Kn   n=0  Disable Data Compression          n=7  12000 bps
      n=1  Auto Data Compression             n=8  14400 bps
      n=2  Enable Data Compression           n=9  16800 bps
      n=3  Selective Data Compression        n=10 19200 bps
&Ln   n=0  Reserved                          n=11 21600 bps
      n=1  Reserved                          n=12 24000 bps
```

```
&Mn   n=0  Normal Mode                              n=13 26400 bps
      n=1  Synchronous Mode                         n=14 28800 bps
      n=4  ARQ/Normal Mode                          n=15 31200 bps
      n=5  ARQ Mode                                 n=16 33600 bps
      n=6  V.25bis                                  n=17 33333 bps
      n=7  V.25bis HDLC                             n=18 37333 bps
&Nn   n=0  Highest Modem Link Speed                 n=19 41333 bps
      n=1  300 bps                                  n=20 42666 bps
      n=2  1200 bps                                 n=21 44000 bps
      n=3  2400 bps                                 n=22 45333 bps
      n=4  4800 bps                                 n=23 46666 bps
      n=5  7200 bps                                 n=24 48000 bps
      n=6  9600 bps                                 n=25 49333 bps
      n=7  12000 bps                                n=26 50666 bps
      n=8  14400 bps                                n=27 52000 bps
      n=9  16800 bps                                n=28 53333 bps
      n=10 19200 bps                                n=29 54666 bps
      n=11 21600 bps                                n=30 56000 bps
      n=12 24000 bps                                n=31 57333 bps
      n=13 26400 bps                                n=32 64000 bps
      n=14 28800 bps                          &W    Store
Configuration
      n=15 31200 bps                          &Xn   n=0  DCE
Synchronous Clock
      n=16 33600 bps                          &Yn   n=0  Destructive
      n=17 33333 bps                                n=1
Destructive/Expedited
      n=18 37333 bps                                n=2
Nondest./Expedited
      n=19 41333 bps                                n=3
Nondest./Unexpedited
      n=20 42666 bps                          &Zn=s Store Phone
Number
      n=21 44000 bps                          &Zn=L Store Last Phone
Number
      n=22 45333 bps                          &Zn?  Query Phone
Number
      n=23 46666 bps
      n=24 48000 bps
      n=25 49333 bps
      n=26 50666 bps
      n=27 52000 bps
      n=28 53333 bps
      n=29 54666 bps
      n=30 56000 bps
      n=31 57333 bps
      n=32 64000 bps

OK
```

Figure 0.2 Ampersand Commands Help Screen (AT&$).

S-Registers(S$)

When you send ATS$, the I-modem displays a screen that shows a partial summary of the S-Register functions. More screens, which are activated when you press any key, show the remaining registers. (See Figure 13.3)

```
ats$
HELP, S Register Functions (CTRL-S to Stop, CTRL-C to Cancel)

S0  Ring to Answer On                      S54 Bit Mapped
S1  Counts # of Rings                       1 = Disable 2400
symbol rate
S2  Escape Code Char                        2 = Disable 2743
symbol rate
S3  Carriage Return Char                    4 = Disable 2800
symbol rate
S4  Line Feed Char                          8 = Disable 3000
symbol rate
S5  Backspace Char                          16 = Disable 3200
symbol rate
S6  Wait Time/Dial Tone (sec)               32 = Disable 3429
symbol rate
S7  Wait Time/Carrier (sec)                64 = Disable V.8 Call
Indicate
S8  Comma Time (sec)                       128 = Disable V.8 Mode
S9  Carrier Detect Time (1/10sec)  S55 Bit Mapped
S10 Carrier Loss Time (1/10sec)        1 = Disable 8S-2D
trellis code
S11 Dial Tone Spacing (msec)         2 = Disable 16S-4D
trellis code
S12 Escape Code Time (1/50sec)        4 = Disable 32S-2D
trellis code
S13 Bit Mapped                         8 = Disable 64S-4D
trellis cod
      1 = Reset On DTR Loss            16 = Reserved
      2 = Do Originate in Auto Answer   32 = Reserved
      4 = No Pause Before Result Codes   64 = Reserved
      8 = Do DS0 On DTR                  128 = Reserved
     16 = Do DS0 On Reset          S56 Bit Mapped
     32 = Disable HST                     1 = Disable Non linear
coding
     64 = Disable MNP Level 3            2 = Disable TX level
deviation
    128 = Hardware Reset               4 = Disable Pre-emphasis
S14 Bit Mapped                            8 = Disable Pre-
coding
      1 = Escape Code Hang Up             16 = Disable Shaping
      2 = Result Code Orig Only           32 = Disable V34+
S15 Bit Mapped                            64 = Disable V.34
      1 = Disable High-Freq EQ           128 = Disable V.FC
      2 = Disable Online Fallback  S58 x2 Mode and Remote
Server Xmit
      4 = Disable 450 bps Back Channel    1 = Disable x2
      8 = Reduced Non-ARQ TX Buffer       2 = Disable server
```

```
mode
     16 = Disable MNP Level 4            4 = Force x2 A-law
mode
     32 = Set DEL=Backspace             8 = Disable symmetric
mode
     64 = Unusual MNP-Incompatibility  6 = Enable -6dbm
constellation
    128 = Custom Applications          S67 Misc. ISDN
Configuration
S16 Test Modes                          1 = Reserved
      1 = Analogue Loopback             2 = Fix Connection
Rate for
      2 = Dial Test                              Digital Calls
      4 = Test Pattern                  4 = Connect at 64K
(else 56K)
      8 = Remote Digital Loopback         8 = Route 3.1K Audio
calls
     16 = Reserved                               to Data Port
     32 = Reserved                       16 = Reserved
     64 = Reserved                       32 = Map LEDs to B-
Channels
    128 = Reserved                     64 = Disable B-Chan.
LED Blink
S17 Reserved                                128 = Reserved
S18 &Tn Test Timeout (sec)          S68 ISDN Universal Connect
S19 Inactivity Timeout (min)           1 = Disallow Analogue
Connects
S20 Reserved                                  Over Digital
Connections
S21 Break Length (1/100sec)            2 = Disable Enhanced
S22 Xon Char                                     Universal
Connect
S23 Xoff Char                          4 = Disable Turbo PPP
S24 DSR Pulse Time (1/50sec)          8 = Disable Multilink
Turbo PPP
S25 DTR Recognition Time (1/100sec)   16 = Route Speech calls
to
S26 RTS/CTS Delay Time (1/100sec)                Data Port
S27 Bit Mapped                      32 = Reserved
      1 = V21 Mode                 64 = Disable Dynamic BW
allocation
      2 = Disable TCM                128 = Reserved
      4 = Disable V32                  S69 Bit Mapped
      8 = Disable 2100hz                 1 = Disable External
PnP
     16 = Disable MNP Handshake          2 = Disable Multi-
Link tones
     32 = Disable V.42                        4 = Reserved
     48 = Disable V.42 Detect Phase           8 = Reserved
     64 = Reserved                           16 = Reserved
    128 = Unusual SW-Incompatibility         32 = Data Over
Voice
S28 V32 Handshake Time (1/10sec)             64 = Reserved
S29 Reserved                                128 = Reserved
S30 Reserved                         S79=n Automode Protocol
Sequence
S31 Reserved                              n = 0 X.75, V.120,
Analogue
S32 Reserved                              n = 1 X.75, V.110,
Analogue
```

S33 Reserved	n = 2 X.75, Analogue

```
S34 Bit Mapped                             n = 3 V.120, V.110,
Analogue
      1 = Disable V32bis                   n = 4 V.120, Analogue
      2 = Disable Enhanced V32 mode        n = 5 V.110, V.120,
Analogue
      4 = Disable Quick V32 retrain        n = 6 V.110, Analogue
      8 = Enable V23 Fallback            S80 International
Controls
     16 = Change MR to DSR                 1 = Disable V.120 LLC
     32 = Enable MI/MIC                 2 = Send *Pn as Calling
Party #
     64 = Disable RA Busy Msg           4 = Force Modem Calls as
Speech
    128 = Disable Terbo                 8 = Enable V.110 at
38400 bps
S35 Reserved                             16 = Insert <CR><LF>
between
S36 Reserved                                RING and Calling
Party #
S37 Reserved                                  32 = Reserved
S38 Disconnect Wait Time (sec)                64 = Reserved
S39 Reserved                                 128 = Reserved
S40 Reserved                             S81 X.75 Layer 2
Protocol
S41 # of Allowed Login Attempts                1 = ISO 7776
S42 Remote Escape Code Char                    2 = Reserved
S43 Remote Escape Code Time (1/50sec)          4 = Reserved
S47 Reserved                                   8 = Reserved
S51 Bit Mapped                                16 = Reserved
      1 = MNP/V.42 Disabled in V.22           32 = Reserved
      2 = MNP/V.42 Disabled in V.22bis        64 = Reserved
      4 = MNP/V.42 Disabled in V.32          128 = Reserved
      8 = Reserved                       S82 X.75 Layer 3
Protocol
     16 = Reserved                            1 = Transparent
     32 = Reserved                             2 = T.70 NL
     64 = Reserved                             4 = Reserved
S53 Bit Mapped                                 8 = Reserved
      1 = Enable Dial Security                16 = Reserved
      2 = Enable Autopass Fallback            32 = Reserved
      4 = Enable Local Access Psw             64 = Reserved
      8 = Reserved                           128 = Reserved
     16 = Reserved
     32 = Reserved
     64 = Reserved
    128 = Reserved

OK
```

Figure 0.3 S-Registers Help Screen (ATS$).

Percent Command Set (%$)

When you send AT%$, the I-modem displays a screen that shows a partial summary of the percent command set. A second screen, which is activated when you press any key, shows the remaining commands. (See Figure 14.4)

```
at%$
HELP, Percent Commands (CTRL-S to Stop, CTRL-C to Cancel)

%An=  Security Account Information %L=PWn Security Local
Access Psw
        Command Structure               PWn = (0-9)
%An=pw,acct e,dial b,new#,ph#      %Nn   V.25bis Synchronous
Clock Rate
      n = (0-9)                         n=0  RESERVED
      pw = Password                     n=1  RESERVED
      acct e = Account Enable           n=2   1200 bps
      dial b = Dial Back Enable         n=3   2400 bps
      new# = New Dial Back #            n=4   4800 bps
      ph# = Dial Back Phone #           n=5   7200 bps
%Bn   Remote DTE Data Rate              n=6   9600 bps
      n=0    110  bps                   n=7  12000 bps
      n=1    300  bps                   n=8  14400 bps
      n=2    600  bps                   n=9  16800 bps
      n=3   1200  bps                   n=10 19200 bps
      n=4   2400  bps                   n=11 21600 bps
      n=5   4800  bps                   n=12 24000 bps
      n=6   9600  bps                   n=13 26400 bps
      n=7  19200  bps                   n=14 28800 bps
      n=8  38400  bps                   n=15 31200 bps
      n=9  57600  bps                   n=16 33600 bps
      n=10 115200 bps             %Pn=s Store Remote Access
Pswd
%Cn   n=0  Defer Configuration          n=0  Query Access
Only
      n=1  Revert Configuration         n=1  Full
Configuration
      n=2  Execute Configuration   %Pn?  Query Remote Access
Pswd
%E=n  Erase Account Information         n=0  Query Access
Only
      n=1  Erase Local Access Psw       n=1  Full
Configuration
      n=2  Erase Autopass Psw      %S=   Psw To Grant Local
Access
      n=3  Erase Accounts Psw      %T    Touch Tone
recognition
      n=4  Erase Accounts Phone #  %V=PWn Security Autopass
Psw
      n=5  Erase Accounts Status        PWn = (0-9)
%Fn   Remote DTE Data Format
      n=0  8, No parity
      n=1  7, Mark parity
      n=2  7, Odd parity
      n=3  7, Even parity

OK
```

Figure 0.4 Percent Commands Help Screen (AT%$).

Asterisk Command Set(*$)

When you send AT*$, the I-modem displays a screen that shows summary of the percent command set. The asterisk commands help screen is shown in Figure 14.5

```
at*$
HELP, Asterisk Commands (CTRL-S to Stop, CTRL-C to Cancel)

*Cn        Audio port volume
             n=0 minimum
               :
             n=9 maximum
*D0=n      Dynamic Bandwidth Allocation in MultiLink PPP
             n = 0 Enable Dynamic Bandwith Allocation
             n = 1 Disable Dynamic Bandwith Allocation
*D1=n      Sample Time to increase bandwidth in MultiLink PPP
             n=1-255 5 second units
*D2=n      Sample Time to decrease bandwidth in MultiLink PPP
             n=1-255 5 second units
*D3=n      Threshold utilization level to increase bandwidth
             n=1-100 %
*D4=n      Threshold utilization level to decrease bandwidth
             n=1-100 %
*K=n       Compression in PPP mode
             n = 0 Pass Through Compression
             n = 1 Auto Compression
             n = 2 Turbo PPP Compression
*M=n       Bus Configuration .
             n=0 Point to Point
             n=1 Multipoint
*O=n       Dialling Mode
             n=0 En-Bloc mode
             n=1 Overlap Sending mode
*P=n       PPP mode
             n = 0 Set all PPP related default values
             n = 1 Async to Sync PPP
             n = 2 Single Link Turbo PPP
             n = 3 Multi Link Turbo PPP
*P1=n..n   Voice Directory Number (DN0)
*P2=n..n   Data Directory Number (DN1)
*T=n       Multi Link Tone
             n = 0 Enable tone, for 2nd link
             n = 1 Disable tone, for 2nd link
*T1=nn     Voice channel TEI
*T1=nn     Voice channel TEI
             nn=1-63 Fixed TEI assignment
*T2=nn     Data channel TEI. .
             nn=0    Automatic assignment
```

```
          nn=1-63 Fixed TEI assignment
*V1=n     Voice Bearer Capability (DN0)
            n=0 3.1Khz Audio
            n=1 Speech
*V2=n     Data Bearer Capability (DN1)
            n=0 Auto Detect
            n=1 V.120 Rate Adaption (Fixed)
            n=2 V.110 Rate Adaption (Fixed)
            n=3 Modem/Fax Emulation (Fixed)
            n=4 Clear Channel (external only)
            n=5 Auto Mode PPP
            n=6 X.75 Rate Adaption (Fixed)
*W=n      ISDN Switch Protocol Type
            n=4 ETSI NET3
            n=5 Germany 1TR6
            n=6 France VNx
            n=7 Japan NTT INSnet64
            n=8 Australia TS.013

OK
```

Figure 0.5 Asterisk Commands Help Screen (AT*$).

Dial Commands(D$)

When you send ATD$, the I-modem displays a screen that shows a partial summary of the percent command set. A second screen, which is activated when you press any key, shows the remaining commands. (See Figure 14.6)

```
atd$
HELP, Dial Commands (CTRL-S to Stop, CTRL-C to Cancel)

0-9 Digits to Dial
*   Auxiliary Tone Dial Digit
#   Auxiliary Tone Dial Digit
T   Tone Dialling
P   Pulse Dialling
R   Call an Originate Only Modem
,   Pause (Wait for S8 Time)
.   Wait for a Connection
;   Remain in Command Mode After Dialling
W   Wait for 2nd Dial Tone (X3-X7)
@   Wait for an Answer (X3-X7)


OK
```

Figure 0.6 Dial Commands Help Screen (ATD $).

Remote Access

This chapter explains:

- Remote, host, and guest
- How to set up remote access
- How to access the host
- How to view and change the host's configuration

Overview

You can set up the I-modem so other devices can view or change its configuration remotely.

As the administrator of an I-modem, you might use remote access if you are away from your I-modem and want to make changes to its configuration.

Please review these terms before you continue:

Local	**The device that is directly connected to the computer you are using**
Remote	The device at the other end of a telephone connection.
Host	The I-modem that will be accessed and controlled by other devices.
Guest	The device that will access and control the host I -modem.

Setting Up Remote Access

At the HostI-modem

1 Prepare to send AT commands.

See Chapter 2, *Using the AT Command Set*, for details.

2 Enable remote access.

Set Register S41 for a value of 1 or greater. S41 sets the number of log-in attempts available to the remote user. A setting of zero allows no log-in attempts, disabling remote access.

ATS41=1&W <Enter>

> **Note:** This method will not work if the multiport I-modem is attached to certain synchronous devices. Refer to your *Getting Started* manual.

3 Set one or two remote-access passwords.

You can set two passwords to allow different levels of access to each I-modem. Remote-access passwords can be up to **eight** alphanumeric characters long, and are not case-sensitive.

To assign a	Use this command	Example
View-only password	**AT%P0**	**AT%P0=*password* <Enter>**
View-and-change password	**AT%P1**	**AT%P1=*password* <Enter>**
Display a remote-access password	**AT%P0?<enter>**	**AT%P1?<enter>**
Erasing a remote-access password	**AT%P0=<enter>**	**AT%P1= <enter>**
Disabling remote access	**ATS41=0<enter>**	

> **Warning:** Keep in mind that if you erase the %P1 password without disabling remote access (using ATS41=0), anyone could access the I-modem and change its configuration.

Accessing the Host

At the Guest Device

The guest device requires no configuration to access the host. The guest device does not need to be made by 3Com. Follow these steps:

1 Be sure that the host device has enabled remote access and is set to auto-answer (ATS0=1). Know the password, if you will need one.

2 Call the host device (although it doesn't matter which device originates the call).

3 After a connection is established, do this:

- **a** Pause 4 seconds.
- **b** Type 4 tildes: **~~~~**
- **c** Pause 4 seconds.

> **Note:** The administrator of the host device can change the remote-access character using S-Register 42, and the pause duration using S-Register 43.

4 You should see a display similar to this:

U.S. Robotics Courier I-modem with ISDN/V.34 Remote Access Session
Serial Number 000000A000000001
Password (Ctrl-C to cancel)?

There is a 3-minute time limit for entering the password.

If the number of unsuccessful log-in attempts exceeds the set limit, the host device returns online and refuses any further log-in attempts during the remainder of the connection.

When the host accepts the password, the following message and prompt will appear on your screen:

Remote Access granted

Remote->

> **Note:** You may not be prompted for a password. If you aren't, password security is not active. The following prompt appears on your screen after you type the four tildes: Remote Access granted (query only), and then Remote->.

5 Continue with *Viewing and Changing the Host's Configuration*, later in this chapter.

Keep in mind that there is a 3-minute inactivity timer. If the host device detects no activity for 3 minutes, it quits the remote-access session and resumes a normal online connection.

Also, during a remote-access session, the maximum number of characters between carriage returns is 40.

Quitting a Remote-Access Session

If you want to quit the remote-access login ***before*** you have entered the password, return online by pressing **<Ctrl>C** or typing **ATO<Enter>.** ***After*** you've entered the password, you can quit by sending one of these commands:

- **ATO** ends the remote-access session and keeps the connection.
- **ATH** ends the remote-access session and ends the connection.
- **ATZ** ends the remote-access session, ends the connection, and resets the guest modem.

Viewing and Changing the Host’s Configuration

Once you've gained guest access to a host, you can communicate with the host just as if you were entering commands from its attached computer.

Depending on your access privileges, you can use the regular set of I-modem AT commands (see Table 8-1).

Table 0-1. Access Privileges.

Access Privileges	**What You Can Do**
View-Only	Use any of the inquiry (ATI) commands.
View and Configure	Use any of the I-modem commands, except those that cannot be used while online (for example, ATD or ATA). You can also use *remote configuration* commands.

Note: Do not to send **ATZ** or **ATZ!** or you will lose the connection!

Remote Configuration Commands

There are special commands that can be used only during a remote-access session:

%Bn	Change the host I-modem’s serial port rate.
%F*n*	Change data format (parity and data bits).
%C*n*	Control whether and when to apply changes to the configuration.

Changing the Host-I-modem's Serial Port Rate

To set the I-modem to	Use this command
110 bps	**AT%B0**
300 bps	**AT%B1**
600 bps	**AT%B2**
1200 bps	**AT%B3**
2400 bps	**AT%B4**
4800 bps	**AT%B5**
9600 bps	**AT%B6**
19200 bps	**AT%B7**
38400 bps	**AT%B8**
57600 bps	**AT%B9**
115200 bps	**AT%B10**

Changing data format

To set the I-modem to	Use this command
No parity, 8 data bits.	**AT%F0**
Mark parity, 7 data bits.	**AT%F1**
Odd parity, 7 data bits.	**AT%F2**
Even parity, 7 data bits.	**AT%F3**

Control When to Apply Changes to the Configuration

To do this	Use this command
Defer changes. Any changes you make to the configuration are deferred until the call is ended; they take effect for ensuing connections. (Default.) The changes you make do not take effect until the next connection, the new configuration is reflected immediately in inquiry responses (**ATI*n***).	**AT%C0**
Restore the original configuration. Use this command to cancel any changes made during remote access and restore the original configuration. Commands that have been written to NVRAM (using **&W**) and forced configuration changes (using **%C2**) will not be restored to their previous settings when you send the host %C1.	**AT%C1**
Force configuration changes. Use this command to make configuration changes take effect immediately. We do not recommend forcing changes unless it is absolutely necessary because an unreliable connection, or even a loss of connection, may result.	**AT%C2**

After you make changes to the host's configuration, the remote-access prompt changes from **Remote->** to **Remote+>**.

If you restore the original configuration using %C1, the top prompt is restored, assuring you the original configuration is intact.

Quitting a Remote-Access Session

If you want to quit the remote-access login ***before*** you have entered the password, return online by pressing **<Ctrl>C** or typing **ATO<Enter>**. ***After*** you've entered the password, you can quit by sending one of these commands:

- **ATO** ends the remote-access session and keeps the connection.
- **ATH** ends the remote-access session and ends the connection.
- **ATZ** ends the remote-access session, ends the connection, and resets the guest device.

Upgrading the I-modem's Software

3Com periodically releases updates and enhancements to the I-modem's operating software. We make the software publicly available from our BBS and ftp site.

You can use two methods to upgrade your I-modem:

If you have	**Upgrade your I-modem with**
A MS-DOS-based computer	SDL.EXE
A computer that doesn't support MS-DOS	XMODEM protocol

> **Important:** If you have an internal modem set to Plug and Play, use XMODEM to upgrade your I-modem's software.

To send the new code to the I-modem, all you need is a standard terminal program that can send files using the XMODEM protocol.

Checking Your I-modem's Software Version

Send **ATI7 <Enter>**. The following screen appears:

```
ati7
USRobotics Courier I-Modem Configuration Profile...

Product type            Country
Options                 HST,V32bis,Terbo,V.FC,V34+
Fax Options             Class 1/Class 2.0
Clock Freq              20.16Mhz
Eprom                   768k
Ram                     256k

Supervisor date         06/02/97
DSP date                06/02/97

Supervisor rev          2.1.0
DSP rev                 2.1.0
```

```
OK
```

Check the Supervisor and Digital Signal Processor (DSP) dates. Visit the 3Com web site to find out the current shipping version of the I-modem's software.

Getting New Operating Software

Make Sure You Have the Correct INF File!

CR115UK.INF supports DTE rates up to 115.2 kbps. This file will work with high speed serial cards, but only at speeds up to 115.2 kbps.

To obtain throughput speeds of 230.4 kbps (only for external modems), you must use CRI230UK.INF in conjunction with a serial card that supports 230.4 kbps. If you use the CRI230UK.INF with a system that does not support 230.4 kbps DTE rate, your I-modem will not function properly.

Most PCs do not support 230 kbps DTE rate ; consult the documentation that came with you PC or interface card to determine if the 230.4 kbps DTE rate is supported.

CRI230UK.INF is available on the UK Web site & BBS.

http://x2.usr.co.uk

Downloading the Latest Code

Visit your country's 3Com Total Service Web Site (or http://totalservice.usr.com) and go to the file download area.

Sending Software to the I-modem With XMODEM

1 Start a communications software package, such as Quick Link II or MacComCenter. Adjust the settings, if necessary, so that you can send **AT** to the I-modem and get an **OK** response.

Note: If you are sending the file from a Macintosh computer, make sure that you do not transfer the file in MacBinary format. In MacComCenter, for example, select Setup | File Transfer… Under MacBinary options, select Never MacBinary.

2 Type **AT~X! <Enter>**. The I-modem should respond as follows:

```
at~x!

SDL Xmodem file transfer - (Y)es (N)o (T)est >
```

3 Type **t <Enter>** to start an integrity test of the XMP file.

```
SDL Xmodem file transfer - (Y)es (N)o (T)est >t
* Test Mode - Flash ROM will not be modified*
Begin Xmodem file transfer now.
CC
```

Send the file to the I-modem using the XMODEM-Checksum or XMODEM-CRC protocol. Since this is a test, the I-modem's existing software is not erased.

4 After you’ve completed the test transfer successfully, use your communications software to send the XMP file using the XMODEM-Checksum or XMODEM-CRC protocol.

```
at~x!

SDL Xmodem file transfer - (Y)es (N)o (T)est >y
Begin Xmodem file transfer now.
CC

SDL Xmodem file transfer completed.
Calculating CRC... OK
Resetting modem...OK
```

Once you see the OK response to the Calculating CRC and Resetting modem messages, your software upgrade is complete!

If Your I-modem Doesn’t Respond

These steps apply to all I-modems except the PC card version.

If your I-modem doesn’t respond, its memory may be corrupted. Follow these steps to force the new software to the I-modem.

1 Power the I-modem off.

2 Set DIP switches 1 and 2 off . The settings on the other DIP switches are ignored.

3 Power the I-modem on.

4 Start your communications software package and send the operating software using the XMODEM protocol.

5 Power the I-modem off.

6 Set the DIP switches to their previous settings.

7 Power the I-modem on.

Sending Software to the I-modem With SDL.EXE

1. Go to the DOS prompt.

2. Change to the directory that you placed the SDL file and type **USRDL <Enter>**. This extracts the files to your hard drive.

3. Run SDL by typing **SDL <Enter>**.

   SDL.EXE checks its code. If an error message appears, the operation is terminated; download the file again.

4. Default COM port information is displayed. Alter the defaults based on your system configuration.

5. A prompt asks if you want to "Download Using These Settings? (Y/N)." Enter "Y" to continue or "N" to abort.

   Once you have accepted the settings, the software download begins. If the MS-DOS prompt displays "Modem reports download successful" and the MR LED lights up, you have successfully upgraded your I-modem's software.

Controlling EIA RS-232 Signalling

This chapter explains how to control the following EIA RS-232 signals:

- Data Terminal Ready
- Data Set Ready
- Carrier Detect

Overview

EIA RS-232 Interface

The EIA RS-232 interface deals with the signals and voltages used when data is exchanged between a computer and a serial device, such as a modem, printer, or scanner.

Using the EIA RS-232 interface, you can control the signals that the I-modem uses to interact with your computer.

This signal	Is sent by the	Indicates that the
Data Terminal Ready	Computer to the I-modem	Computer is ready to receive data
Data Set Ready	I-modem to the computer	I-modem is ready to receive data
Carrier Detect	I-modem to the computer	I-modem has received a carrier from a device on the other end of the telephone line

Controlling EIA232 Signalling

Data Terminal Ready

Data Terminal Ready (DTR) is a signal sent from your computer to the I-modem that indicates the computer is ready to receive data.

To set the I-modem to	Use this command
Operate as though the DTR signal is always ON.	**AT&D0**
Use a change in the DTR signal to enter Command Mode. To return online, use the O*n* command, or hang up with the ATH command. Refer to your communication software's manual for details.	**AT&D1**
Respond normally to the DTR signal. The I-modem will not accept commands until your computer sends a DTR signal. The call will end when the DTR signal is dropped.	**AT&D2**

To change the DTR recognition time, set S-Register 25.

Data Set Ready

Note: Do not change the default setting of **&S0** unless you know that your installation requires a different setting.

Data Set Ready (DSR) is a signal sent from your computer to the I-modem that indicates the I-modem is ready to receive data.

To set the I-modem to	Use this command
Send the DSR signal at all times. (Default.)	**AT&S0**
When originating a call, send the DSR signal after dialling when the I-modem detects the remote analogue device's answer tone.	**AT&S1**
When answering a call, send DSR after the I-modem sends its answer tone.	**AT&S1**

To set the I-modem to	Use this command
Work with specialized automatic callback units. After sending CD, send a pulsed DSR signal, followed by a Clear to Send (CTS) signal.	AT&S2
Work with specialized automatic callback units. After sending CD, send a pulsed DSR signal.	**AT&S3**
Send a DSR signal to your computer at the same time the I-modem sends CD.	**AT&S4**
Send DSR signal to your computer (with CTS) after sending CD.	**AT&S5**

To change the DSR pulse time (in 20ms increments), set S-Register 24.

Carrier Detect

The Carrier Detect (CD) signal indicates that the I-modem has received a carrier from a device on the other end of the telephone line.

To set Carrier Detect	Use this command
Always ON.	**AT&C0**
Send CD normally. (Default)	**AT&C1**

Note: Under normal conditions, the I-modem sends a CD signal in response to receiving the carrier from the device on the other end and drops the CD signal when it disconnects.

The I-modem can perform digital and remote digital loopback tests. You can use these tests to check the operations of the transmitter and receiver, or to locate a problem with a remote device or a telephone line.

Test by sending an &T command or by setting Register S16. Only one test can be performed at a given time. If you send a test command while the I-modem is in test mode, you'll receive an ERROR message.

All loopback testing conforms to ITU-T Recommendation V.54.

> **Note:** When the I-modem is in synchronous mode (&M1, &M6, &M7), testing is *not* available.

Testing the I-modem (Using &T)

Perform digital loopback and remote digital loopback testing by using the &T command. You can type in your own data during testing or use the I-modem's internal test pattern and error detector.

> **Note:** Disable error control (using the &M0 command) before testing. If the I-modem is detecting errors and retransmitting the affected data, your results will be invalid.

Digital Loopback Testing (&T3)

This test can help you locate a problem with a remote device or with the telephone line. Figure 0.1 shows the data flow during digital loopback testing.

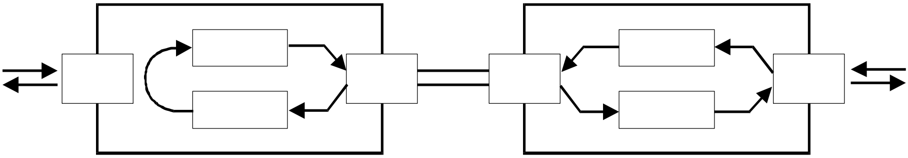


Figure 0.1   Data Flow During Digital Loopback.

1 Send the command **AT&M0&N3S14.0=0** to prepare the I-modem for testing.

This command disables error control, fixes the connection rate at 2400 bps, and makes the I-modem return to command mode when you type **+++**.

2 Establish a connection with the remote device.

3 Send the I-modem the **+++** escape code to bring it back to Command mode.

4 Send the I-modem the AT&T3 command. The I-modem enters digital loopback mode.

5 Have the remote user type a short message. It will be looped back by your I-modem's transmitter for verification on the remote user’s screen. You will not see the message or any other data.

6 When the remote user has completed the test, send the escape code, **+++**, and then AT&T0 to end the test.

Alternatively, you can end the test by sending ATH, ATZ, or ATZ! Be careful, though, because ATZ and ATZ! Z! reset the I-modem in addition to ending the test.

In any case, the I-modem responds OK. If the I-modem sends an ERROR message, you have issued an invalid command.

7 Send AT&M4, unless you used a reset command (ATZ or ATZ!).

Stopping a Test (&T0, S18)

To stop a test, send an &T0 command, or set Register S18 to a specified number of seconds (for example, S18=10). When the 10 seconds are up, the I-modem will stop the test automatically and return to Command mode. Send an ATH command to hang up the I-modem, or an ATZ command to hang up the I-modem and reset it to its defaults.

Note: If you use the S18 test timer, but in the process of testing you issue an ATZ command, S18 resets to zero and the timer is disabled. You cannot store a value for S18 in NVRAM; its power-on and reset default is always zero.

Remote Digital Loopback Testing (&T6, &T7)

This test, like the local digital loopback test, verifies the condition of both devices and of the phone line. Data flow is shown in Figure 0.2

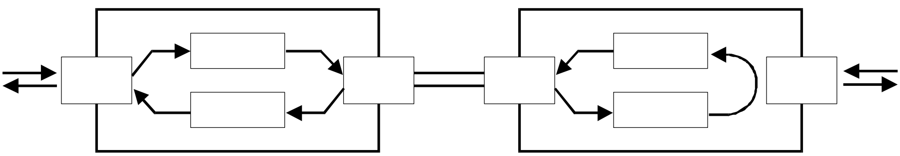


Figure 0.2 Data Flow During Remote Digital Loopback.

The request for and granting of remote digital loopback testing requires that both devices use ITU-T V.22 standard signalling. If the remote device does not have the capability or is not set to respond (with &T4), you will get an ERROR result code.

There are two remote digital loopback options. If you select &T6, you send keyboard data to the I-modem and verify it when it is returned over the phone lines and to your screen. If you select &T7, the I-modem sends its internal test pattern and returns an error count to your screen.

Granting a Digital Loopback Test Request (&T4)

The &T4 option causes the I-modem to grant a remote device's request for a remote digital loopback test.

Canceling All Digital Loopback Test Requests (&T5)

The &T5 option cancels &T4, and the I-modem fails to recognize remote digital loopback test requests. This is the default so that your I-modem isn't subject to another user calling and tying up your I-modem without your permission.

Testing Using Keyboard Data (&T6)

1. Send the command **AT&M0&N3S14.0=0** to prepare the I-modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the I-modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. For example, older U.S. Robotics modems need to be set to S16=8.

4. Send the I-modem the **AT&T6** command. The I-modem enters remote digital loopback mode, and, if the I-modem is an external model, the MR status light flashes.

5. Type a short message. It will be looped back to your I-modem by the remote device and to your screen for verification. (The remote user will not see your data.)

6. Send the escape code, **+++**, and then **AT&T0** to end the test.

   Alternatively, you can end the test by sending ATH, ATZ, or

ATZ! Be careful, because ATZ and ATZ! reset the I-modem in addition to ending the test.

If you issue an invalid command, the I-modem sends an ERROR message. If you set Register S18, the I-modem automatically ends the test when the test timeout is reached.

Data errors indicate a problem with the remote device or with the phone link.

7. Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

Testing Using a Built-in Test Pattern (&T7)

This test option causes the I-modem to perform a remote digital loopback test by sending a built-in test pattern. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

You don't need to type anything during this test. The I-modem sends only its final error count to your screen.

1. Send the command **AT&M0&N3S14.0=0** to prepare the I-modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the I-modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. For example, older U.S. Robotics modems need to be set to S16=8.

4. Send the **AT&T7** command to the I-modem. The I-modem enters remote digital loopback mode, and, if the I-modem is an external model, the MR status light flashes.

The I-modem sends its built-in test pattern to the remote device, which loops it back to your I-modem. You will not see the data on your screen.

5 Send the escape code, **+++**, and then **AT&T0** to end the test. You can also end the test by sending ATH, ATZ, or ATZ! Be careful, though, because ATZ and ATZ! reset the I-modem in addition to ending the test.

If you issue an invalid command, the I-modem sends an ERROR message. If you set Register S18, the I-modem automatically ends the test when the test timeout is reached.

When the test ends, the I-modem returns a three-digit code, followed by OK. A code of 000 indicates no errors were found; a code of 255 indicates 255 or more errors.

Data errors indicate a problem with the remote device or with the phone link.

6 Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

Testing the I-modem Using S16

Register S16 is a bit-mapped register. (See Chapter 2, *Using the AT Command Set*, for instructions for setting bit-mapped registers.)

Table 16–1. S-Register 16.

Bit	**Value**	**Function**
2	4	Remote digital loopback with built-in test pattern
3	8	Remote digital loopback using keyboard data

Note: Earlier U.S. Robotics modems require bit 3 to be enabled to grant digital loopback testing to a remote device. The I-modem requires its default &T4 setting instead. To perform remote digital loopback testing with a U.S. Robotics modem that does not use the &T test repertoire, that modem should be set to S16=8.

Remote Digital Loopback Testing

Testing Using Keyboard Data (S16=8)

1. Send the command **AT&M0&N3S14.0=0** to prepare the I-modem for testing.

   This command disables error control, fixes the connection rate at 2400 bps, and makes the I-modem return to command mode when you type the escape code (**+++**).

2. Establish a connection with the remote device.

3. If you haven't already done so, arrange with the remote user to cooperate with the test.

   If necessary, set the remote device to acknowledge the remote digital loopback request. U. S. Robotics modems should be set to &T4. (Older U.S. Robotics modems should be set to S16=8.)

4. Send the I-modem **ATS16=8O.**

   The I-modem enters remote digital loopback mode and then goes back online (O command). It then transmits the test signals, causing the remote device to enter remote digital loopback mode. If you are using an external I-modem, the MR status light flashes during this operation.

5. Type a short message. It will be looped back to your I-modem by the remote device and to your screen for verification. (The remote user will not see your data.)

6. Send the escape code, **+++**, and then **ATS16=0** to end the test.

   If you issue an invalid command, the I-modem sends an ERROR message. If you set Register S18, the I-modem automatically ends the test when the test timeout is reached.

   If you wish to resume data transmission with the remote device, add the O command after the ATS16=0 string to return online. If you do this, bear in mind that error control is disabled. Because error control is negotiated during the connection sequence, its status cannot be changed until the I-modem is back on hook and in Command mode.

7 Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

Testing Using a Built-in Test Pattern (S16=4)

Starting Testing That Uses the Test Pattern

The test pattern is available at all speeds. At 300 bps, the I-modem's serial port rate must be fixed (&B1) and the link rate fixed at 300 bps (&N1). At rates over 9600 bps, just set the I-modem for a fixed serial port rate (&B1).

To use the test pattern during testing with S16, type the following command:

AT&M0S16=12

To use the test pattern with the &T test, insert the test pattern command, S16=4, before issuing the test command:

ATS16=4&T6

The test pattern (ATS16=4) is used for testing equipment and the phone line. When S16 is set to 4, the I-modem transmits the test pattern when it connects with a remote device.

Ending Testing That Uses the Test Pattern

Pressing any character key cancels all tests and hangs up the I-modem. If you used Register S16, be sure to reset Register S16 and return to the error-control default. Send **ATZ** or **AT&M4S16=0**.

Handshaking, Error Control, Data Compression, and Throughput

Handshaking

With each call, the I-modem goes through a link negotiation process with the remote device. Another name for the negotiation process is “handshaking.”

The way in which the I-modem handles outgoing and incoming calls depends on the call type setting you’ve chosen. You can set the I-modem to handle calls one of eight different ways: Universal Connect, Internet access, clear-channel synchronous, V.120 only, V.110 only, analogue modem / fax emulation, or X.75.

Universal Connect

When you set the I-modem to Universal Connect and make or receive a call, the I-modem tries a number of calls and detection processes. The main flow of calls is depicted in Figure 11.1. In-band monitoring is depicted in Figure 11.2.

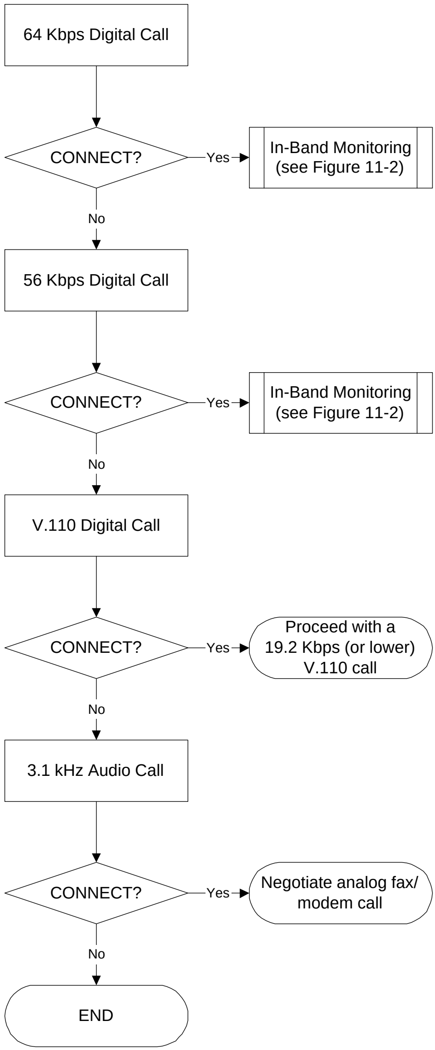


Figure 0.1 Universal Connect Call Progression.

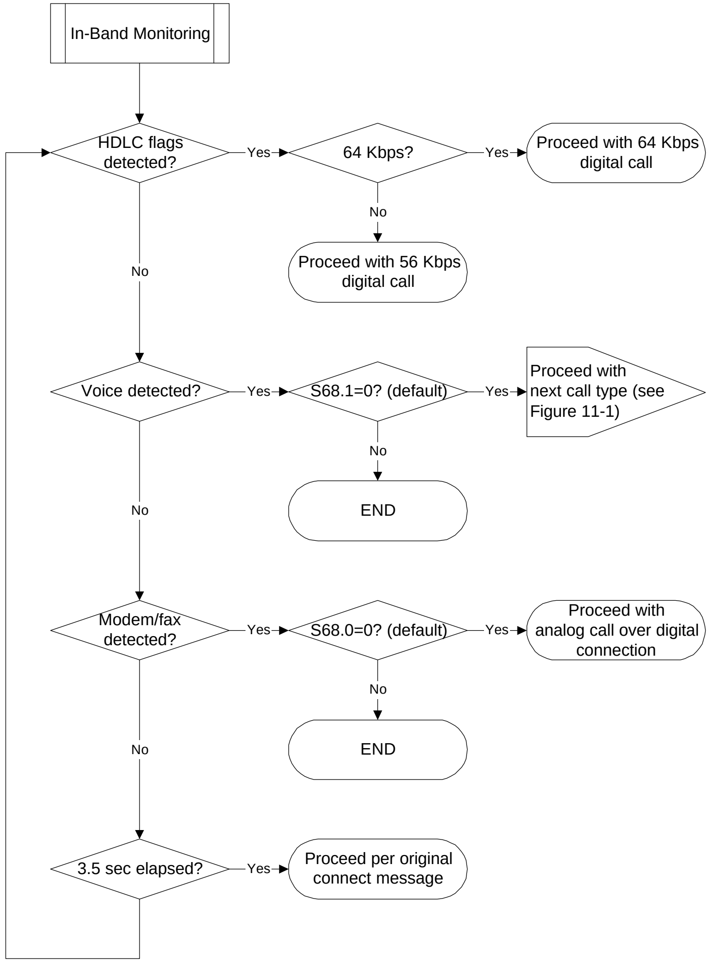


Figure 0.2 In-Band Monitoring.

In-Band Monitoring

Because the possibility always exists that calls can be labeled incorrectly by the telephone company's equipment, the I-modem monitors and compares the call set-up messages and the activity on the line.

By default, In-band Monitoring is active during every connection attempt the I-modem makes. You can, however, disable parts of the monitoring process.

Monitor	If detected, the I-modem…	To disable	If disabled and then detected, I-modem…
64 kbps V.120	Connects at 64 kbps V.120	S67.1=1.2=0	Ends connection attempt
56 kbps V.120	Connects at 56 kbps V.120	S67.1=1.2=1	Ends connection attempt
Voice	Tries call again at 3.1 kHz Audio instead of digital	S68.1=1	Ends connection attempt
Modem / fax	Connects modem / fax call over digital connection	S68.0=1	Ends connection attempt

TurboPPP

TurboPPP mode permits both Internet and remote LAN access. It allows you to use any networking software that is capable of delivering asynchronous Point-to-Point Protocol (PPP) through your computer's serial port. (NetManage Chameleon and Trumpet Winsock are examples.)

By default, the I-modem tries to establish a multilink PPP (MP-PPP) session. See Figure 0.3 for a diagram of the default connection process.

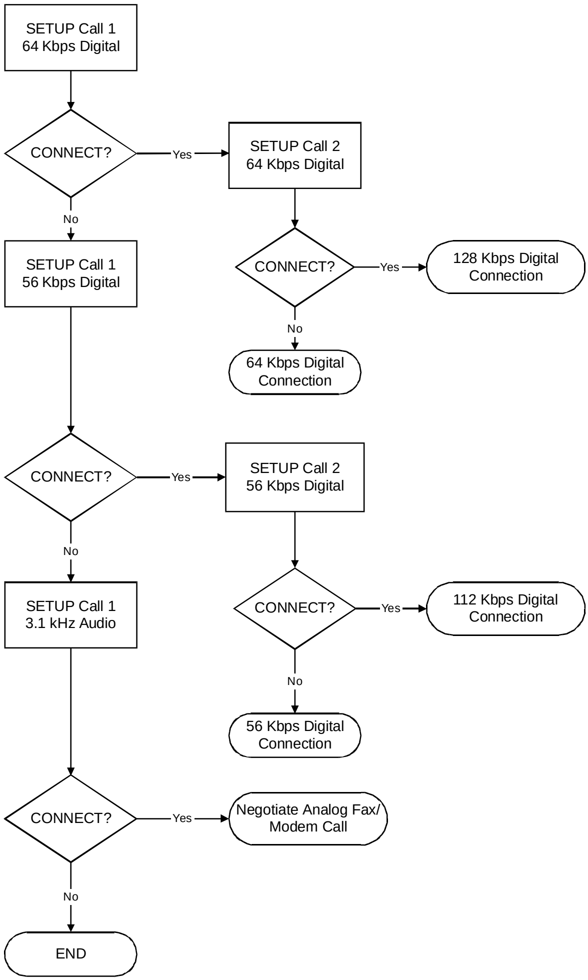


Figure 0.3 The (Default) TurboPPP Connection Process.

You can set up the I-modem to skip either the 64 kbps or the 56 kbps call. To skip the 64 kbps call, set S67.1=1.2=0. To skip the 56 kbps call, set S67.1=1.2=1.

You can change whether the I-modem makes one or two calls by a combination of bit 3, S-Register 68 and the use of an ampersand (&) in the dial string, as shown in Table 0-1.

Table 0-1. Dialling for PPP/MP-PPP Calls.

Dial string	Number of calls made	
	S68.3=0	S68.3=1
ATDT5550001	2	1
ATDT5550001&	2	2
ATDT5550001&5550002	2	2

You can disable TurboPPP by turning on bit 2 of S-Register 68 (send **ATS68.2=1 <Enter>**). When TurboPPP is disabled, the I-modem performs asynchronous PPP to synchronous PPP conversion, but uses only one B-channel with no compression.

Clear-Channel Synchronous (External I-modems Only)

The I-modem sets up a clear channel (64 or 56 kbps) with a remote device. Common applications are videoconferencing and remote access to mini- or mainframe computers. For more details, see Chapter 16, *Analogue Synchronous Applications.*

V.120 Rate Adaptation

If you set the I-modem to V.120, it will negotiate only for V.120 connections. If a V.120 connection cannot be made, the I-modem does not negotiate for other types of connections.

V.110 Rate Adaptation

If you set the I-modem to V.110, it will negotiate only for V.110 connections. If a V.110 connection cannot be made, the I-modem does not negotiate for other types of connections.

X.75 Rate Adaptation

If you set the I-modem to X.75, it will negotiate only for X.75 connections. If an X.75 connection cannot be made, the I-modem does not negotiate for other types of connections.

Analogue Mode Handshaking

When making analogue connections, the I-modem defaults to V.34 and tries for the highest possible speed (33.6 kbps) when it attempts to connect with a modem. The V.34 range spans 33.6, 31.2, 28.8, 26.4, 24, 21.6, 19.2, 16.8, and 14.4 kbps, and 9600, 7200, 4800, and 2400 bps. If the remote analogue device is not V.34 capable, a connection is made using the highest compatible modulation scheme (V.FC, V.32*terbo*, V.32*bis*, and so on, down to as low as Bell 103, or 300 bps).

If the remote analogue device has V.34 capability, the I-modem uses a line-probing technique to determine the highest speed possible under current line conditions, then completes the connection. If the remote analogue device does not have V.34 capability, the I-modem listens to the device's answer tones to identify the standard rate at which the remote analogue device is operating, and then adjusts to that rate.

When the I-modem answers a call from an analogue device, the I-modem sends out a series of answer tone signals until both devices negotiate the best connection rate.

Fast Class (V.FC) Handshaking

After trying V.34, the I-modem tries for the fastest possible V.Fast Class (28.8 kbps) connection. The V.FC range spans 28.8, 26.4, 24, 21.6, 19.2, 16.8, and 14.4 kbps. If the remote device is not V.FC-capable, a connection is made using the highest compatible modulation scheme (V.32*terbo*, V.32*bis*, and so on, down to as low as Bell 103, or 300 bps).

If the remote device has V.FC capability, the I-modem uses a line-probing technique to determine the highest speed possible under current line conditions, then completes the connection. If the remote analogue device does not have V.FC capability, the I-modem listens to the device's answer tones to identify what standard rate the remote analogue device is operating at, and then adjusts to that rate.

When the I-modem answers a call from an analogue device, the I-modem sends out a series of answer tone signals until both devices negotiate the best connection rate.

USR V.32*terbo* to USR V.32*terbo*

On these analogue connections, I-modems have two features that result in outstanding performance: Quick Connect and Adaptive Speed Leveling (ASL).

Quick Connect allows the devices to connect in approximately 7 seconds, a far shorter time than with most devices.

ASL (described below in *Other V.Protocol Operations*) is used by I-modems operating in V.32*terbo* and V.32*bis* modes.

Other V. Protocols

Earlier, lower-speed "V." protocols do not employ line probing. Instead they use predefined answer tones to specify or identify speed capabilities. These protocols define the following maximum speeds:

- V.32*terbo*: 19.2 kbps, with an additional USR device-to-USR device speed of 21.6 kbps.
- V.32*bis*: 14.4 kbps.
- V.32, V.22*bis*, etc.: 9600 bps and lower.

ASL (used in V.32*terbo* and V.32*bis* modes) is a technique that allows the I-modem's receivers and transmitters to act independently of each other. One transceiver may slow down and then speed up without affecting the data flow on the other. The result is more efficient line operation.

Note 1 : When answering using V.32*terbo,* I-modems shift their serial port rate up to 38.4 kbps (for 21.6 kbps connections) if the calling V.32*terbo* device dials in at 21.6 kbps. The answering V.32*terbo* device then sends data to its computer at 38.4 kbps. V.32*bis* I-modems also shift their serial port rate to 19.2 kbps to make 14.4 kbps connections. If your computer does not support these higher serial port rates, disable V.32*terbo* and / or V.32*bis*. (See Register S34, in Appendix A, *Alphabetic Command Summary*.)

Note 2 : While most modems on the market now use higher speeds, there may be a problem in answering older, V.32 modems at 9600 bps. Use Register S28 to modify the duration of the extra tones used in V.32 negotiations, in the rare instance that this may be necessary. (See Appendix A, *Alphabetic Command Summary*.)

Dual Standard Handshaking

We recommend that I-modems retain the default B0 and &N0 settings. This allows them to make analogue connections with "V." protocol and HST modems in both Originate and Answer modes at a variety of speeds.

When originating an analogue call and the I-modem is set to B1, it sends out a Bell answer tone, which is the prevalent standard in the
United States and Canada for connections at 2400 bps and lower. At higher speeds, the I-modem also recognizes the ITU answer tones necessary for connecting with V. protocol modems, and adjusts to the answering device.

However, when answering a call, an I-modem sending out the Bell answer tone (B1) won't be recognized by V. protocol modems. The calling modem, instead, will wait until it detects a tone it recognizes. The V.22*bis* tone used at 2400 bps.

If you want the I-modem connect with V. protocol modems at high speeds, make sure it is set to B0 for the ITU answer tones. It will also connect with HST modems at speeds up to 16.8 kbps.

Error Control

I-modems employ error-control techniques only during V.120, X.75, and analogue connections.

> **Note:** High-speed analogue calls are highly vulnerable to errors unless the data is protected by error control. The operations described below take place even if the I-modem or remote analogue device is not set for error control. If your I-modem connects with a remote analogue device at a high speed, but without error control, and if you are not using an error control protocol for your call, you may lose data.

Some of the following text includes the term *ARQ*, which stands for Automatic Repeat Request. ARQ is a method used in many error-control protocols to ensure that any data that has been corrupted in transit is retransmitted. We use the term to designate a connection under error control.

Error control is available for calls at 1200 bps and above. It can be disabled, although high-speed analogue calls (9600 bps or higher) should always be under error control. The operations defined in an error-control protocol include:

- Establishing compatibility.
- Formatting data frames.
- Detecting errors using Cyclic Redundancy Checking (CRC).
- Retransmitting corrupt data frames.

The I-modem is set at the factory to &M4, causing it to try for an error-control connection and, if that isn't possible, to proceed with the call in Normal mode.

The I-modem first tries for a V.42 connection, then an MNP connection. The following information is based on the I-modem's setting of &M4.

Error Control

This international standard includes a two-stage handshaking process:

- A *Detection* phase that is based on an exchange of predefined characters.
- A Link Access Procedures for Modems (LAPM) negotiation phase, during which the devices identify their capabilities concerning maximum data block size and the number of outstanding data blocks allowed before an acknowledgment is required.

MNP Error Control

The Microcom Networking Protocol (MNP) is supported by the ITU-T V.42 Recommendation. It was originally developed by Microcom, Inc. and is now in the public domain.

MNP is based on special protocol frames. If the remote device doesn't recognize an MNP Link Request, error control isn't possible. (In HST asymmetrical mode, U.S. Robotics devices use a proprietary scheme similar to MNP.)

Error Control and Flow Control

Flow control of data from the computer is required under error control for two reasons:

- The transmitting device buffers a copy of each frame it transmits to the remote end until it is acknowledged by the receiving device.
- If errors are encountered, retransmission activity can cause a steady stream of data from the computer to overflow the buffer.

Enabling Error Control or Enable Synchronous protocols

The I-modem and the remote device must use the same protocol.

To set the I-modem to	Use this command
Normal mode, no error control. Due to the nature of phone line channels, this is never recom mended for analogue calls above 2400 bps.	**AT&M0**
Online synchronous mode without V.25*bis*. (External I-modems only.)	**AT&M1**
Normal / ARQ mode. Operate in Normal mode (&M0) if an ARQ connection can't be made. When V.32-type devices revert to Normal mode (&M0), they transfer data at high speeds without the reliability of error control. To avoid this, both local and remote devices should always be set for error control. USR devices in HST mode drop to 2400 bps if they're unable to establish an error-control connection.	**AT&M4**
Enter ARQ asynchronous mode. The I-modem hangs up if it can't make an ARQ connection.	**AT&M5**
Start V.25*bis* synchronous mode, using a character-oriented link protocol similar to BISYNC. (External I-modems only.)	**AT&M6**
Start V.25*bis* synchronous mode, using the HDLC	**AT&M7**

link protocol. (External I-modems only.)	

Data Compression

I-modems employ different data compression techniques during analogue and TurboPPP (digital) connections.

TurboPPP

When a call uses TurboPPP, the I-modem supports three kinds of compression: Ascend, Microsoft, and Stac. Compression is available only when the remote device requests one of the three supported compression types.

Compression for TurboPPP calls is controlled by the &K command. By default, compression is enabled. Set &K0 to disable compression.

Analogue

If an I-modem successfully establishes a V.42 error control connection with a remote device, it also negotiates for V.42*bis* data compression.

If the I-modem successfully establishes an MNP connection with a remote device, it also negotiates for MNP5 data compression.

The type of compression for a call, if any, is reported in the ATI6 display (see Chapter 13, *Querying*), and in the CONNECT message if the I-modem is set to &A3 (see Chapter 5, *Controlling Result Code Displays*).

V.42bis versus MNP5 Data Compression

I-modems using V.42*bis* compression negotiate the following options and report them in the ATI6 display:

- Dictionary size, that is, the amount of memory available for compression table entries. (Entries are codes devised for redundant data. The data is packed into shorter data units, called code words, and unpacked by the receiving device.)

Possible dictionary sizes:

Bits	Entries
9	512
10	1024
11	2048

I-modems use an 11-bit, or 2048-entry dictionary, but they can reduce its size to accommodate a remote modem that uses a 9- or 10-bit dictionary.

- Maximum string length of each entry. As the dictionary fills, the I-modem deletes the oldest unused strings.

V.42*bis* compression is more efficient than MNP5 compression, in part because it dynamically deletes entries that are no longer used. In addition, it works better with files that are already compressed. These include .ZIP files and 8-bit binary files, which seem to I-modems to be compressed.

MNP5 compression should not be used with such files because it adds data to the files, which lessens throughput. (The additional data is stripped when the file is decompressed by the remote modem.) When transferring such files, it's best to set the I-modem to &K3. This allows V.42*bis* compression to work dynamically with the compressed data, but disables MNP5.

Enabling/disabling data compression

To set I-modem to	Use this command
Disable analogue and TurboPPP data compression.	**AT&K0**
Auto enable / disable. Enable compression if the serial port rate is fixed (&B1). Disable compression if the serial port rate is variable (&B0) because compression offers no throughput advantage when the serial port and connection rates are equal (compression may even degrade throughput).	**AT&K1**
Enable data compression. Use this setting to keep the I-modem from disabling compression.	**AT&K2**
Enable selective data compression. The I-modem negotiates only for V.42*bis* compression, and disables MNP Level 5 (MNP5) compression. Use this setting to transfer 8-bit binary files, .ZIP files, and other files that are already compressed.	**AT&K3**

Getting Maximum Throughput

The following guidelines should help you to make the most of the I-modem's advanced performance features. In many instances, experimentation and experience will indicate what works best for your applications.

Maximum throughput results when:

- The communications software allows fixing the serial port rate higher than the connection rate by setting the software to 230400 or 115200 and setting the I-modem to &B1.
- If the software automatically switches serial port rates to follow the connection rate, the I-modem's serial port rate must be also set to follow the connection rate for each call (&B0) and throughput will be limited.
- Installations with specialized software may want to enable a fixed serial port rate for ARQ calls and a variable serial port rate for non-ARQ calls. (See the &B2 command in Chapter 7, *Controlling Data Rates*.)
- The call is under data compression.
- The data is made up of text files rather than binary files such as .EXE or .COM files.
- MNP5 compression is disabled for files that are already compressed and 8-bit binary files that appear to the I-modem to be already compressed. Disable MNP5 compressing by sending the I-modem &K3.
- The file transfer is not slowed down by a File Transfer Protocol. Many non-text files require a File Transfer Protocol, but the results vary.

> **Note**: For the best throughput on error-controlled connections with hardware flow control, we recommend the most current version of ZMODEM.

For example, certain public domain File Transfer Protocols have the following effects:

Kermit	Newer versions support packets up to 9K and a sliding window design to eliminate turn-around delay. With earlier versions, however, throughput may be severely reduced due to short block lengths (possibly under 128 bytes) and acknowledgment turn-around time.
XMODEM	Throughput may be reduced if your version uses short block lengths (128 bytes). Some versions use larger blocks (1K blocks). Throughput is also reduced by overhead (error-control protocol information).
YMODEM	There is an improvement over XMODEM due to larger block lengths (1K bytes), but throughput is still reduced by the protocol's error control overhead.

The protocols listed above further reduce throughput when an error control connection is established. The accuracy of the data is checked both by the File Transfer Protocol and the I-modem. To avoid redundancy, use the above protocols only for non-ARQ connections, and only at speeds of 2400 bps and below.

Overhead is minimal with ZMODEM, resulting in throughput that is almost equal to that obtained with no File Transfer Protocol. ZMODEM should also be used for non ARQ connections. Leave the I-modem at its &M4 and &K1 settings for both error control and data compression.

YMODEM-G is another good choice, but never use it unless both the local and remote devices are using error control: if YMODEM-G detects an error, it aborts the transfer. **Do not use either protocol with software flow control (XON/XOFF signalling).**

Party Number Identification

Overview

The I-modem has the ability to display the Called Party Number and the Calling Party Number when it is presented in the central office SETUP message (collected from the D-channel).

You can use this party number information to identify incoming calls.

Called Party Number and the Calling Party Number

Each time an incoming call arrives at your ISDN line, the SETUP message presents certain information to help I-modem answer the call. A portion of the SETUP message identifies the DN of your ISDN line and the DN of the remote user's ISDN line.

Called Party Number

When remote users call your the I-modem, they dial the complete DN that your service provider assigned. The I-modem may use this DN information to determine how to set up the I-modem's programmed DNs.

> **Note:** Depending upon your ISDN line and the service options you selected, your I-modem may only receive a portion (or none) of the DN. This may render routing command settings (*P1and *P2) unusable.

When an incoming call arrives, the I-modem checks the Called Party Number to determine if the call is intended for the I-modem. If the call is intended for the I-modem, the I-modem then determines how to route the call to the Voice Port, the Data Port, or another attached ISDN device.

To set the DN you want the I-modem to route to channel	Use this command	Example
Voice	**AT*P1=n**	**AT*P1=5551234**
Data	**AT*P2=n**	**AT*P2=5551234**

The default factory settings leave *P1 and *P2 blank (or empty) so the I-modem routes all incoming calls based on bearer capabilities.

You can program the Called Party Number in the I-modem's DN setting. When the next incoming call matching this DN arrives, the I-modem automatically routes the call to the proper port.

> **Note:** If you do not program the DNs, you can set the I-modem to automatically route all 3.1 kHz Audio calls directly to the data port by setting **ATS67.3=1**. You can set the I-modem to automatically route speech calls to the data port with **ATS68.4=1**.

Viewing Called Party Number Information

After the incoming call arrives, you can view the Called Party Number by viewing the I15 screen.

Calling Party Number

Depending on your ISDN service, the remote caller's DN may also be present in the SETUP message. This information, known as the Calling Party Number, is displayed in the I15 screen and can be enabled after the RING announcement on an incoming call.

Applications of Calling Party Number Technology

You can use Calling Party Number to screen calls, keep a record of calls, or prevent unauthorized access to your network. Third-party database and telephony applications, such as security and call logging, and call blocking applications can take advantage of the Calling Party Number information provided by the I-modem.

How the I-modem Handles the Party Numbers

When the Courier receives the SETUP message, it stores it in memory. The information can be accessed at any time by sending **ATI15 <Enter>**.

Using the #CID command, you can have the I-modem send the information to your computer after the RING message.

```
RING 8475550001
```

The party number information remains in memory until you either reset the I-modem or the I-modem receives another SETUP message.

Commands to Set Up Called Party Number ID

Use the following AT command to control called party number ID:

To do this	Command
Disable reporting after ring message	**AT#CID=0**
Enable reporting after ring message	**AT#CID=1**
Display the current called party number ID setting	**AT#CID?**
Display the available called party number ID actions	**AT#CID=?**
Display a help screen for the octothorpe (#) command	**AT#$**
Display the latest called party number ID information	**ATI15**
Save AT#CID status in Flash ROM	**AT&W**
Force the Caller ID output to use a carriage return (instead of a space) between RING and CALLING PARTY NUMBER).	**ATS80.4=0**
Force the Caller ID output to use a space (instead of carriage return) after RING message.	**ATS80.4=1**

Analogue Synchronous Applications

This chapter applies to situations in which you want the I-modem to work with devices, such as mainframe computers, that communicate using analogue, synchronous protocols. The I-modem must be connected to a synchronous serial port.

Note: These procedures do not apply to synchronous PPP calls.

There are two ways to operate the I-modem in analogue synchronous mode:

- **Dial Using V.25*bis* Software.** Configure the I-modem to enter synchronous mode when you power it on. Then run communications software that uses the V.25*bis* protocol to control the dialling process.
- **Dial Using AT Commands.** Configure the I-modem to dial out using AT commands and then switch to synchronous mode once a connection is made.

Requirements

You must have these before you start:

A Device with a Synchronous Serial Port

Find out what hardware and software you need before proceeding. You will probably have to purchase and install a synchronous adapter card. These cards provide:

- A synchronous serial port.
- Support for one or more synchronous protocols.
- Additional software functions. For example, the card may tell the mainframe what type of computer or terminal you are using. The card may also tell the mainframe what resources you want to use.

A Serial Cable

Obtain a shielded serial cable with a male DB-25 connector on one end and a connector on the other end that is appropriate for your synchronous serial port. The I-modem provides an EIA-232 interface through its serial port.

Transmit and Receive synchronous timing pins are required at the EIA-232 interface. Pins 15 and 17 are required: The I-modem transmits timing signals through pin 15 and receives timing signals through pin 17.

Communications Software

The devices at both ends of the link must use the same synchronous protocol.

Ask your network administrator about the software support (for example, a specific communications package) that you need to log into the network.

Synchronous Operations

During synchronous operations, transmit and receive clocks at both ends of the phone link control the precise timing of the data flow. The communications equipment at the remote device and the I-modem and computer must all handle the data at the same speed.

The I-modem is always the source of the transmit clock timing signals and sends them to your computer over the EIA-232 interface. Your computer's rate will follow the connection rates.

Dial Using V.25*bis* Software

To make synchronous connections using V.25*bis* communications software, you must first configure the I-modem using AT commands. Once the I-modem is configured, run your communications software, which takes control of the I-modem for the duration of the connection.

Configuring the I-modem

Before you attempt to connect to a synchronous network, you must first configure the I-modem using an asynchronous device, such as a terminal or a computer running standard asynchronous communications software.

1 Find out which V.25*bis* protocol, HDLC or character-oriented, is being used for dialling and answering at the host computer and then set the I-modem to dial using it.

To dial using:	**Use this command**
Character-oriented protocol that is similar to BISYNC. The I-modem and the remote device must use the same 8-bit data format. The character length must be 7 bits and either ODD or EVEN parity (ODD is preferred), or 8 bits and NO parity.	AT&M6
High Level Data Link Control (HDLC) protocol. HDLC ignores parity.	AT&M7

Example: **AT&M7&W <Enter>** selects HDLC.

2 Set the off-line clock speed, or the clock speed to be used (between the I-modem and the computer to which it is directly attached) when the I-modem is not engaged in a synchronous connection.

%N0	Reserved	%N6	9600 bps (default)
%N1	Reserved	%N7	12000 bps
%N2	1200 bps	%N8	14400 bps

%N3	2400 bps	%N9	16800 bps
%N4	4800 bps	%N10	19200 bps
%N5	7200 bps		

Example: **AT%N10&W <Enter>** selects an off-line clock speed of 19200 bps.

3 Choose a connection rate to be used (between the I-modem and the remote communications device) when the I-modem is online.

If &N*n* is set for 2–10, the I-modem ignores the %N*n* rate and uses the &N*n* rate as the online connection rate.

&N0	Variable (default)	&N8	14.4 kbps
&N1	Reserved	&N9	16.8 kbps
&N2	1200 bps	&N10	19.2 kbps
&N3	2400 bps	&N11	21.6 kbps
&N4	4800 bps	&N12	24.0 kbps
&N5	7200 bps	&N13	26.4 kbps
&N6	9600 bps	&N14	28.8 kbps
&N7	12.0 kbps	&N15	31.2 kbps
		&N16	33.6 kbps

Note: We recommend that you fix the rate between the computer or terminal and I-modem (%N*n*) and that you set the connection rate (&N*n*) to match. This avoids dramatic changes in the rate produced when the connection rate adjusts to the off-line clock speed.

Example: **AT&N10%N10&W <Enter>** selects a connection rate and an off-line clock speed of 19200 bps.

4 Choose whether the I-modem should display normal or extended synchronous result codes.

Depending on the setting of the X*n* command, the I-modem displays normal or extended synchronous result codes. Extended result codes provide more detailed information. Don't be concerned if synchronous result codes do not appear on your screen—they are intended for your communications software.

By default, the I-modem is set to **X1** for extended result codes. To change to normal result codes, set the I-modem to **X0**.

Example: **ATX1&W <Enter>** selects extended result codes.

5 If the I-modem is to answer calls, enable automatic answering.

In order to:	Use this command:
Disable Auto Answer.	S0=0
Enable Auto Answer.	S0=1

Example: **ATS0=1&W <Enter>**

> **Note:** Due to the nature of synchronous dial-up, the I-modem auto-answers only on the third or fourth ring.

6 Set the I-modem to enter clear-channel synchronous mode.

Example: **AT*V2=4&W <Enter>**

Alternatively, you can combine all the previous commands into a compound command, like this:

AT&M7&N10%N10X1S0=1*V2=4&W <Enter>

This tells the I-modem to use the HDLC protocol for dialling, an off-line clock speed and connection rate of 19200 bps, display extended result codes, auto-answer incoming calls, enter clear-channel synchronous mode, and write these settings to NVRAM.

7 Set DIP switch 1 ON and then power the I-modem OFF, and then ON. Setting DIP switch 1 ON causes the I-modem to read the settings you just made from NVRAM, enabling synchronous operation.

Dialling Using V.25bis

Your communications software, which must support V.25*bis*, handles the dialling. Once the synchronous connection is made and the I-modem is in synchronous mode, V.25*bis* commands are no longer necessary and are ignored. For dialling instructions, refer to the manual included with your communications software.

Hanging Up

Since the I-modem cannot accept commands once it is connected in synchronous mode, you cannot use the ATH (hang-up) command or the **+++** escape code.

The only way for the I-modem to disconnect is to drop its Data Terminal Ready (DTR) signal. Either power off the I-modem or use your communications software (check the software user's manual for instructions).

Returning to Asynchronous Mode

Once you've completed a synchronous session, you can switch back to asynchronous mode by flipping DIP switch 1 OFF and then ON. The I-modem cannot switch between synchronous and asynchronous modes while a call is connected.

*V.25*bis Reference

> **Note:** The commands and result codes described in this section are sent and recognized by your V.25*bis* communications software. You are not expected to send them to the I-modem the way you do with AT commands.

Commands

CIC	Connect incoming call	Instructs the I-modem to answer an incoming call.
CRN	Call request using number provided	Instructs the I-modem to dial the number following this command. *Example:* **CRN18005551234**

CRS	Call Request with memory location	Instructs the I-modem to dial a number stored in memory. *Example:* **CRS3**
DIC	Disregard incoming call	Instructs the I-modem to disregard an incoming call—overrides auto answer for this call.
PRN*n*	Program number	Stores a number in NVRAM. *Example:* **PRN3; 18005551234**
RFN	Request list of forbidden numbers	Instructs the I-modem to list the numbers with which the I-modem is unable to connect.
RLN	Request list of stored numbers	Instructs the I-modem to list the numbers previously stored in NVRAM.

Dial Options

0–9	Digits
&	Flash
:	Wait for dial tone
>	(Greater Than) separator
<	Pause
=	(Equal Sign) separator
P	Pulse
T	Tone
.	(Period) separator
-	(Minus) separator

Result Codes

These are the normal (X0) result codes.

CFI	Call failed
CFRT	Ringing
CNX	Connect
INC	Incoming call
INV	Invalid action
LS	List of numbers
LSF	List of forbidden numbers

LSN	List of stored numbers
VAL	Valid

These are the extended result codes (X1) that replace CFI and INV.

CFAB	Call aborted
CFCB	Local I-modem busy
CFET	Remote device busy
CFFC	Forbidden call
CFNS	Number not stored
CFNT	Answer tone not detected
INVCU	Command unknown
INVMS	Message syntax error
INVPS	Parameter syntax error
INVPV	Parameter value error

Commands and Result Codes NOT Supported

CRI	Call request with identification number
PRI	Program identifier
RLD	List of delayed call numbers
RLI	Request list of identification numbers

Synchronous Dialling Using AT Commands

To use AT commands to dial, you must set the I-modem to enter *online synchronous mode* when you dial. You then dial the remote device's number using AT commands. Once the remote device answers, the I-modem switches to synchronous mode and starts sending synchronous timing signals to your computer.

Because the I-modem will not accept commands when it is in synchronous mode, you must configure it in asynchronous mode before trying to connect to a synchronous network.

The I-modem always generates the Transmit clock-timing signals when in synchronous mode.

Note: Data Terminal Ready (DTR) override must be OFF when using the I-modem in online synchronous mode. Use &D1 or &D2. See Chapter 6, *Controlling EIA-232 Signalling*.

Configuring the I-modem

1 If your communications software isn't running, load the program and start *Terminal mode* (see your software user's guide for instructions).

2 Send **AT&F0B0<Enter>**.

The device you are calling should also be set to the equivalent of B0, which tells the I-modem to use the V.25 answer sequence.

3 Set the connection rate to be used (between the I-modem and the remote communications device) when the I-modem is online.

First try a variable connection rate of &N0. If that doesn't work, try a fixed connection rate of &N6 (9600 bps) or &N3 (2400 bps).

&N0	Variable (default)	&N8	14.4 kbps
&N1	Reserved	&N9	16.8 kbps
&N2	1200 bps	&N10	19.2 kbps
&N3	2400 bps	&N11	21.6 kbps
&N4	4800 bps	&N12	24.0 kbps
&N5	7200 bps	&N13	26.4 kbps
&N6	9600 bps	&N14	28.8 kbps
&N7	12.0 kbps	&N15	31.2 kbps
		&N16	33.6 kbps

Example: **AT&N0 <Enter>**

> **Notes:**
> - If an I-modem is set to a fixed rate, and the remote device is not set to the same rate, the I-modem hangs up.
> - I-modems cannot connect at 21.6 kbps in synchronous mode.
> - HST and V.FC modulations do not support synchronous communications.

4 If the I-modem is to answer calls, enable automatic answering.

S0=0 Disables automatic answering.

S0=1 Enables automatic answering.

> **Note:** Due to the nature of synchronous dialup, the I-modem auto-answers only on the third or fourth ring.

Example: **ATS0=1 <Enter>**

5 Set the I-modem to enter clear-channel synchronous mode.

Example: **AT*V2=4 <Enter>**

Dialling

6 Send &M1 to have the I-modem enter synchronous mode, followed by the number to dial. Dial should be the last command before the Carriage Return.

Example: **AT&M1DT555-1234 <Enter>**

Alternatively, you can combine all the previous commands into a compound command, like this:

AT&F0B0&N0S0=1&M1*V2=4DT555-1234 <Enter>

This tells the I-modem to load the "no flow control" factory template, and then use the V.25 answer sequence, make the I-modem the source of timing signals, set a variable connection rate, auto-answer incoming calls, switch to online synchronous mode after connection, enter clear-channel synchronous mode, and then dial 555-1234.

There are two methods of autodialling a stored telephone number: You can have the I-modem dial the stored number either when it receives the Data Terminal Ready (DTR) signal from your computer or at power-on / reset.

1 Store a telephone number to memory position **0** using the AT&Z0=n command. For example, to store (847) 555-1111, and tone dial, type:

AT&Z0=T18475551111 <Enter>

2 Follow step **a** or **b**, depending on the dialling method you choose.

a. To have the I-modem dial when it receives the DTR signal from your computer, type:

ATS13.3=1&W <Enter>

b. To have the I-modem dial when you power it on or reset it, type:

ATS13.4=1&W <Enter>

3. Make sure DIP switch 1 is set to ON to load settings from NVRAM.

Hanging Up

The I-modem remains online until the remote device disconnects, your software causes the DTE to drop the Data Terminal Ready signal (DTR), or you power off the I-modem. When one of these events occurs, the I-modem returns to asynchronous Command mode.

Configuring TurboPPP with AT Commands

This chapter explains how to control TurboPPP with AT commands.

Overview

TurboPPP allows your I-modem to use both B-Channels to send and receive data over the ISDN.

TurboPPP includes the following features:

This feature	Allows the I-modem to
PPP / ML-PPP (Multilink PPP)	Accept PPP / ML-PPP calls
Dynamic Data Bandwidth Allocation (DBA)	Save money by only using the second B-channel when it is need for data transfers, and then dropping the second B-channel when it is not needed

Point to Point Protocol (PPP) / ML-PPP

Your Courier I-modem now supports Originate and Host Mode PPP / ML-PPP. Host Mode ML-PPP allows you to set the I-modem to accept ML-PPP calls. Originate Mode allows PPP / ML-PPP calls to be made from the I-modem.

Determining TurboPPP Settings

To do this	Use this command
Obtain an overview of TurboPPP settings	**ATI16**

Setting PPP/ML-PPP Host and Originate Mode

Use the following *P settings to control PPP/ ML-PPP:

To do this	Use this setting	Or these settings
Set all PPP-related default values	***P=0**	***V2=5, S68.2=0, S68.3=0, S68.6=0, S69.1=0, *D1=2, *D2=24 *D3=90, *D4=44, *K=1**
Set Asynchronous to Synchronous PPP	***P=1**	**S68.2=1**
Set Single Link TurboPPP	***P=2**	**S68.2=0, S68.3=1**
Set ML-PPP	***P=3**	**S68.2=0, S68.3=0 (default)**

Note: Before you can use this feature you must enable PPP/ ML-PPP using ***V2=5**.

Making Calls With ML-PPP

You can make ML-PPP calls with any PPP dialler.

Making an Outgoing ML-PPP Call

When making an outgoing ML-PPP call, enter the number of the host. If the phone number for two calls is different, you must enter both of them. They must be separated by an '&' as shown below. If only one phone number is given, the same number will be dialled for both calls.

Making an Incoming ML-PPP Call to Your I-modem

When someone attempts to call your I-modem using ML-PPP, they must call the Data Port number first and the Analogue Device Port number second.

See the following figures for an example of phone numbers with and without ML-PPP using Windows 95. These rules apply when using terminal programs with other operating systems.

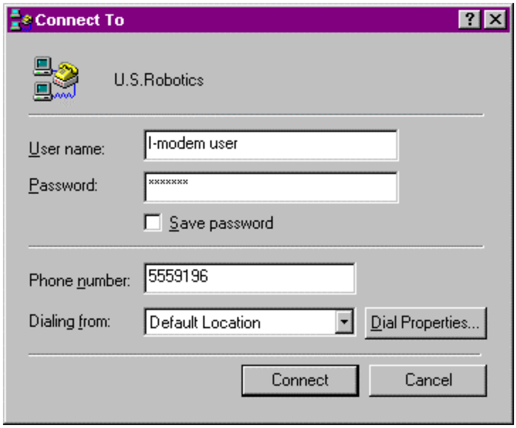


Figure 20.1 Regular Connection Without ML-PPP

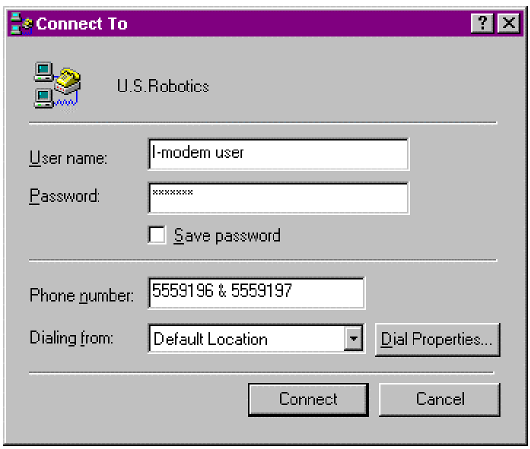


Figure 20.2 Connection With ML- PPP

Dynamic Data Bandwidth Allocation

Dynamic Data Bandwidth Allocation is a cost savings feature that helps you save money by only using the second B-channel when it is need for data transfers, and then dropping the second B-channel when it is not needed. Dynamic Bandwidth Allocation determines the need for the second B-channel by measuring the amount of data sent or received during a set period of time.

Dynamic Data Bandwidth Allocation settings (*D0, *D1, *D2, *D3, and *D4) determine under which conditions the second link should be brought up or down.

If you enter a value in	**TurboPPP does this**
*D3 that is more than the time set in *D1	Brings up the second link
*D4 that is less than the time set in *D2	Brings down the second link

Important: Dynamic Bandwidth Allocation is set on by default. To turn off Dynamic Bandwidth Allocation, use ***D0=1**.

Controlling Dynamic Bandwidth Allocation in ML-PPP

Use the following *D0 settings to control Dynamic Bandwidth Allocation:

To do this	**Use this setting**	**Or this setting**
Enable Dynamic Bandwidth Allocation in ML-PPP (default).	*D0=0	**S68.6=0**
Disable Dynamic Bandwidth Allocation in ML-PPP	*D0=1	**S68.6=1**

Use the following settings to control the period of time your I-modem samples the throughput in order to determine if the second link needs to be brought up or down:

To set the period of time your I-modem samples througput to determine	Use this setting	Example
If a second link should be brought up	*D1=n, where n equals 1-255 five second units	***D1=2** (ten seconds)
If a second link should be brought down	*D2=n, where n equals 1 -255 five second units	***D2=10** (50 seconds)

Setting When the Second Link Comes Up

Use the following *D3 setting to determine when the I-modem should bring up a second link:

To do this	Use this setting	Example
Determine when the second link should be brought up, based on the level of utilization of the existing link	*D3=n, where n equals 1 -100%	***D3=90** (90%)

Setting When the Second Link Comes Down

Use the following *D4 setting to determine when the I-modem should bring down a second link:

To do this	Use this setting	Example
Determine when the second link should be brought down, based on the level of utilization of the existing link	*D4=n, where n equals 1-100%	***D4=44**

Enabling the Tone When the Second Link Comes Up

Use the following *T settings to enable the tone when the I-modem brings up a second link:

To do this	Use this setting	Or this setting
Enable tone when second link is brought up (default)	***T=0**	**S69.1=0**
Disable tone when second link is brought up	***T=1**	**S69.1=1**

Using Compression in TurboPPP mode

Courier I-modem supports the following three types of compression modes in TurboPPP.

Pass-through Compression

Pass-through compression allows the terminal applications running on each PC on both ends of the connection to perform compression. Using this form of compression, the Courier I-modem does not perform compression.

Pass-through compression allows for maximum compression by eliminating the serial port bottleneck.

Auto Mode Compression

Auto Mode Compression allows the I-modem to negotiate compression if your application cannot negotiate compression. This is the default.

Turbo Mode Compression

Turbo Mode Compression allows the I-modem to negotiate compression with the remote host and disable compression between the I-modem and your application.

Setting Modes of Compression

Use the following *K settings to use compression in TurboPPP mode:

Use this mode of compression	Use this setting
Pass-through Mode	***K0**
Auto Mode (Default)	***K1**
Turbo Mode	***K2**

3Com recommends that you enable the compression in your application software and keep compression set to &K1 (default).

Note: Under Auto Mode Compression (&K1), the I-modem allows your application to negotiate compression. If you have enabled compression in your application and the application successfully negotiates compression, then the I-modem switches to Transparent Mode compression and allows your application do data compression.

Using Rate Adaptation Protocols

This chapter explains the following:

- Enabling and disabling X.75
- Setting X.75 frame and window size

Controlling Auto Detect

Dial Security Users: If dial security is active and prompting is turned off (S53.0=1 and S53.1=0), you must set the I-modem for analogue calls (*V2=3) or the autopass feature will not work. For example, if the receiving modem is left in automode, V.110, V.120, or X.75, the call will bypass the security mode.

What Is X.75?

X.75 is a popular protocol present in many European Terminal Adapters (TAs) that allows the I-modem to take full advantage of the 64-kbps
B-channel. Originally designed for packet-switched signalling, X.75 is used as the data-link layer for ISDN telematic services.

The I-modem implements the most common forms of X.75 known as X.75 transparent or X.75 SLP and T.7ONL. The data-link layer consists of a fully-symmetric High-Level Data Link Control (HDLC) procedure defined in ISO 7776 for DTE-DTE communications and allows communication with most competing products.

Controlling X.75 With AT Commands

Use the following AT commands to control X.75:

To do this	Use this command
Enable X.75 and limit incoming calls to X.75	***V2=6**
Enable X.75 in auto detect	***V2=0**, **S79 = 0**, **1**, or **2**

Selecting Frame and Window Size

Frame Size

Frame size is the number of data bytes sent in an X.75 frame.

Window Size

Window size is the number of frames sent before and expected acknowledge (ACK).

Window size is an important consideration in the performance of the system. The larger the window, the more frames that can be transferred without an acknowledgment. However, the more frames that are transferred without an acknowledgment, the more the receiver is required to allocate additional buffer space to handle the incoming transmissions.

Selecting Frame and Window Size

Use the following AT commands to select frame and window size:

To do this	Command	Where n equals	Default
Set frame size	**AT*X0=n**	Between 1 and 2048	2048 bytes
Set window size	**AT*X1=n**	Between 2 and 7	7

Selecting Layer 2 Protocol

To control Layer 2 protocol, set the following bit in the S81 register:

To do this	Set this bit in S81	Example
Select Layer 2 ISO 7776 protocol	0	**ATS81.0=1**
Reserved	1-7	N / A

Selecting Layer 3 Protocol

To control Layer 3 protocol, set the following bit in the S82 register:

To do this	Set this bit in S82	Example
Select Layer 3 Transparent protocol	0	**ATS82.0=1**
Reserved	1-7	N / A

Controlling T.70NL

To do this	Set this bit in S82	Example
Enable T.70NL	1	**ATS82.1=1**

Controlling Btx

To do this	Set this bit in S82	Example
Enable Btx	2	**ATS82.2=1**

Note: **Some services, such as T-Online, required you to enable Btx. Consult your online service provider for more information.**

Viewing Current Frame and Window Size Settings

Use the following AT commands to view current frame and window size settings:

To do this	Use this command
View current *X0 and *X1 settings	**ATI4**

Note: **You must write the current settings to NVRAM (** AT&W**) to save frame and window settings.**

Controlling V.120

To control additional international requirements for V.120, set the following bit in the S80 register:

To do this	Set this bit in S80	Example
Disable V.120 LLC	0	**ATS80.0=1**
Reserved	1-7	N / A

Note: **In the U.K. you cannot select V.120 protocol in the Lower Layer Capability message. Set this bit in the U.K. to allow V.120 connections.**

Controlling V.110

To Enable enhanced V.110 connections use the S80 register.

To do this	Set this bit in S80
Enable V.110 at 38400 bps	ATS80.3=1

Using Common ISDN Application Interface (CAPI) 2.0

Overview

What is CAPI?

Common-ISDN-Application Interface (CAPI) is an ISDN application programming interface standard designed to simplify the development of ISDN applications.

CAPI is hardware-independent; developers that use CAPI do not have to redesign applications for each hardware vendor.

Where is CAPI Used?

CAPI is used primarily in Germany. Increasingly, CAPI is used throughout the international ISDN community. Consult your online service provider to determine if they support the CAPI interface.

Robotics CAPI 2.0

3Com version of CAPI is called CAPI 2.0. CAPI 2.0 allows your I-modem to function using standard CAPI applications. It is designed for use on the following operating systems:

- Windows ® 3.0 and higher
- Windows ® 95

CAPI for End Users

Installing CAPI 2.0

CAPI 2.0 is bundled with the latest version of Configuration Manager* software. See "Installing the Configuration Manager" in the *Courier I-modem Getting Started* manual.

Note: **You must restart Windows after installing the CAPI 2.0 driver.**

Configuring CAPI 2.0

The I-modem Configuration Manager* has all the functionality of the Configuration Manager documented in the *Courier I-modem Getting Started* manual.

The only addition is the **Enable CAPI 2.0 Support** check box.

Perform the following actions to enable CAPI 2.0 support:

1 Click the Enable CAPI 2.0 Support check box.

2 Click Save to load the CAPI 2.0 drivers.

CAPI for Application Programmers

Configuring CAPI 2.0

When the **Enable CAPI 2.0 Support** option is checked, the installation program performs the following actions:

Copies the Configuration Manager* and uninstall programs to the appropriate directories*

Note: A maximum of 10 hardware DLLs (drivers) are supported by CAPI 2.0.

- Creates the necessary configuration files for the drivers
- Creates or updates the [US Robotics CAPI 20] section in SYSTEM.INI

```
[US Robotics CAPI 20]

UsrDriver1= CRI.DLL; hardware DLL specific for I-Modem
```

- Creates or updates the [CRI.DLL] section in SYSTEM.INI:

* only for Windows 3.1x as Windows 95 has its own Uninstall feature.

```
[CRI.DLL]

I-Modem1=COM1: ; enable CAPI support for I-modem attached to COM1:

I-Modem2=COM3:; enable CAPI support for I-modem attached to COM3:CIP
```

Values Supported by I-modem

The following CIP values are supported by CAPI 2.0:

- CIP value 2 (Unrestricted digital information 64K)
- CIP value 4 (3.1-kHz audio)
- CIP value 8 (56 kbps rate adaption – V.110)

CAPI Operations Supported by I-modem

The following operations are supported by CAPI 2.0:

- CAPI_REGISTER
- CAPI_PUT_MESSAGE
- CAPI_GET_MESSAGE
- CAPI_RELEASE
- CAPI_SET_SIGNAL
- CAPI_GET_VERSION
- CAPI_GET_SERIAL_NUMBER
- CAPI_INSTALLED
- CAPI_GET_PROFILE
- CAPI_GET_MANUFACTURER

CAPI Messages Not Supported by I-modem

The following messages are not supported by CAPI 2.0:

- ALERT_REQ
- RESET_B3_REQ
- FACITLITY_REQ
- INFO_REQ
- SELECT_B_PROTOCOL_REQ
- MANUFACTURER_REQ

Removing the Configuration Manager

Use the following steps to remove the Configuration Manager:

1. Remove the I-MODEM directory and all files within it.

Note: By default, the I-modem files are located in the C:\I-MODEM directory.

2. Delete the "I-modem Configuration Manager" group from the Programs group.

NOTE: For Windows 95, use the UNINSTALL feature.

Removing the CAPI Drivers

To remove the CAPI 2.0 driver, delete the following two sections from the SYSTEM.INI file:

- [US Robotics CAPI 2.0]
- [CRI.DLL]

Delete the following files from the C:\WINDOWS directory:

- USRCAPI.EXE
- CRI.DLL
- CAPI20.DLL

Important: Before you delete CAPI20.DLL, please make sure that the file was manufactured by 3Com.

Routing Calls to the Analogue Device Port or Data Port

This chapter explains how the I-modem routes incoming calls to the Analogue Device Port or the Data Port.

Overview

The I-modem routes incoming calls (digital, speech, or fax) to

- The Data Port, or
- A telephone, modem or fax machine connected to the I-modem's Analogue Device Port

Routing Based on Information Provided by the ISDN

The I-modem can route calls based on two types of information provided by the ISDN line:

- Directory Numbers
- Bearer capability information

Routing Based on Directory Number

Your ISDN service provider typically assigns one DN per BRI line unless you request additional DNs.

If you request more than one DN for your BRI line, you can assign one DN to the analogue device port and a different DN to the data port. When modem or fax calls arrive *that contain the called DN*, the I-modem routes the call to the appropriate device.

Routing Based on Directory Number Length

If the incoming number is	The routing number	Example
The same length as the number in *P1 or *P2	Is routed if the incoming call is an exact match to *P1 or *P2	***P1 or *P2 Number:** 12345678 **Routed:** 12345678 **Not routed:** any other number
Longer than the number in *P1 or *P2	Is routed if the first (rightmost) digits come in match the programmed number.	***P1 or *P2 Number:** 45678 **Routed:** 345678 **Not routed:** 34567
Shorter than the number in *P1 or *P2	Is routed if the number of digits received match the programmed number	***P1 or *P2 Number:** 12345678 **Routed:** 45678 **Not routed:** 4567

How Does the I-modem Match the DNs?

The ISDN provides information about the call destination as part of the SETUP message called the Called Party Number. This information is the DN (or a portion of it) that the ISDN provider assigned. The I-modem matches the Called Party Number to the values stored in *P1 and *P2 starting from the right most digit.

Example: If ***P1=0049899900**, the Called Party Number is 899900

You do not need to program the DNS in your I-modem to answer calls. The I-modem matches incoming calls even when the DNs are blank.

Once the I-modem determines a match to one (or both) DNs, it routes the call to the applicable port. If the port is available (not in use), and if the port is able to accept the incoming call type, the I-modem will answer the call.

If you route the call to the	With this command	These types of calls will be answered
Analogue Device Port	*P1	Speech 3.1 kHz audio
Data Port	*P2	Speech 3.1 kHz audio Unrestricted digital

Note: Unrestricted digital calls to ***P1** are accepted if *V2=5 is set to allow ML-PPP connects.

When the called DN information is not available, the I-modem routes the call based on *bearer capability* (or call type) information.

Routing Based on Bearer Capability

The call setup message that arrives from the calling device via the ISDN contains information indicating the type of call being placed (bearer capabilities). The I-modem recognizes three bearer capabilities:

This bearer capability in the call setup message	Indicates this call type	The I-modem automatically routes this call type to
Speech	A voice call, modem or fax	To the Analogue Device Port or the Data Port
3.1 kHz Audio	A voice call, modem or fax	To the Analogue Device Port or the Data Port
Unrestricted Digital	A V.110 or V.120 ISDN call	To the Data Port

Note: If two DNs are present, the I-modem automatically routes calls to the DN in ***P1** to the Analogue Device Port and routes calls to the DN in ***P2** to the Data Port. If a digital call comes in to either DN, the I-modem assigns it to the Data Port.

Understanding Incoming Call Settings

You can set four call settings to help the I-modem determine if a call should be routed to the Analogue Device Port or Data Port:

- You can set your preferred call type, based upon the call type of the modems attempting to connect to your I-modem.
- You can set the Data Port DN to determine where you want the
  I-modem to route data calls.
- You can set the Analogue Device Port DN to determine where you want the I-modem to route voice or certain analogue calls.

Note: You can set where you want the I-modem to route 3.1 kHz calls (such as analogue modem calls). If you leave both of DN's blank, the
I-modem answers all incoming ISDN calls. If other devices exist on the line the I-modem may interfere with how other devices answer calls.

Setting the Preferred Call Type (Data Port only)

Set your preferred call type, based upon the call type of the modems attempting to connect to your I-modem.

Routing a Specific DN to the Analogue Device Port

You can set the Analogue Device Port DN to determine where you want the I-modem to route data calls.

Example: To route your desired DN to the Analogue Device Port, use the following command: **AT*P1=5551212**

Routing a Specific DN to the Data Port

You can set the Data Port DN to determine where you want the I-modem to route voice or certain analogue calls.

Example: To route your desired DN to the Data Port, use the following command: **AT*P2=5551234**

Routing 3.1 kHz Calls to the Data Port

Determine where you want to route 3.1 kHz calls (such as speech or analogue modem calls)and modify this setting.

Note: The I-modem can only route calls to the Data Port if ***P1** and ***P2** are blank.

To allow I-modem to	Use this command
Route 3.1 kHz calls to the data port	**ATS67.3=1**

Based on the 3.1 kHz settings determine where you want to route speech and modify this setting.

To allow I-modem to	Use this command	Example
Route speech calls to the data port (analogue modem) [This requires that S67 Bit 3 is set]	**ATS68.4=1**	**ATS67.3=1,S68.4=1**

For PBX Users

To do this	Command
Force analogue modem calls to be sent as speech calls instead of 3.1 KHZ audio. (Affects users in the U.K. only)	**ATS80.2=1**

Note: If you have your I-modem connected to a PBX, you may need to force your outgoing modem calls as SPEECH before your PBX allows them to be routed out.

Courier I-modem & Multiple Subscriber Numbering

ISDN in the customers premises allows for up to eight terminals to be connected. In order to accomplish the connection of multiple terminals, MSN (Multiple Subscriber Number) is required.

MSN

This service allows you to have up to 10 directory numbers allocated to one ISDN line. This is configured as a 10 number Direct Dialling In (DDI) system with 2 channels, allowing you to allocate different telephone numbers to the equipment connected to the ISDN line i.e. one for fax/ for speech/ for data etc etc.

Courier I-modem is a dual function device. With the analogue port, it is possible to use a service such as MSN to organise the way the I-modem handles your calls. You may assign one directory number to the analogue interface and another number to the I-modem. In this case specific voice and data calls can be routed per the dialled number. ***Refer to the Asterisks Command Set section below for information concerning the programming of directory numbers (*Pn=Directory number).***

Configuring Your Courier For Windows 95

This chapter explains how to:

- Configure your I-modem for use with Plug and Play
- Obtain and install the latest I-modem files
- Configure Dial-Up Networking to access your ISP

Overview

The first time you start Windows 95 after you've installed your Courier, Windows 95 auto-detects your Courier. Since Windows 95 supports Plug and Play, most installations are trouble-free.

> **Note for external Courier users:** You must power on your I-modem before you start Windows 95, or Windows 95 will not recognize your I-modem.

What You Need

You need Windows 95 with Dial-Up Networking installed to configure your I-modem for Windows 95.

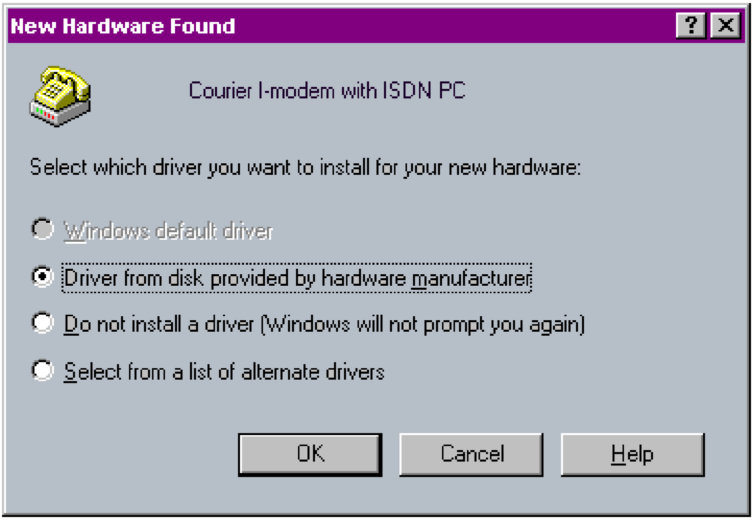
Configuring Your Courier With Plug and Play

Plug and Play mode allows Windows 95 to automatically detect your I-modem and determine which modem configuration file (called an INF file) to use.

> **Note for internal Courier users:** If you do not want to use the Plug and Play mode of your operating system, you must manually change the jumpers on the modem to the desired COM port/ IRQ settings.

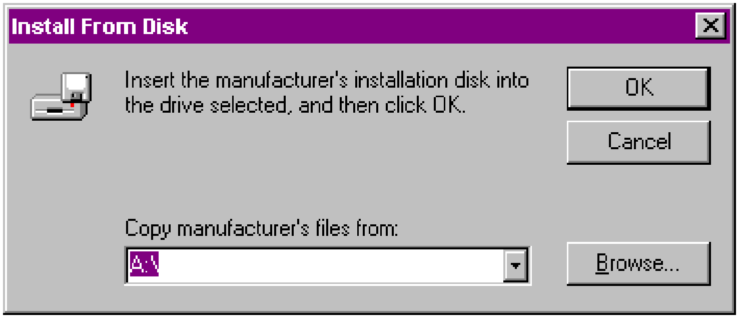
Follow the steps below to install I-modem INF file for Windows 95:

1 Power on your computer and start Windows 95. Your computer detects new hardware and displays the following window:

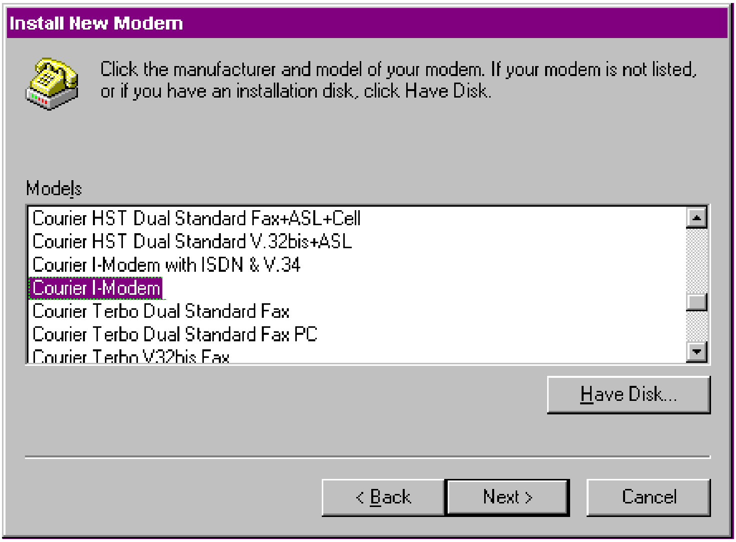


2 Select **Driver from disk provided by hardware manufacturer** and click **OK** to install the INF file that is provided on the root directory (D:\ or the correct path of your CD-ROM) of the *Connections* CD-ROM.

3 When the following window appears, insert your *Connections* CD-ROM, change the default drive (A:\) in “Copy Manufacturer’s files from” to D:\ (or the correct path of your CD-ROM) and click **OK** to install the INF file.


Install From Disk
Insert the manufacturer's installation disk into the drive selected, and then click OK.
OK
Cancel
Copy manufacturer's files from:
A:\
Browse...

Windows 95 displays the following window asking you to choose your I-modem type from the list:



4 Select the **Courier I-modem EXT or Courier I-modem INT** from the list and click **OK**.

Your I-modem is now ready to use!

Files Needed By Your I-modem

For your I-modem to work most efficiently, 3Com recommends that you use the latest version of the following two files from the 3Com web site (http://totalservice.usr.com).

This file	Does this
The I-modem software	Contains software that contains new feature updates
The INF file	Helps your computer work more effectively with your I-modem

Installing the Latest I-modem Software

See your I-modem *Command Reference Manual* for information about upgrading your Courier's software.

Accessing Your Internet Service Provider

This section explains how to set up your I-modem to access the Internet using Windows 95 Dial-Up Networking. You can also use Dial-Up Networking to access Internet Service Providers (ISPs) or remote LANs. To access your ISP or a remote LAN, you must do the following:

Step One: Determine if Dial-Up Networking is installed.

Step Two: Install Dial-Up TCP/IP support.

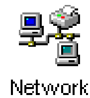
Step Three: Set up a connection to your ISP.

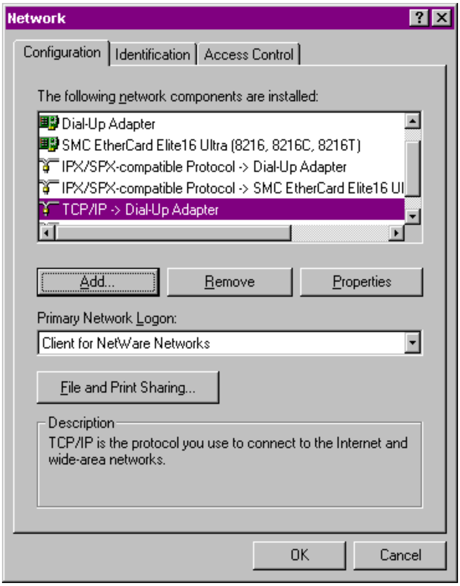
Step Four: Customize TCP/IP settings (if necessary).

Step One: Determine if Dial-Up Networking is Installed

1 **Click Start | Settings | Control Panel** .

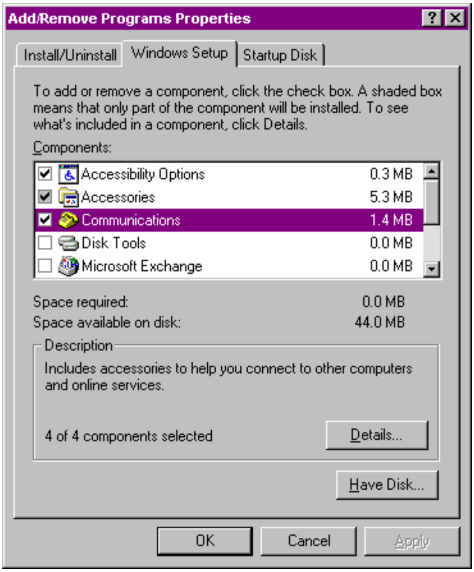
2 On the Control Panel, double-click on Network to display the Network Window.





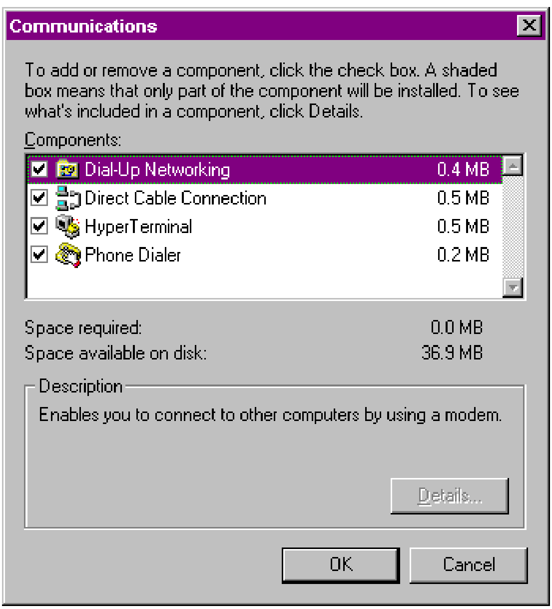
If Dial-Up Networking	Do this
Is listed	Go to the section “Installing TCP / IP Support” to install Dial-Up Networking.
Is not listed	Go to Step 3.

3 Return to the Control Panel and double-click on Add / Remove Programs to open the Add / Remove Programs Properties window:



4 Click Windows Setup tab.

5 Double-click on Communications to display the Communications window:



6 Click on Dial-Up Networking to check the box.

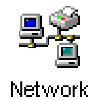
7 Click OK | OK.

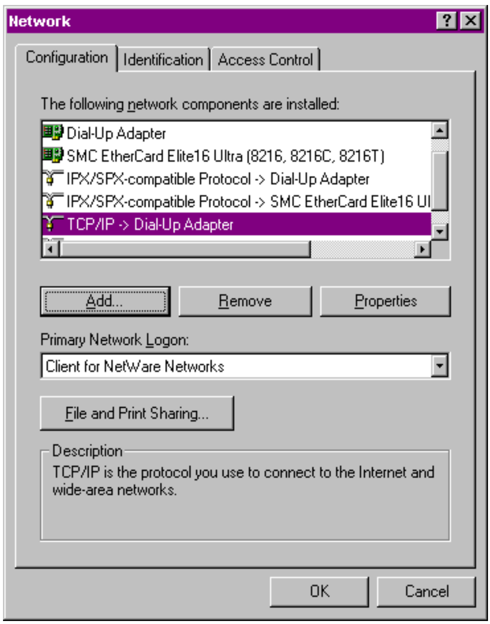
8 Insert your Windows 95 Setup diskette or CD-ROM when you are prompted, and Windows 95 installs Dial-Up Networking.

Step Two: Installing Dial-Up TCP/IP Support

1 **Click Start | Settings | Control Panel** .

2 On the Control Panel, double-click on the Network icon to display the following window:





Determine if the TCP / IP Dial-Up Adapter is installed:

IF TCP/IP -> Dial-Up Adapter	Do this
Is not listed	Click **Add...** | **Protocol** | **Microsoft** | **TCP/IP** | **OK**. Insert your Windows 95 Setup diskette or CD-ROM when you are prompted, and Windows 95 installs TCP / IP protocol support.
Is listed	Read the section "Customize the TCP / IP Settings"

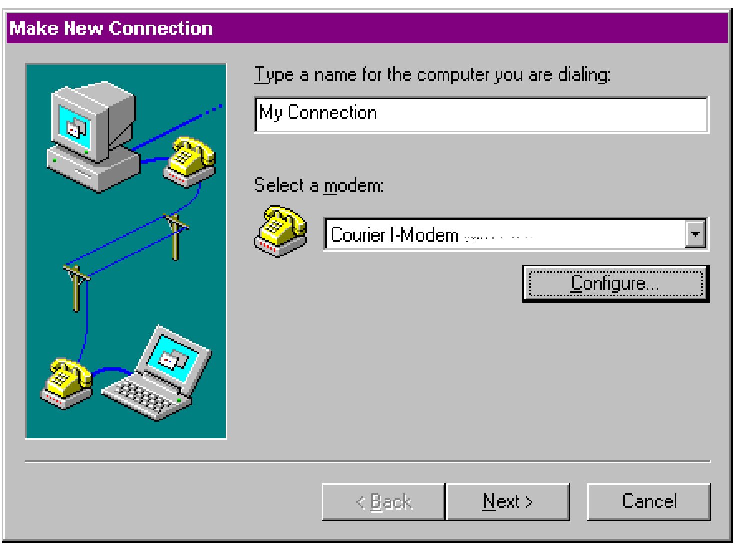
Step Three: Setting Up a Connection to Your ISP

1 Click **Start** | **Programs** | **Accessories** | **Dial-Up Networking**.

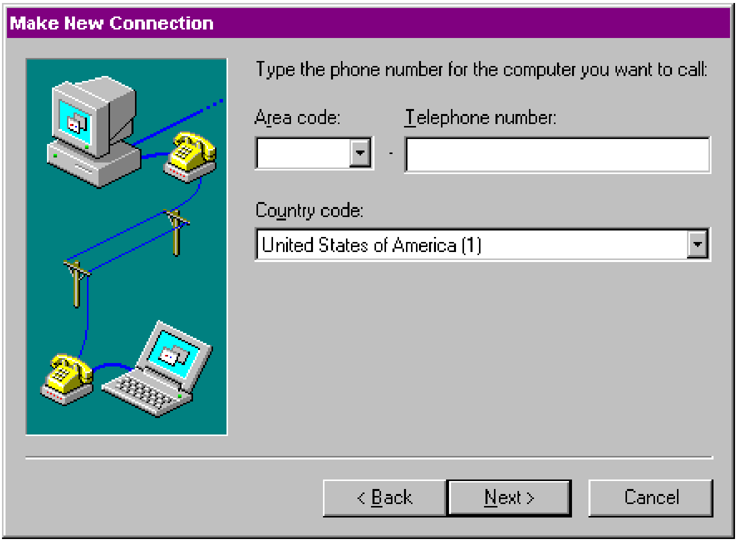
2 Double-click Make New Connection.

3 Select the correct Courier modem, if not already selected.

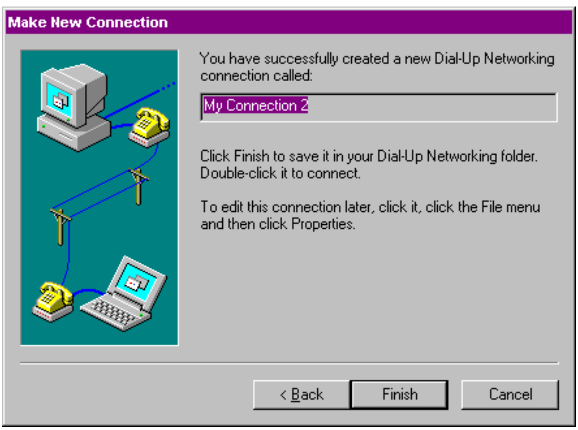
4 Type a name for the connection and click **Next** .



5 Type a phone number for the connection and click **Next** .

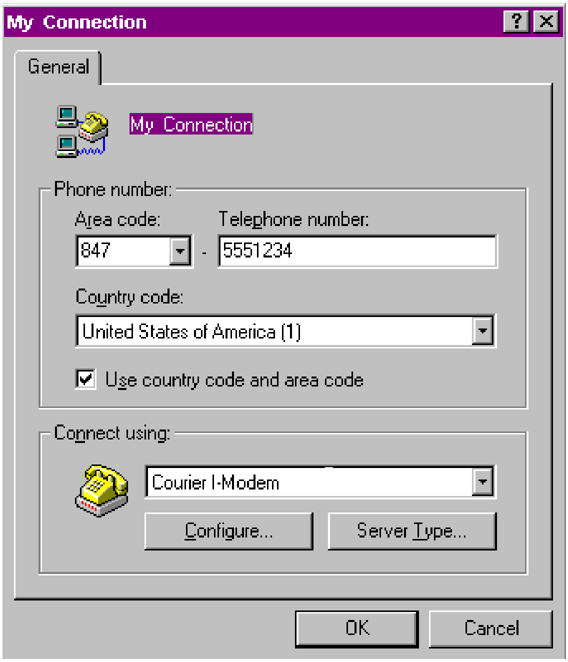


6 You should see a message indicating that a new connection was created successfully.



7 Click **Finish**.

8 On the Dial-Up Networking window, move your cursor to the new icon you have just created and click the right mouse button. Select **Properties** on the menu to display the following window:



8 On the My Connection window, click **Server Type**..., and deselect the following:

- Log on to Network
- NetBEUI
- IPX / SPX Compatible

9 Click **OK**, and **OK**.

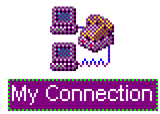
If your ISP	**Do this**
Gives you specific IP or server addresses	Go to **Step Four: Customizing TCP/IP Settings**
Does not give you specific IP or server addresses	Double-click on the icon you just created to dial your ISP.

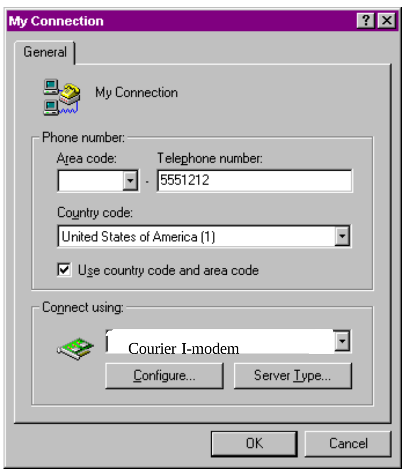
Step Four: Customizing the TCP/IP Settings

Depending on the ISP you use, you may need to customize the TCP/IP settings. Contact your ISP for specific information, such as IP address, or domain name servers (DNS).

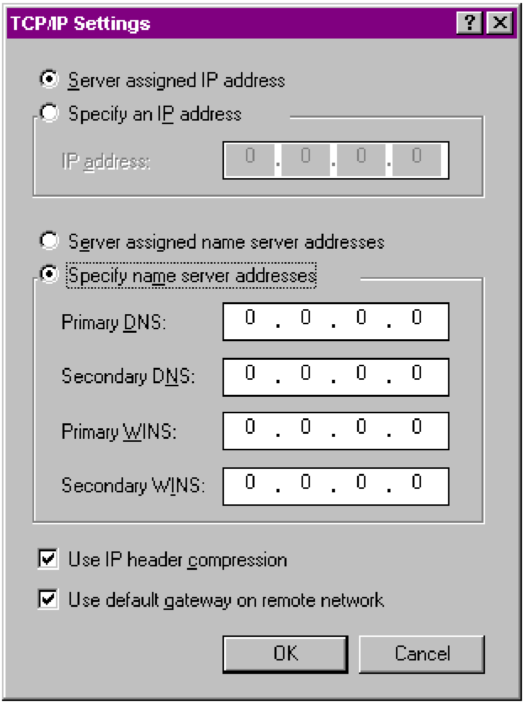
1 Click My Computer and double-click Dial-Up Networking icon to display all the connections you can customize.

2 Right-click the icon you created and select **Properties** to display the My Connection window.





3 On the My Connection window, click **Server Type** to display the TCP / IP Settings window.



4 Specify an **IP address**, if needed:

If your ISP	Do this
Gives you a specific IP address	Click **Specify an IP address** and enter the IP address provided by your ISP
Does not give you a specific IP address	Click **Server assigned IP address**

5 After you specify an **IP Address**, specify **server assigned server addresses**, if needed:

If your ISP	Do this
Gives you specific server addresses	Click **Specify name server addresses** and enter the server address(es) provided by your ISP
Does not give you specific server addresses	Click **Server assigned server address**

6 Double-click your New Connection icon to connect!

Configuring Your I-modem for Other Operating Systems

This chapter explains how to configure your I-modem for:

- Windows 3.x
- Windows NT
- MS-DOS
- OS/2
- UNIX, Linux, or AIX

If You Are Using Windows 3.x

Windows 3.x comes with a built-in communications software package, Windows Terminal. You can use Windows Terminal to test your I-modem or you can install the communications software package that is included with your Courier.

Because Windows Terminal only supports speeds up to 19200 bps, it is recommended that you use a third-party communications software package.

For instructions about how to set up your Windows 3.x communications software package, visit the 3Com Totalservice web site at http://totalservice.usr.com.

If You Are Using Windows NT 4.0

What You Need

You need Windows NT with Remote Access Service (RAS) installed to configure your I-modem for Windows NT.

Configuring Your I-modem

To obtain and install the I-modem INF file for Windows NT, follow the same steps as Windows 95 users.

Installing the Latest I-modem Software

After you obtain the latest I-modem INF file, copy it to the C:\WINNT\INF subdirectory.

For more information about Windows NT, see the Windows NT documentation or visit the 3Com Totalservice web site at http://totalservice.usr.com.

If You Are Using MS-DOS

Because there is no communications software built in to MS-DOS, you must install and run a third-party communications software package to operate your I-modem.

You must choose the COM port to which your I-modem is attached in whatever communications software package you are using.

For instructions about how to set up your MS-DOS communications software package, see the software documentation or visit the 3Com Totalservice web site at http://totalservice.usr.com.

For Internal Couriers Only

You must choose the COM port, IRQ, and the I/O address within the communications software that you use. These are the standard I/O address and IRQ settings for each COM port:

COM Port	I/O Address	IRQ
COM1	03F8	IRQ4
COM2	02F8	IRQ3
COM3	03E8	IRQ4
COM4	02E8	IRQ3

If You Are Using OS/2

Replace the standard OS/2 serial port drivers COM.SYS and VCOM.SYS with SIO.SYS and VSIO.SYS. You can get these enhanced drivers from the 3Com web site.

For instructions about how to set up your OS/2 communications software package, visit the 3Com Totalservice web site at http://totalservice.usr.com.

For Internal Couriers Only

These are the standard I/O address and IRQ settings for each COM port:

COM Port	I/O Address	IRQ
COM1	03F8	IRQ4
COM2	02F8	IRQ3
COM3	03E8	IRQ4
COM4	02E8	IRQ3

Nonstandard COM/IRQ settings are done by adding switches (command line parameters) to the COM.SYS (or SIO.SYS) line in CONFIG.SYS.

For example, to select COM3 and IRQ5, enter the following command line:

```
\OS2\BOOT\COM.SYS /i5/c3
```

If You Are Using UNIX, Linux, or AIX

Linux has a built-in communications software package called minicom. You can obtain minicom on the 3Com FTP site (ftp.usr.com) in the usr/bin directory.

For instructions about how to set up your UNIX®, Linux, or AIX communications software package, visit the 3Com Totalservice web site at http://totalservice.usr.com.

These are the standard port names and settings:

Outgoing Calls	Incoming Calls	Port	IRQ	I/O Address
/dev/cua0	/dev/ttyS0	COM1	4	03F8
/dev/cua1	/dev/ttyS1	COM2	3	02F8
/dev/cua2	/dev/ttyS2	COM3	4	03E8
/dev/cua3	/dev/ttyS3	COM4	3	02E8

Use the **setserial** command to tell Linux about any nonstandard COM/IRQ combinations that you may have set using your Courier's jumpers. Setserial also selects serial port speed and I/O port address.

Alphabetic Command Summary

This appendix contains an alphabetic listing of the AT commands to which the I-modem will respond. Default settings are **bold**.

Basic Command Set

$ Display help for the Basic command set.

+++ Escape code. Once an I-modem is online with another device, the only command it recognizes is an *escape code* of three typed plus signs, which forces the modem back to Command mode. Do the following when issuing the command:

1 Wait 1 second after sending the last item of data.

2 Type **+++**
Do not type the AT prefix or press Enter.

3 Wait 1 second before typing any data.

When you type **+++**, the I-modem will either hang up or stay on line, depending on how you set S14.

> Repeat command. If you include the repeat command in the Dial string, the I-modem will dial the number and wait 60 seconds for a carrier.

AT>DT1234567 <Enter> or
ATDT1234567> <Enter>

If the line is busy, the I-modem will pause for 2 seconds and then redial. The I-modem makes a maximum of
10 attempts.

A / Reexecute the last-issued command. Do not type AT or press Enter.

A> Repeat the last-issued command until canceled by pressing any key. Do not type AT or press Enter.

AT Attention prefix: informs an I-modem that a command is coming. AT must precede all commands except A/, A>, and **+++**.

A Force an I-modem to answer when it is not receiving an incoming call.

B*n* Set handshaking options.

B0	ITU-T V.25 answer sequence; required to answer all V.34-type and overseas calls.
B1	Bell answer tone. This setting selects HST modulation, but use it only if the I-modem is not required to answer V.34-type calls.

C*n* Enable or disable the transmitter.

C0	Transmitter disabled; for receiving only.
C1	Transmitter enabled.

D*n* Dial a phone number and issue other optional commands.

The numbers 0–9, plus * and # are accepted. The maximum number of characters allowed is 36, including the AT prefix, punctuation, and spaces.

> **Note:** With the exception of the Dial options, I-modems ignore any commands issued after D in the same command string.

Optional parameters:

P	Dial using pulses. Accepted but ignored.
T	Dial using tones. Accepted but ignored.
,	(Comma) Pause for 2 seconds (or the time in S-Register 8).
;	(Semicolon) Remain in Command mode after dialling.
"	Dial the letters that follow.
W	Wait for a second dial tone before continuing dialling (with X3 or higher).

@	Wait for an answer (with X3, X4, or X7).
/	Pause for 125 milliseconds.
R	Reverse frequencies. Use this command when calling an originate-only modem. It forces the I-modem to dial out at the answer frequency.
L?	Display the last-dialled number.
L	Dial the last-dialled number.
$	Display help for the dial commands.

E*n* Command mode echo. Enables or disables the display of your typed commands.

E0 Command mode echo OFF. Your typing will not appear on the screen.

E1 Command mode echo ON. Your typing will appear on the screen.

> **Note:** If double characters appear on the screen, both the I-modem's local echo and your software's local echo are on.

F*n* Online local echo. If ON, an I-modem displays on your screen the data that it is transmitting to another modem.

F0 Online echo ON. (Sometimes called half duplex.)

F1 Online echo OFF. (Sometimes called full duplex.)

H*n* Go on or off hook.

H0 Go on hook (hang up).

H1 Off hook.

H2 Reject incoming call.

I*n* Query the I-modem.

I0 Display the four-digit product code.

I1 Display results of ROM checksum test (factory test).

I2 Display results of RAM test.

I3 Displays the banner (product name).

I4 Display current modem settings.

I5 Display settings stored in NVRAM.

	I6	Display statistics for the last call.
	I7	Display product configuration.
	I10	Display dial security account status information.
	I11	Display connection report (contains symbol rates).
	I12	Display the ISDN settings.
	I15	Display party number status.
	I16	Display PPP configuration.

K*n* Control the modem clock. I6 displays the time.

K0	If online, display current call duration. If offline, display last call's duration.
K1	Display the actual time. Set the clock using ATI3=HH:MM:SS K1.

L*n* Conrol the speaker volume.

L0	Lowest speaker volume.
L1	Low speaker volume.
L2	Medium speaker volume.
L3	High speaker volume.

M*n* Speaker configurations.

M0	Speaker off.
M1	Speaker on until CD.
M2	Speaker always on.
M3	Speaker off during dial

O*n* Return online. Use with the escape code (**+++**) to toggle between command and online modes.

O0	Return online (normal).
O1	Return online and retrain. Use O1 if there were errors in a non-ARQ data transfer.

P Pulse Dial

Q*n* Enable or disable the display of result codes.

Q0	Display result codes.
Q1	Suppress result codes (quiet).

Q2 Suppress result codes when answering.

S$ Display help screens for the S-Registers.

S*r*=*n* Set S-Register value: *r* is any S-Register; *n* must be a decimal number between 0 and 255.

S*r*.*b*=*n* Set a bit-mapped register: *r* is the S-register, *b* is the bit, and *n* is 0 (off) or 1 (on).

S*r*? Query contents of S-register *r*.

V*n* Display result codes in words or numbers.

V0 Display result codes in numeric form.

V1 Display result codes in verbal form.

X*n* Control the amount of information displayed in the result codes. The default is X7 (all codes except 12 / VOICE).

	Setting							
Result Codes	**X0**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**
0/OK	•	•	•	•	•	•	•	•
1/CONNECT	•	•	•	•	•	•	•	•
2/RING	•	•	•	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•	•	•	•
4/ERROR	•	•	•	•	•	•	•	•
5/CONNECT 1200		•	•	•	•	•	•	•
6/NO DIAL TONE			•		•		•	•
7/BUSY				•	•	•	•	•
8/NO ANSWER				•	•	•	•	•
10/CONNECT 2400		•	•	•	•	•	•	•
11/RINGING						•	•	•
12/VOICE						•	•	
13/CONNECT 9600		•	•	•	•	•	•	•
18/CONNECT 4800		•	•	•	•	•	•	•
20/CONNECT 7200		•	•	•	•	•	•	•
21/CONNECT 12000		•	•	•	•	•	•	•
25/CONNECT 14400		•	•	•	•	•	•	•
43/CONNECT 16800		•	•	•	•	•	•	•
85/CONNECT 19200		•	•	•	•	•	•	•
91/CONNECT 21600		•	•	•	•	•	•	•
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•
151/CONNECT 31200		•	•	•	•	•	•	•
155/CONNECT 33600		•	•	•	•	•	•	•
162/CONNECT 56000		•	•	•	•	•	•	•
165/CONNECT 64000		•	•	•	•	•	•	•
Functions								
Wait for Answer (@)				•	•	•	•	•

Z Software reset. If DIP Switch 1 is ON (factory setting), revert to the settings in NVRAM. If DIP switch 1 is OFF, reset to the &F0 configuration template (no flow control).

Z! Hardware reset (equivalent to powering off and then back on). If DIP Switch 1 is ON (factory setting), revert to the settings in NVRAM. If DIP switch 1 is OFF, reset to the &F0 configuration template (no flow control).

Ampersand (&) Command Set

&$ Display help for the ampersand (&) command set.

&A*n* Enable or disable the display of additional result code subsets. (Also, see the X*n* command.)

&A0 Do not display ARQ result codes.

&A1 Display ARQ result codes.

&A2 In addition to ARQ result codes, display HST, V.32, V.FC, V.34, or DIGITAL modulation indicator.

&A3 In addition to ARQ and modulation indicators, display an error control indicator (LAPM, HST, MNP, SYNC, V.120, or NONE) and a data compression type (V42*bis* or MNP5).

&B*n* Set the serial port rate to variable or fixed.

> **Note:** The serial port rate *must be equal to or higher than* the &N*n* rate.

&B0 Variable: The serial port rate adapts to match the speed of the connection.

&B1 Fixed: The I-modem always communicates with your computer at the rate at which you have set, regardless of the connection rate.

&B2 When answering calls, use the fixed rate for ARQ calls and variable rates for non-ARQ calls.

&C*n* Control how the I-modem sends a Carrier Detect (CD) signal to your computer.

&C0 CD always ON, even if the I-modem is not on line.

&C1 Normal operations. The I-modem sends a CD signal when it connects with another modem and drops the CD when it disconnects.

&D*n* Control how the I-modem sends Data Terminal Ready (DTR) signals.

&D0 DTR is always ON.

&D1 If issued *before connecting with another device*, the
I-modem can enter online Command mode during a call by dropping DTR.

&D1 functions similarly to the escape code (+++).

Return online with the O*n* command, or hang up with the H*n* command.

&D2 Normal DTR operations. The modem will not accept commands unless your computer sends a DTR signal. Dropping DTR ends a call.

&F*n* Load one of the three configuration templates that are stored permanently in read-only memory. Chapter 4, *Working with Memory*, lists the settings for each template.

To load a template into current memory, enter AT&F*n*. To write a template to NVRAM, enter AT&F*n*&W.

If DIP switch 1 is OFF, &F0 is always loaded into memory at power-on or reset.

&F0 Load No Flow Control template settings.

&F1 Load Hardware Flow Control template settings.

&F2 Load Software Flow Control template settings.

&G*n* Not used in the external I-modem.

&H*n* Transmit data flow control. Prevents the I-modem's buffer for data transmitted to the I-modem by its attached computer from overflowing.

&H0 Disable transmit data flow control.

&H1 Use hardware flow control. Requires that your computer and software support Clear to Send (CTS) at the EIA-232 interface.

&H2 Use software flow control. Requires that your software support XON/XOFF signalling.

&H3 Use both hardware and software flow control. If you are unsure about what your equipment supports, select this option.

&I*n* Received data software flow (XON / OFF) control.

&I0 Disables XON/XOFF flow control of received data.

&I1 The I-modem acts on your typed XON/XOFF commands, Ctrl-S or Ctrl-Q, and passes them to the remote device.

&I2 The I-modem acts on your XON/XOFF commands, but removes them from the data stream instead of passing them to the remote device. This is the recommended setting for ARQ mode.

&I3 Hewlett Packard-Host mode. Applies only to I-modems attached to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only.

&I4 Hewlett Packard-Terminal mode. Applies only to I-modems attached to terminals in an HP system that uses the ENQ/ACK protocol. Use in ARQ mode only.

&I5 This setting is designed to enable flow control on the phone link when the connection is not under error control. For this to work, the remote device must have &I5 capability.

&K*n* Enable or disable data compression.

&K0 Disable data compression.

&K1 Use auto-enable/disable. The I-modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0) because compression offers no throughput advantage when the serial port and connection rates are equal; in fact, compression may degrade throughput.

&K2 Always enable data compression. Use this setting to keep the I-modem from disabling compression.

&K3 Selective data compression. The I-modem negotiates only for V.42*bis* compression, and disables MNP Level 5 (MNP5) compression. Use this setting to transfer 8-bit binary files, .ZIP files, and other files that are already compressed.

&Ln Reserved.

&M*n* Enable ARQ (error control) or synchronous protocols. Both your I-modem and the remote device must use the same protocol.

&M0 Normal mode, no error control. Due to the nature of phone line channels, this is never recommended for calls above 2400 bps.

&M1 Use for online synchronous mode without V.25*bis*. This setting is exclusive of the I-modems' error control.

&M4 Normal/ARQ mode. If an ARQ connection isn't made, the modem operates in Normal mode as though it were set to &M0.

&M5 ARQ asynchronous mode. The I-modem hangs up if an ARQ connection cannot be made.

&M6 V.25*bis* synchronous mode using a character-oriented link protocol similar to BISYNC.

&M7 V.25*bis* synchronous mode using the HDLC link protocol.

&N*n* Connection rate variable or fixed (analogue connections only).

&N0 Variable rate. The I-modem negotiates with the remote device for the highest possible connection rate, depending on the capabilities of the remote device.

&N1- &N32 Fixed rate. The I-modem connects only if the remote device is operating at the same rate. You can use this feature to filter out calls at other than a specific rate for security or other reasons.

The connection rate must always be lower than or equal to the serial port rate.

&N1	300 bps	&N17	33333
&N2	1200 bps	&N18	37333
&N3	2400 bps	&N19	41333
&N4	4800 bps	&N20	42666
&N5	7200 bps	&N21	44000
&N6	9600 bps	&N22	45333
&N7	12000 bps	&N23	46666
&N8	14400 bps	&N24	48000
&N9	16800 bps	&N25	49333
&N10	19200 bps	&N26	50666
&N11	21600 bps	&N27	52000
&N12	24000 bps	&N28	53333
&N13	26400 bps	&N29	54666
&N14	28800 bps	&N30	56000
&N15	31200 bps	&N31	57333
&N16	33600 bps	&N32	64000

&R*n* Received data (RTS) hardware flow control.

&R0 Delay Clear to Send (CTS) response after Request to Send (RTS).

&R1 Ignore RTS. This setting is required if your computer or terminal or software does not support RTS.

&R2 Enable hardware flow control of received data. The I-modem sends data to the computer only upon receipt of the RTS signal.

&S*n* Send the computer a Data Set Ready (DSR) signal via the EIA-232 interface. ("Data Set" is industry jargon for modem.)

&S0 DSR is always ON (override).

&S1 In Originate mode: Send DSR after dialling, on detection of the remote device's answer tone. In Answer mode: Send DSR after sending an answer tone.

&S2 When Carrier is lost, send a pulsed DSR signal with Clear to Send (CTS) following Carrier Detect (CD). This option is for specialized equipment such as automatic callback units.

&S3	Same as &S2, but without the CTS signal.
&S4	Send the computer DSR at the same time as CD.
&S5	Send DSR normally, and follow CTS with CD.

&T*n* Test the I-modem.

&T0	End testing.
&T3	Start local digital loopback testing.
&T4	Grant a remote digital loopback test of your I-modem.
&T5	Deny a remote digital loopback test of your I-modem.
&T6	Start remote digital loopback testing.
&T7	Start remote digital loopback with self-test and error detection.

&U*n* Connection rate variable or fixed (analogue connections only).

&U0 Variable rate. The I-modem negotiates with the remote device for the lowest possible connection rate, depending on the capabilities of the remote device.

&U1- &U32 Fixed rate. The I-modem connects only if the remote device is operating at the same rate. You can use this feature to filter out calls at other than a specific rate for security or other reasons. The connection rate must always be lower than or equal to the serial port rate.

&U1	300 bps	&U17	33333
&U2	1200 bps	&U18	37333
&U3	2400 bps	&U19	41333
&U4	4800 bps	&U20	42666
&U5	7200 bps	&U21	44000
&U6	9600 bps	&U22	45333
&U7	12000 bps	&U23	46666
&U8	14400 bps	&U24	48000
&U9	16800 bps	&U25	49333
&U10	19200 bps	&U26	50666
&U11	21600 bps	&U27	52000
&U12	24000 bps	&U28	53333
&U13	26400 bps	&U29	54666

&U14	28800 bps	&U30	56000
&U15	31200 bps	&U31	57333
&U16	33600 bps	&U32	64000

&W Write the current settings to NVRAM.

&Y*n* Break handling. This command lets you send a break to stop data transfer without disconnecting.

&Y0 Destructive, don't send break.

&Y1 Destructive, expedited.

&Y2 Nondestructive, expedited.

&Y3 Nondestructive, unexpedited; the I-modem sends a break-in-sequence with data received from your computer or terminal.

> **Note:** If the call is under MNP5 data compression, destructive breaks cause both modems to reset their data compression tables. When transmission resumes, the modems build new tables, and the result is lower-than- normal throughput.

&Z*n*=*s* Store up to 10 numbers in NVRAM, where *n* is the position 0–9 in NVRAM, and *s* is the phone number string. The number string may be up to 36 characters long, including any Dial command options.

AT &Z2=5556789 <Enter>

> **Note:** Do not include modem settings in the &Z*n* string. If the call requires a special setting, insert it in the command string before the DS*n* command.

In the following example, &M0 (no error control) is inserted before the Dial command:

AT&M0 DS2 <Enter>

> **Note:** The &Z*n*=*s* command functions differently when Dial Security is enabled.

&Z*n*=L stores the last-dialled number in position *n*.

&Z*n*? Display the phone number stored in NVRAM at position *n* (where *n* = 0–9).

Percent (%) Command Set

%$ Display the help panels for the percent (%) command set.

%A*n* Create and configure security accounts.

%B*n* Remotely configure an I-modem's serial port rate.

%B0	110 bps	%B6	9600 bps
%B1	300 bps	%B7	19200 bps
%B2	600 bps	%B8	38400 bps
%B3	1200 bps	%B9	57600 bps
%B4	2400 bps	%B10	115200 bps
%B5	4800 bps		

%C*n* Remote configuration control.

%C0 Defer configuration changes until the call is ended. Changes take effect for ensuing connections.

%C1 Cancel configuration changes and restore the original configuration.

Note: %C1 will not reverse any changes that you wrote to NVRAM (with &W) or forced (with %C2).

%C2 Force configuration changes to take effect immediately.

Note: We recommend against forcing configuration changes unless it is absolutely necessary. An unreliable connection, or loss of connection, may result.

%E=*n* Erase security settings.

%E=1 Erase local-access password.

%E=2 Erase Autopass password.

%E=3 Erase passwords in accounts 0–9.

%E=4 Erase phone numbers in accounts 0–9.

%E=5 Disable Account, Dialback, and New Number fields in accounts 0–9.

%F*n* Remotely configure another device's data format.

%F0	No parity, 8 data bits.
%F1	Mark parity, 7 data bits.
%F2	Odd parity, 7 data bits.
%F3	Even parity, 7 data bits.

%L= Set a local-access password.

%N*n* Set the offline clock speed for synchronous mode. External I-modems only.

%N0	Reserved	**%N6**	9600 bps
%N1	Reserved	%N7	12000 bps
%N2	1200 bps	%N8	14400 bps
%N3	2400 bps	%N9	16800 bps
%N4	4800 bps	%N10	19200 bps
%N5	7200 bps		

%P*n*= Disable password security (*n*=0 or *n*=1) when no character follows the equal sign.

%P*n*=*s* Set the following password (*s*) for viewing privileges only (*n* = 0), or view and configuration privileges (*n*= 1).

%P*n*? Display password *n*.

%S=*n* Access the security accounts. Does not disable security.

%T Enable the recognition of tone frequencies of analogue dialling devices. %T is meant primarily for use with network applications, but may also be integrated into certain software programs. For example, %T could be used in a security program to identify incoming tone security codes.

To return the modem to Command mode, press any key or drop the computer's or terminal's DTR signal. The I-modem responds OK.

%V=PW*n* Assign the password in account *n* in your I-modem’s security account as your Autopass password.

Asterisk (*) Command Set

*$ Display the help screens for the asterisk (*) command set.

*C*n* Set the volume of the sound that comes out of the analogue device jack.

*C0 Off

*C9 Highest volume

*D0=n Control Dynamic Bandwidth Allocation.

*D0=0 Enable Dynamic Bandwidth Allocation in ML-PPP (default).

*D0=1 Disable Dynamic Bandwidth Allocation in ML-PPP

*D1=n Control the period of time your I-modem samples througput to determine when the second link should be brought up. Values: 1-255 five second units.

*D2=n Control the period of time your I-modem samples througput to determine when the second link should be brought down. Values: 1 -255 five second units.

*D3=n Determine when the second link should be brought up, based on the level of utilization of the existing link.

*D4=n Determine when the second link should be brought down, based on the level of utilization of the existing link

*K*n* Set Compression in TurboPPP Mode.

*K0 Pass-through Mode

*K1 Auto Mode (Default)

*K2 Turbo Mode

*M=*n* Set whether your connection to the telephone company's switch is point-to-point or multipoint.

*M=0 Point-to-point.

*M=1 Multipoint.

*O=*n* Dialling mode. I-modems with an Analogue Device Port only.

*O=0 En-bloc dialling. Dials similarly to a cellular telephone. To complete the call, press # after dialling the number.

*O=1 Overlap dialling. Dials like a standard analogue telephone.

*P Control PPP/ ML-PPP.

*P*n*=*s* Set the Directory Number (DN) that was assigned to you by your telephone company.

*P1= The DN for the Voice B-channel.

*P2= The DN for the Data B-channel.

*R*n* Internal I-modem only. Adjusts the ringing signal volume. 0 is quietest and 9 is loudest.

*T=n Control when the I-modem tone sounds.

*T=0 Enable tone when second link is brought up (default)

*T=1 Disable tone when second link is brought up

*T*n*=*s* Set the Terminal Endpoint ID (TEI). Your telephone company's central-office switch may use automatic TEI assignment; if so, set the TEI(s) to 0.

*T1= 0-63 for the Voice B-channel.

*T2= 0-63 for the Data B-channel.

*V*n*=*s* Set the call type for each B-channel.

*V1= 0-1 for the Voice B-channel.

n	**Call Type**
0	3.1 kHz Audio (modem/fax)
1	Speech

*V2= 0-5 for the Data B-channel.

n	**Call Type**
0	Autodetect
1	V.120 rate adaptation only
2	V.110 rate adaptation only
3	Modem or fax only
4	Clear-channel synchronous
5	Asynchronous to synchronous PPP conversion
6	X.75 rate adaptation

*W=*n* Set the switch protocol used telephone company's central office.

n	**Switch Protocol Type**
4	ETSI NET 3 (Euro-ISDN) or DSS 1
5	Germany 1TR6
6	France VN*x*
7	Japan NTT INSnet64
8	Australia TS.013

*X0=n Select X.75 frame size, where n equals a value Between 1 and 2048. (Default is 2048)

*X1=n Select X.75 window size, where n equals a value Between 2 and 7. (Default is 7)

Calling Party Number Commands

#CID=*n* Set Calling Party Number Commands.

n	**Do this**
0	Disable reporting after ring message
1	Enable reporting after ring message
	Display the available called party number ID actions

S-Registers

Table A–1. S-Registers: Their Functions and Default Settings.

Register	Default	Function
S0	0	Sets the number of rings on which to answer in Auto Answer mode. S0=0 disables Auto Answer. S0=1 enables Auto Answer and the I-modem answers on the first ring.
S1	0	Counts and stores the number of rings from an incoming call.
S2	43	Stores the ASCII decimal code for the escape code character. Default character is "+". A value of 128-255 disables the escape code.*
S3	13	Stores the ASCII decimal code for the Carriage Return character. Valid range is 0–127.*
S4	10	Stores the ASCII decimal code for the Line Feed character. Valid range is 0–127.*
S5	8	Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function.*
S6	2	Detects dial tone during the default 2 seconds. Wait Time / Dial Tone (sec).
S7	60	Sets the number of seconds the I-modem waits for a carrier. May be set for much longer duration if, for example, the I-modem is originating an international connection.
S8	2	Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command reexecutions (> and A> commands).
S9	6	Sets the required duration, in tenths of a second, of the remote device's carrier signal before recognition by the I-modem.

* See Appendix B, *ASCII Chart*.

Register	Default	Function
S10	10	Sets the duration, in tenths of a second, that the I-modem waits after loss of carrier before hanging up. This guard time allows the I-modem to distinguish between a line hit, or other disturbance that momentarily breaks the connection, from a true disconnect (hanging up) by the remote device
S11	70	Sets the duration and spacing, in milliseconds, of dialled tones.
S12	50	Sets the duration, in fiftieths of a second, of the guard time for the escape code (+++) sequence.
S13	0	Bit-mapped register.

Bit	Value	Result
0	1	Reset when DTR drops.
1	2	Reverse normal Auto Answer operation: On incoming RING, enter Originate Mode and look for an answer tone.
2	4	Disable 250 ms pause before result code display.
3	8	On DTR signal, autodial the number stored in NVRAM at position 0 (external I-modem only).
4	16	At power-on/reset, autodial number stored in NVRAM at position 0.
5	32	Disable HST (used for testing V.32*terbo* in Dual Standard I-modems).
6	64	Disable MNP Level 3 (used for testing Level 2).
7	128	Hardware reset (works like powering off and then on).

Register	Default	Function
S14	1	Bit-mapped register.

Bit	Value	Result
0	1	Disconnect on escape code.
1	2	Send result codes only when originating a call.

Register	Default	Function
S15	0	Bit-mapped register.

Bit	Value	Result
0	1	Disable the I-modem's extra high-frequency equalization if it causes problems on shorter-link calls —for HST modulation only.
1	2	Disable online fallback.
2	4	Disable 450 bps back channel— HST only.
3	8	Reset non-ARQ mode Transmit buffer from 1.5K bytes to 128.* (for the convenience of BBS operators taking calls from remote users of slower modems).
4	16	Disable MNP Level 4; retransmitting the larger Level 4 data blocks may be a problem if you expect a great number of errors during a call.
5	32	Set Backspace key to delete.
6	64	Some earlier 2400 bps MNP I-modems, not made by U.S. Robotics or Microcom, were not fully compatible with the MNP protocol. If you have difficulty making a successful 2400 bps MNP connection with a remote MNP I-modem, it may be because of this incompatibility. Set S15 to 64 and try again to make the connection.
7	128	Custom applications only.

Register	Default	Function
S16	0	Bit-mapped register.

Bit	Value	Result
1	2	Reserved.
2	4	Test pattern.
3	8	Remote digital loopback.

Register	Default	Function
S18	0	Test timer for software-initiated loopback testing (&T*n)*; disabled when S18 is set to 0. Used to set the duration of testing, in seconds, before the I-modem automatically times out and terminates the test.
S19	0	Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the phone line, and at the timeout the I-modem hangs up. S19=0 disables the timer.
S21	10	Sets, in 10-millisecond units, the length of breaks sent from the I-modem to the computer or terminal. Applies to ARQ mode only.
S22	17	Stores the ASCII code for the XON character.*
S23	19	Stores the ASCII code for the XOFF character.*
S24	150	Sets the duration, in 20-millisecond units, between pulsed DSR signals when the I-modem is set to &S2 or &S3. The default is 3 seconds.
S25	5	Sets DTR recognition time in 10-millisecond units.
S26	1	Sets duration, in 10-millisecond units, of the delay between RTS and the CTS in synchronous mode.
S27	0	Bit-mapped register.

Bit	Value	Result
0	1	Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the I-modem answers both Bell 103 and V.21 calls, but only originates V.21 calls.
1	2	Enable unencoded (non- trellis-coded) modulation in V.32 mode; this option

* See Appendix B, *ASCII Chart*.

		is part of the ITU-T V.32 recommendation, but is rarely used.
2	4	Disable V.32 modulation; used for testing HST modulation.
3	8	Disable 2100 Hz answer tone to allow two V.42 devices to connect more quickly.
4	16	See next page.
5	32	See next page.
7	128	Unusual software incompatibility. Some software may not accept some result codes. This setting disables the codes and displays the 9600 code instead. The call's actual rate can be viewed on the ATI6 screen.

Error control handshaking options: Select the total value of bits 4 and 5.

Bit 4	Bit 5	Result
0	0	Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.
16	0	Disable MNP.
0	32	Disable V.42 Detection and LAPM.
16	32	Disable Detection phase, if you know that the remote I-modem does LAPM, but not the Detection phase.

Register	Default	Function
S28	8	Sets the duration in tenths of a second of the extra 3000/600 Hz answer tones sent during V.32 handshaking. This gives V.32 modems additional time to connect in V.32 mode before timing out. If there is difficulty answering older, manually operated V.32 modems (for example, modems that require a button to be pushed in order to dial, try lengthening the duration of the extra tones). Setting S28 to zero eliminates the extra tones resulting in a faster connect time if, for example, the I-modem is set to use V.21 modulation (300 bps) or V.23 modulation (1200 bps).

Register	Default	Function
S34	0	Bit-mapped register. **Bit** / **Value** / **Result** 0 / 1 / Disable V.32*bis*. Used for troubleshooting; 3Com Technical Support may ask you to disable V.32*bis* for testing purposes. 1 / 2 / Disable the I-modem's enhanced, proprietary V.32*bis* modulation. Used for troubleshooting. 2 / 4 / Disable the faster retrains that occur during proprietary V.32*terbo* modulation. Used for troubleshooting. 3 / 8 / Enable V.23. Required for some British connections. 4 / 16 / Disable quick V32 retrain. 6 / 64 / Disable the remote-access busy message. 7 / 128 / Disable V.32*terbo*.
S38	0	Sets the duration, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call. This is provided to allow time for a remote device to acknowledge receipt of all transmitted data. Default = 0: The I-modem immediately hangs up when DTR drops. If the I-modem receives the ATH command, it ignores S38 and immediately hangs up.
S41	0	Sets the number of allowable remote-access login attempts, thus enabling or disabling remote access. The default setting of zero allows no remote login attempts, thus disabling remote access. A value of 1 or greater enables remote access. If the number of unsuccessful login attempts exceeds the limit set by this register, the I-modem returns online and any further login attempts during the remainder of that connection are refused.
S42	126	Stores the ASCII decimal code for the remote-access escape character. The default character is a tilde (~).
S43	200	Sets the duration, in fiftieths of a second, of the guard time for the remote-access (~~~~) sequence.

Register	Default	Function
S51	0	Bit-mapped register.

Bit	Value	Result
0	1	Disable MNP/V.42 for V.22 (1200 bps)
1	2	Disable MNP/V.42 for V.22*bis* (2400 bps)
2	4	Disable MNP/V.42 for V.32/V.32*bis*/V.32*terbo* (9600/14400/19200/21600 bps).

Register	Default	Function
S53	N/A	Bit-mapped register.

Bit	Value	Result
0	1	Dial security enabled.
1	2	Prompting enabled.
2	4	Local-access password protection enabled.

Note: Enabling local-access password protection disables the *&Zn=s* command (which stores up to 10 phone numbers) because stored phone numbers occupy the same space in NVRAM as the dialback numbers for Dial Security accounts.

Register	Default	Function
S54	64	Symbol rate bit-mapped register used primarily by 3Com Technical Support for debugging purposes.

Bit	Value	Result
0	1	Disable 2400 symbol rate.
1	2	Disable 2743 symbol rate.
2	4	Disable 2800 symbol rate.
3	8	Disable 3000 symbol rate.
4	16	Disable 3200 symbol rate.
5	32	Disable 3429 symbol rate.
6	64	Disable Call Indicate (CI).
7	128	Disable V.8.

Register	Default	Function		
S55	0	Trellis code bit-mapped register used primarily by 3Com Technical Support for debugging purposes.		
		Bit	**Value**	**Result**
		0	1	Disable 8S-2D mapping.
		1	2	Disable 16S-4D mapping.
		2	4	Disable 32S-2D mapping.
		3	8	Disable 64S-4D mapping.
S56	0	Bit-mapped register primarily used by 3Com Technical Support for debugging purposes.		
		Bit	**Value**	**Result**
		0	1	Disable non-linear coding.
		1	2	Disable TX level deviation.
		2	4	Disable preemphasis.
		3	8	Disable precoding.
		4	16	Disable shaping.
		5	32	Disables the 33.6 speed. The highest analog speed will be 28.8 (if x2 is not being used).
		6	64	Disable V.34.
		7	128	Disable V.FC.
S58	16	x2 bit-mapped register.		
		Bit	**Value**	**Result**
		0	1	Disable x2
		2	4	Force A-law mode
		3	8	Disable Symmetric Mode
S67	0	Misc. ISDN Configuration		
		Bit	**Value**	**Result**
		0	1	Reserved
		1	2	Fix Connection Rate for digital calls.
		2	4	Connect at 64K (else 56K)
		3	8	Route 3.1K Audio calls to data port
		4	16	Reserved
		5	32	Map LEDs to B-Channels
		6	64	Disable B-Chan. LED Blink
		7	128	Reserved

Register	Default	Function		
S68	0	Bit-mapped register.		
		Bit	**Value**	**Result**
		0	1	Do not allow analogue calls over digital data connections.
		1	2	Disable voice fallback in Universal Connect.
		2	4	Disable enhanced universal connect.
		3	8	Disable multilink PPP.
		4	16	Disable Turbo PPP.
		6	32	Disable Dynamic Bandwidth Allocation.
S69	0	Bit-mapped register.		
		Bit	**Value**	**Result**
		0	1	Disable Plug and Play signalling. (For external I-modems only.)
S79	1	Automode Protocol Sequence		
		Bit	**Value**	**Result**
		0	1	X.75, V.120, Analog
		1	2	X.75, V.110, Analog
		2	4	X.75, Analog
		3	8	V.120, V.110, Analog
		4	16	V.120, Analog
		5	32	V.110, V.120, Analog
		6	64	V.110, Analog
S80	1	International Controls		
		Bit	**Value**	**Result**
		0	1	Disable V.120 LLC
		1	2	Send *Pn as Calling Party #
		2	4	Force Modem Calls as Speech
		3	8	Enable V.110 at 38400 bps
		4	16	Insert <CR><LF> between RING and Calling Party #

Register	Default	Function		
		5	32	Reserved
		6	64	Reserved
		7	128	Reserved
S81	1	Bit-mapped X.75 register.		
		Bit	**Value**	**Result**
		0	1	Select Layer 2 ISO 7776 protocol

Register	Default	Function		
S82	1	Bit-mapped X.75 register.		
		Bit	**Value**	**Result**
		0	1	Select Layer 3 Transparent protocol
		1	2	Select Layer 3 T.70 NL
		2	4	BTX

Understanding Bit-Mapped S-Registers

Certain registers are "bit-mapped." A bit-mapped register uses *one* number to describe a *collection* of settings. While bit-mapping allows us to pack a lot of information in a small space, it is complex. Unfortunately, some discussion of binary mathematics is necessary to explain bit-mapping.

When the I-modem displays the value of an S-Register, *you* see a decimal value between 0 and 255. The *I-modem*, however, understands the decimal value as a collection of binary digits (bits). Here's how bits are mapped to decimal values:

Each bit can be either on (1) or off (0). Eight bits create 256 unique combinations of 1s and 0s. Each of the eight bits can be assigned a number corresponding to its position:

b b b b b b b b
7 6 5 4 3 2 1 0

Each bit can also be assigned a value corresponding to its number:

Table 0-1. Values Assigned to Bits.

This Bit	Is the same as	And has this value
7	2^7	128
6	2^6	64
5	2^5	32
4	2^4	16
3	2^3	8
2	2^2	4
1	2^1	2
0	2^0	1

Converting Bits to Decimal Values

Starting with a string of 8 bits, assign each "1" bit a value based on its position. Add the values to come up with the final decimal value.

Here's an example of how bits are converted to decimal values:

01001111

0	1	0	0	1	1	1	1	
0	+ 64	+ 0	+ 0	+ 8	+ 4	+ 2	+ 1	= **79**

Converting Decimal Values to Bits

Convert decimal values to bits by finding the largest value in the 3rd column in the table on the previous page that is no greater than the decimal value. Subtract that value and mark the corresponding bit "1." Continue until the decinal value is zero.

113

113 – 64 = 49
01
49 – 32 = 17
011
17 – 16 = 1
0111
1 – 1 = 0

01110001

Table 0-2. Default (NVRAM) S -Register Settings.

S-Registers		**Default**
S0	Auto Answer	N / A
S1	Counts & stores rings from incoming calls	0
S2	Escape code character	43
S3	Carriage Return character	13
S4	Line Feed character	10
S5	Backspace character	8
S7	Carrier wait-time, sec	60
S8	Dial pause, sec	2
S9	Carrier Detect time, 100 ms	6
S10	Carrier loss wait-time, 100 ms	14
S11	Tone duration, spacing, ms	70
S12	Escape code wait time, 500 ms	50
S13	Bit-mapped functions	0
S15	Bit-mapped functions	0

S-Registers		Default
S19	Inactivity / hang up timer	0
S21	Break length, 10 ms	10
S22	XON character	17
S23	XOFF character	19
S24	Pulsed DSR duration, 20 ms	150
S25	DTR recognition time, 10 ms	5
S26	RTS / CTS delay time, 10 ms	1
S27	Bit-mapped functions	0
S28	V.32 handshake time, 100 ms	8
S29	V.21 handshake time, 100 ms	20
S34	Bit-mapped functions	0
S38	Disconnect wait time, sec	0
S41	Allowable remote log-in attempts	0
S42	Remote Access ASCII character	126
S43	Remote wait time, 500 ms	200
S51	Bit-mapped functions	0
S53	Bit-mapped functions	0
S54	Bit-mapped functions	0
S55	Bit-mapped functions	0
S56	Bit-mapped functions	0
S58	x2 Mode and Remote Server Xmit	16
S67	Misc. ISDN Configuration	N / A
S68	ISDN Universal Connect	N / A
S69	Bit-mapped functions	N / A
S79	Automode Protocol Sequence	N / A
S80	International Controls	N / A
S81	X.75Layer 2 protocol	1
S82	X.75 Layer 3 protocol	1

Note: The following S-Registers are not used**S6**, **S14**, **S16-S18**, **S20**, **S30-S32**, **S33**, **S35-37**, **S39-S40**, **S44-S50**, **S52**, **S57**, **S70-78** and **S83.**

ASCII Chart

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
00	00	NUL	32	20	SP	64	40	@	96	60	`
01	01	SOH	33	21	!	65	41	A	97	61	a
02	02	STX	34	22	“	66	42	B	98	62	b
03	03	ETX	35	23	#	67	43	C	99	63	c
04	04	EOT	36	24	$	68	44	D	100	64	d
05	05	ENQ	37	25	%	69	45	E	101	65	e
06	06	ACK	38	26	&	70	46	F	102	66	f
07	07	BEL	39	27	‘	71	47	G	103	67	g
08	08	BS	40	28	(	72	48	H	104	68	h
09	09	HT	41	29	)	73	49	I	105	69	I
10	0A	LF	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	45	2D	-	77	4D	M	109	6D	m
14	0E	SO	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	48	30	0	80	50	P	112	70	p
17	11	XON	49	31	1	81	51	Q	113	71	q
18	12	DC2	50	32	2	82	52	R	114	72	r
19	13	XOFF	51	33	3	83	53	S	115	73	s
20	14	DC4	52	34	4	84	54	T	116	74	t
21	15	NAK	53	35	5	85	55	U	117	75	u
22	16	SYN	54	36	6	86	56	V	118	76	v
23	17	ETB	55	37	7	87	57	W	119	77	w
24	18	CAN	56	38	8	88	58	X	120	78	x
25	19	EM	57	39	9	89	59	Y	121	79	y
26	1A	SUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	62	3E	>	94	5E	ˆ	126	7E	~
31	1F	US	63	3F	?	95	5F	_	127	7F	DEL

Fax Information for Programmers

Fax Service Class 1 Commands

To program with Fax Service Class 1 commands, use the chart below:

To do this	Use this command	Where n equals
What Fax class is in use?	**AT+FCLASS=?**	N / A
Class identification and control.	**AT +FCLASS=n**	0,1, or 2.0
Stop transmission and pause, 10 ms.	**AT +FTS=n**	0 or 255
Wait for silence, 10 ms.	**AT +FRS=n**	0 or 255
Transmit data with carrier.	**AT +FTM=n**	3, 24, 48, 72, 73, 74, 96, 121, 122, 145, or 146
Receive data with carrier.	**AT +FRM=n**	3, 24, 48, 72, 73, 74, 96, 121, 122, 145, or 146
Transmit HDLC data with carrier.	**AT +FTH=n**	3, 24, 48, 72, 73, 74, 96, 121, 122, 145, or 146
Receive HDLC data with carrier.	**AT +FRH=n**	3, 24, 48, 72, 73, 74, 96, 121, 122, 145, or 146

FAX Service Class 2.0 Commands

In addition to the standard Class 2.0 fax commands, 3Com implements the following optional Class 2.0 fax commands :

To set this	Use this command	Where n equals
Pass-through, nonstandard negotiation byte string.	**AT+FNS=n**	0 or 1
Capability to receive.	**AT +FCR=n**	0 or 1
Adaptive Answer mode.	**AT +FAA=n**	0 or 1
Phase C Timeout	**AT +FCT=n**	0 to 255 secs.
Hangup Status Code, read only.	**AT +FHS=n**	0 to 255
Minimum Phase C Speed.	**AT +FMS=n**	0 to 3
Buffer size, read only.	**AT +FBS?=n**	100 or 500

Fax Mode Flow Control Setting

Many facsimile software products use software flow control when the modem is in Fax mode. Throughout our documentation, we recommend that you use hardware flow control for Data mode (factory setting). However, to allow compatibility with software products that use software flow control by default, U.S. Robotics fax modems automatically change to software flow control when entering Fax mode.

FCC Notice

FCC part 68, rules regarding fax operation, has been amended as follows:

Telephone facsimile machines—identification of the sender of the message: It shall be unlawful for any person within the United States to use a computer or other electronic device to send any message via a telephone facsimile machine unless such a message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business, other entity, or individual sending the message and the telephone number of the sending machine or of such business, other entity, or individual. Telephone facsimile machines manufactured on and after December 20, 1992 must clearly mark such identifying information on each transmitted page.

Notes

If you want to know more about the supported Class 1 fax commands, refer to the standard for the Service Class 1 fax protocol:

ANSI/EIA/TIA-578-1990 (EIA-578)
Asynchronous Facsimile DCE Control Standard
November, 1990 Approved: October 22, 1990

For more information on Class 2.0, refer to the standard for the Service Class 2.0 fax protocol:

ANSI/EIA/TIA-592-1993 (EIA-592)
Asynchronous Facsimile DCE Control Standard
May, 1993

You can obtain copies of these standards by contacting Global Engineering Documents at 1-800-854-7179.

Troubleshooting

This chapter is divided into three sections:

- Problems that occur before connecting.
- Problems that occur after connecting.
- What to do if you still have problems.

Problems That Occur Before Connecting

Problem:	**Do this:**
There is no response to AT	Make sure you set the correct COM port and IRQ in your communications software and, if applicable, in Windows' Control Panel – Ports.
	Make sure your communications software is in Terminal mode. (See Chapter 1, *Using the AT Command Set*.)
	Be sure your communications software is set to the correct bit rate and word length (7 bits with or without a parity bit, or 8 bits and no parity).
	Check that DIP switch 2 is ON, for "act on AT commands." If the switch is OFF, power off the I-modem, set the switch ON, and power on the I-modem again. Then try typing AT <Enter> again.
	Make sure that verbal result codes (status messages) are enabled. Send these commands to the I-modem: **ATQ0 <Enter>** (to enable message display) **ATV1 <Enter>** (to display verbal messages)
	Review your communications software manual to see what Carrier Detect (CD) operations your software requires. Then see Chapter 6, *Controlling EIA-232 Signalling*.
	Check to see if your computer is reversing the send/receive functions at the EIA-232 interface. Refer to your computer's documentation.
Double characters appear on your monitor This is a signal that both the I-modem's local echo and your software's local echo are on.	Type the command to turn off your online echo (ATF1 <Enter>) or turn your communications software's local echo off (refer to your software's documentation).

Problem:	**Do this:**
The I-modem won't dial	Check your communications software's manual to find out which Data Terminal Ready (DTR) setting it requires. You may need to change the DTR setting at the I-modem. If so, see Chapter 6, *Controlling EIA-232 Signalling*.
Hear ringing, but the I-modem won't answer	Check your communications software's manual to find out what DTR operations your software requires. Also, for external I-modems, look at the TR LED to make sure your terminal or computer is sending a DTR signal via the EIA-232 interface.
	Send ATI4 to the I-modem and check that S0 is set to a value higher than 0.
	Set &F and S0=1, then try again.
The I-modem acts as though a data link has been established, but no call was received	Carrier Detect (CD) may be overridden (with &C0), but your system may require that the override be turned OFF (with &C1). Review your communications software manual to see what CD operations are required.
The I-modem behaves as if <Enter> were pressed when you don't press any keys	Your software may be misreading signals from the I-modem when the I-modem sends a Carriage Return and a Line Feed before and after the RING and CONNECT messages. Sending the Quiet mode command, ATQ1 <Enter>, should solve the problem.

Problems that Occur After Connecting

Your screen displays random or "garbage" characters

Make sure the I-modem is set to the same bit rate, word length, parity, and number of Stop bits as the device to which you are connecting.

If the settings are correct, the problem may be with the phone line. Try the following measures:

- Place the call again. The phone company routes even local calls differently each time you call.
- Call a different device to see if the problem persists. The

problem may be with the device you first tried to call.

If the I-modem is set to a fixed serial port rate (&B1) and your software is fixed at 19200, 38400, 57600, or 115200 bps, the reason may be one of the following:

- Your computer may not support the higher serial port rate. If this is the case, fix your software rate at 9600 bps and disable high-speed V.32*terbo* modulation: ATS34=3 or ATS34.0=1.1=1.
- If you use memory-resident programs (TSRs–Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your communications software.
- Check that your software and the I-modem are set for the same kind of flow control, either hardware or software. Some communications programs also require that you disable the kind you are not using. Send AT&F1.

Many CRC errors

- Send AT&F1 to enable hardware flow control and other optimized settings.
- Try a different File Transfer Protocol (do not use XMODEM if other protocols are available to you)
- If you use memory-resident programs (TSRs–Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your communications software.

Mainframe computer keeps dropping your connection

You must turn off the I-modem's result codes and character echo (ATQ1E0). The modem at the mainframe also needs to be set to ATQ1E0.

Bad faxes or can't fax

- Make sure the fax software is set to use Class 1 fax. Refer to your fax software's manual.
- If you use memory-resident programs (TSRs–Terminate and Stay Resident programs) or disk-caching programs, they may be interfering. Try disabling them before you run your com-

munications software.

Both devices exchange carrier signals, but fail to establish a communications link

- Make sure the I-modem is in the correct mode (fax or data), depending on whether the connection is to be made with a facsimile device or a data device.

  See Chapter 2, *Modes of Operation*, for information on switching between Fax and Data modes.

- Make sure the proper bit rate, word length, parity, and number of Stop bits have been selected.
- Synchronous operations: Review the instructions in Chapter 16, *Analogue Synchronous Applications* If you've configured the I-modem correctly, the problem may be with the synchronous adapter or with the system you're trying to call.

  - Send ATI4 and check to see that your modem is at the correct B*n* setting to connect with either an HST modem (B1 setting) or V.32*terbo* modem (B0 setting).

- Make sure your I-modem's connection rate setting, &N*n*, is correct for the call. If the connection rate is locked at a speed (&N1–&N14) different from the calling modem's, the I-modem hangs up. The default setting of &N0 (variable link operations) allows the two modems to negotiate the highest possible connection rate.
- If your modem is attempting to answer a V.32 call, you may need to lengthen the extra V.32 answer tones. See Appendix A, *Alphabetic Command Summary*, under S28.
- If you are attempting to make a connection using HST modulation, make sure the modem at the other end of the line is HST-compatible, V.32*terbo* compatible at 14.4 kbps, V.32 compatible at 9600 bps, V.22*bis*-compatible at 2400 bps, Bell 212A-compatible at 1200 bps, or Bell 103-compatible at 300 bps.
- If none of the above corrects the problem, it's likely that the quality of the phone connection is poor. The variable quality of phone line connections may be due to any number of conditions in the phone service's equipment or the current environment. Try several calls, and if you still can't get

through, try calling another device. If the second device accepts your call, the problem may lie with the device you first tried to call.

Errors during software download

Try running the PCSDL program at a lower serial port rate. External I-modems Only: if your computer doesn't have a 16550 UART, a slower serial port rate can make all the difference.

If You Still Have Problems

Should you encounter any difficulties with your Courier I-modem, refer to the manual first.

For the UK

Call or visit your dealer, if they are unable to assist you, contact the 3Com UK Technical Support Department from Monday through to Friday, between 9:30am -5:00pm on;

Email address:	uksupport@usr.com
CompuServe:	GO UKVENA
BBS:	0118 969 2200
FOD*:	0118 922 8299
Fax:	0118 969 4222
Tel:	0118 944 1000
Web site:	http://www.usr.co.uk

*FOD = Fax on Demand

Upon contacting 3Com you will be issued with a Call Reference Number (CRN). This should be quoted when contacting the Technical Support Department in relation to your query.
Should you be advised to return your modem, 3Com will repair and return the unit to you.

Please note that our U.S. Robotics brand modems can not be returned without prior approval by the 3Com Technical Support Department.

For European countries

Should you encounter any difficulties with your modem, refer to the manual first.

Call or visit your dealer, if they are unable to assist you, contact the U.S. Robotics Technical Support Department from Monday through to Friday, between 9:30am -5:00pm on.

Hotline: +33 (0) 3 20 19 24 24
Fax: +33 (0) 3 20 19 24 34
USR BBS: +33 (0) 3 20 91 03 08
CompuServe: GO USROBOTICS
Internet: eurosupport@usr.com

Should you return the momdem to us, contact U.S. Robotics Customer Support to obtain a Return Materials Authorisation (RMA) number. You must have an RMA number before returning the modem to us.

Phone : +33 (0) 3 20 87 04 97
Fax : +33 (0) 3 20 87 06 94

Ship the unit, postage paid, in a strong box made of corrugated cardboard with plenty of packing material (preferably the original container.)

Include your RMA number, name and address on the shipping label as well as inside the package.

Ship to the following address:

U.S. Robotics Logistics sarl
European Repair Center
RMA#
Rue Jules Verne
Centre de Gros N°2
F-59818 Lesquin Cedex
France

Technical Specifications

Standards Compatibility

The I-modem uses multiple standard data communications protocols and is also compatible with many nonstandard schemes.

ISDN

ITU-T Q.921	ISDN data link layer
ITU-T Q.931/I.451	ISDN call control signalling variants:
ITU-T V.120/I.463	Encapsulates asynchronousor synchronousdata for transmission over the ISDN at 56 or 64 kbps.
ITU-T V.110/I.462	Encapsulates asynchronous or synchronous data for transmission over the ISDN at 56 or 64 kbps adapted to 19.2 kbps.

Modulation

x2	Up to 56 kbps downstream and V.34 speeds upstream
ITU-T V.34	33.6 K/31.2 K/28.8 K/26.4 K/24 K/21.6 K/19.2 K /16.8 K/14.4 K/12 K/9600/7200/4800 bps asynchronous Trellis Coded Modulation (TCM)
V.FC	28.8 K/26.4 K/24 K/21.6 K/19.2 K/16.8 K/14.4 K bps asynchronous TCM
V.32*terbo*	21.6 K/19.2 K/16.8 K/14.4 K/12 K/9600/7200 bps asynchronous TCM; 4800 bps asynchronous Quadrature Amplitude Modulation (QAM)
HST	16.8 K/14.4 K/12 K/9600/7200 bps asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps TCM and QAM; 4800 bps asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps QAM
ITU-T V.32*bis*	14.4 K/12 K/9600/7200 asynchronous TCM; 4800 bps

	asynchronous QAM
ITU-T V.32	9600 asynchronous, TCM;4800 bps asynchronous, QAM
ITU-T V.22*bis*	2400 bps asynchronous, QAM
Bell 212A	1200 bps (also V.22) asynchronous, Differential Phase Shift Keying (DPSK)
ITU-T V.23	1200 bps asymmetrical with 75 bps back channel with Frequency Shift Keying (FSK)
Bell 103	300 bps (ITU-T V.21 optional) asynchronous, Frequency Shift Keying (FSK)

Error Control, Data Compression, and Testing

ITU-T V.42	LAPM error control, 1200 bps and higher
MNP	Levels 2, 3 and 4 error control, level 5 data compression, 1200 bps and higher
HST	Asymmetrical mode, at 16.8K, 14.4K, 12K, 9600, 7200, 4800 bps, 450/300 bps back channel
ITU-T V.42*bis*	Data compression, 1200 bps and higher (analogue calls only)
ITU-T V.54	Digital and remote digital loopback testing
ITU-T V.25*bis*	Dialling and answering method for automatic calling and/or answering equipment.

Fax

The I-modem provides Group III-compatibility when controlled by Class 1 or Class 2.0 fax software. In addition, the I-modem adheres to the following standards:

TIA/EIA-578	Service Class 1 Asynchronous Facsimile DCE Control Standard
TIA/EIA-592	Service Class 2.0 Asynchronous Facsimile DCE Control Standard
ITU-T V.17	14.4K/12K bps
ITU-T V.29	9600/7200 bps
ITU-T V.27*ter*	4800/2400 bps
ITU-T V.21	300 bps

Additional Specifications

<table>
<tr><td>Serial port</td><td>DB-25</td></tr>
<tr><td>Serial interface</td><td>EIA RS-232</td></tr>
<tr><td>Supported serial port rates</td><td>230400, 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200, 300 bps</td></tr>
<tr><td>Adaptive Speed Leveling (ASL)</td><td>21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800 bps</td></tr>
<tr><td>ISDN physical interface</td><td>RJ45 jack</td></tr>
<tr><td>Communications channel</td><td>ISDN B-channels</td></tr>
<tr><td>Data format</td><td>Binary, serial; defaults to 8-bit word length, no parity, and 1 stop bit.
<table>
<tr><th>Word Length</th><th>Parity (1 Bit)</th><th>Stop Bits</th></tr>
<tr><td>7</td><td>Even, Odd, Mark, Space</td><td>1</td></tr>
<tr><td>7</td><td>None</td><td>2</td></tr>
<tr><td>8</td><td>None</td><td>1</td></tr>
</table></td></tr>
<tr><td>Flow Control Buffers</td><td>Variable sizes</td></tr>
<tr><td>Command Buffer</td><td>60 characters, excluding the AT prefix, Carriage Return and spaces</td></tr>
<tr><td>Test Options</td><td>Remote digital loopback, digital loopback, test pattern, and dial test</td></tr>
<tr><td>Failed Call Timeout</td><td>60 second default, programmable 2-255 sec</td></tr>
<tr><td>Answer Tone Timeout</td><td>60 seconds</td></tr>
<tr><td>Answer Tone Detector</td><td>2200-2300 Hz</td></tr>
<tr><td>Loss of Carrier (Disconnect Timer)</td><td>0.7 second default, programmable 0.2-25.5 sec.</td></tr>
<tr><td>Equalization</td><td>Adaptive</td></tr>
<tr><td>Receive Sensitivity</td><td>- 44 dBm ± 2 dBm</td></tr>
<tr><td>Transmit Level</td><td>- 9 dBm maximum</td></tr>
<tr><td>Transmitter Frequency Tolerance</td><td>.01%</td></tr>
<tr><td>Certification</td><td>EMC Directive 89/336/EEC, Low Voltage Directive 73/23/EEC, TTE Directive 91/263/EEC</td></tr>
</table>

Ringer Equivalence

U.S. Ringer Equivalence Number: **3**

Ringer equivalence is defined as the maximum sum of the REN values for all the analogue devices that are attached to the I-modem. Because a typical telephone has a REN value of 0.6, the I-modem can support up to five phones connected through the Analogue Device port over short loops.

Power Consumption

Total power consumed:

Normal: 20W

Maximum: 30W

Notices

European Community

The Courier I-modem with ISDN / V.34 has been approved for connection to the telecommunications network in the European Community under the TTE Directive.

The telecommunications cable supplied with the product is the model used during the approval process. Use of a cable other than the one supplied with the product may affect the performance and violate the approval requirements of the product.

The safety status of the interconnection ports on the Courier I-modem are as follows:

Ports marked as **S/T Interface** = TNV

TNV is a circuit that under normal operating conditions carries Telecommunication Signals

Port marked as **PHONE** = SELV

SELV is a secondary circuit which is so designed and protected that under normal and single fault conditions , the voltage between any two accessible parts does not exceed a safe value

(42.4 V peak or 60 V d.c.).

Important: You should only connect apparatus complying with the relevant interface requirements to the ports on the Courier I-modem. The analogue interface (PHONE) is intended for connection to standard PSTN equipment and not to the analogue telephone network. If you have any doubts seek the advice from an engineer before attaching the apparatus.

x2 Result Codes and Disconnect Reasons

This Appendix contains the following information:

- Result Codes
- Disconnect Reasons
- Dial Security Disconnect Reasons

Result Codes

Use the following table for a list of all result codes:

Numeric	Alphanumeric
180	CONNECT 33333
181	CONNECT 33333/ARQ
182	CONNECT 33333/x2
183	CONNECT 33333/ARQ/x2
184	CONNECT 37333
185	CONNECT 37333/ARQ
186	CONNECT 37333/x2
187	CONNECT 37333/ARQ/x2
188	CONNECT 41333
189	CONNECT 41333/ARQ
190	CONNECT 41333/x2
191	CONNECT 41333/ARQ/x2
192	CONNECT 42666
193	CONNECT 42666/ARQ
194	CONNECT 42666/x2
195	CONNECT 42666/ARQ/x2
196	CONNECT 44000
197	CONNECT 44000/ARQ
198	CONNECT 44000/x2
199	CONNECT 44000/ARQ/x2

Result Codes (Continued)

Numeric	Alphanumeric
200	CONNECT 45333
201	CONNECT 45333/ARQ
202	CONNECT 45333/x2
203	CONNECT 45333/ARQ/x2
204	CONNECT 46666
205	CONNECT 46666/ARQ
206	CONNECT 46666/x2
207	CONNECT 46666/ARQ/x2
208	CONNECT 48000
209	CONNECT 48000/ARQ
210	CONNECT 48000/x2
211	CONNECT 48000/ARQ/x2
212	CONNECT 49333
213	CONNECT 49333/ARQ
214	CONNECT 49333/x2
215	CONNECT 49333/ARQ/x2
216	CONNECT 50666
217	CONNECT 50666/ARQ
218	CONNECT 50666/x2
219	CONNECT 50666/ARQ/x2
220	CONNECT 52000
221	CONNECT 52000/ARQ
222	CONNECT 52000/x2
223	CONNECT 52000/ARQ/x2
224	CONNECT 53333
225	CONNECT 53333/ARQ
226	CONNECT 53333/x2
227	CONNECT 53333/ARQ/x2
228	CONNECT 54666
229	CONNECT 54666/ARQ
230	CONNECT 54666/x2

Result Codes (Continued)

Numeric	Alphanumeric
231	CONNECT 54666/ARQ/x2
232	CONNECT 56000
233	CONNECT 56000/ARQ
234	CONNECT 56000/x2
235	CONNECT 56000/ARQ/x2
236	CONNECT 57333
237	CONNECT 57333/ARQ
238	CONNECT 57333/x2
239	CONNECT 57333/ARQ/x2
240	CONNECT 64000
241	CONNECT 64000/ARQ
242	CONNECT 64000/x2
243	CONNECT 64000/ARQ/x2

Disconnect Reasons

Table 12-2 explains the disconnect reasons that are displayed in the ATI6 response. Messages pertaining to analogue connections are indicated *by italics*.

Disconnect Reason	Explanation
A Rootless Tree	The I-modem received an invalid V.42bis (compression) frame.
Bearer capability not authorized	You have requested a B-channel capability you are not authorized to use.
Bearer capability not implemented	The device you called does not support the B-channel capability you requested.
Bearer capability not presently available	You have requested a B-channel capability that is not currently available.
Break Timeout	Incompatible processing of a Break signal occurred.
Call awarded and being established in an established channel	The call is connected through the usual, expected channel.

Disconnect Reason	Explanation
Call rejected	The device you tried to call refused to accept the call, and it is not busy or incompatible.
Channel type not implemented	You have reached an unsupported channel type.
Channel unacceptable	The device you are trying to call cannot negotiate for any channel other than the one specified in the SETUP message.
Circuit / channel congestion	There is no appropriate circuit (channel) to handle your call request.
Destination out of order	The call could not reach the user because of a physical or data link problem.
DISC	The remote device sent a V.42 Disconnect frame.
DTR dropped	The computer dropped the Data Terminal Ready signal, terminating the call.
Escape code	The operator sent the I-modem the +++ escape code.
Extra Stepup	The I-modem received an invalid V.42bis (compression) frame.
Facility rejected	The network cannot provide the facility you requested.
GSTN (General Switch Telephone Network) Clear Down	The connection was non-ARQ, and DTR was dropped from one side of the connection; or the DISC frame was corrupted due to noise.
Identified channel does not exist	You sent a request to use a channel that is not activated.
Illegal command code	The I-modem received an invalid V.42bis (compression) frame.
Inactivity timeout	The I-modem detected no activity on the line for the duration specified in Register S19 (default is 0, timer disabled).
Incoming calls barred	The device you called refused to accept your call.

Disconnect Reason	Explanation
Incompatible destination	The device you called cannot accommodate your request (for example, it can't match the data rate).
Information element non-existent or not implemented	You sent a message that was processed successfully, even though it contained unrecognizable information elements.
Interworking class, unspecified	Your call went through a network that cannot provide messages, so you won't know what the causes for any problems were.
Invalid call reference value	You sent a message with a "call reference" that can't currently be used.
Invalid codeword	The I-modem received an invalid V.42bis (compression) frame.
Invalid information element contents	You sent an information element that contained information that is not valid, but it was processed anyway. It might have been truncated.
Invalid message, unspecified	An "invalid message" event occurred that doesn't fit any other invalid message descriptions.
Invalid number format (incomplete number)	The destination cannot be reached because the number is either not valid or not complete.
Invalid speed	The I-modem is set to &N1 or higher, for a fixed link rate; and the remote device is not operating at the same rate.
Keypress abort	You pressed a key that ended the session.
LD received	The remote device sent an MNP error-control Link Disconnect request.
Loss of carrier	The I-modem detected a loss of the remote device's carrier and waited the duration specified in Register S10 (default is 0.7 seconds).
Mandatory information element is missing	The message you sent cannot be processed because it is missing one or more mandatory elements.

Disconnect Reason	Explanation
Message not compatible with call state	You sent a message that could not be received because of the receiving device's call state.
Message type non-existent or not implemented	You sent a message that could not be recognized because its type is either not defined or defined but not implemented.
MNP incompatibility	Either the I-modem is set to &M5 and the remote device does not have MNP capability, or there was an error in the MNP negotiation procedure.
No route to destination	The network through which you are calling does not serve the number you are trying to call.
No route to specified transit network	The network through which you are trying to call either doesn't exist or cannot be accessed.
No user responding	The user has not responded to the call with either an ALERT or CONNecting indication within a specified amount of time.
Non-selected user clearing	The user was not awarded the incoming call.
Normal call clearing	The call ended at the request of one of the users
Normal, unspecified	A "normal" event occurred that doesn't fit any of the other normal descriptions.
Number changed	The number you called is no longer assigned.
Only restricted digital information bearer capability is available	You have requested unrestricted B-channel capability, but only restricted is available.
Protocol error, unspecified	A protocol error event occurred that doesn't fit any of the other protocol error definitions.
Recovery on timer expiry	Your call could not be established because it wasn't responded to in time.
Requested channel not available	The channel you requested is not available: it's engaged or out of service.
Requested facility not implemented	You cannot access the facility you requested because it's not implemented.

Disconnect Reason	Explanation
Requested facility not subscribed	You cannot access this facility because you are not subscribed to it.
Resource unavailable	A “network resource unavailable” event occurred that doesn’t fit any of the other network congestion descriptions.
Response to STATus ENQuiry	Included in the STATus message when the STATus message was sent in response to a STATus ENQuiry.
Retransmit limit	The devices reached the maximum of 12 attempts to transfer a data frame without error.
SABME (Set Asynchronous Balance Mode Extended) Timeout	The devices failed this part of V.42 link negotiation.
Service or option not available, unspecified	A “service or option not available” event occurred that doesn’t fit any of the other service or option-not-available descriptions.
Service or option not implemented, unspecified	A “service or option not implemented” event occurred that doesn’t fit any of the other service or option not implemented descriptions.
Switching equipment congestion or B-channel negotiation	Heavy traffic at the switch.
Temporary failure	The called device or network is not functioning, but should function shortly.
Unassigned (unallocated) number	The number you are trying to call has not been assigned to a device.
Unable to Retrain	After several attempts, disturbances on the phone line prevented the devices from retraining, and they could no longer transmit or receive data.
User alerting, no answer	The call has been cleared because no valid CONNect message was received.
User busy	Though the user’s equipment is compatible with the call, it has no resources to handle the call.

Disconnect Reason	Explanation
User information discarded	Could not deliver user information to the remote user as requested.
XID timeout	The devices failed to negotiate the V.42 Detection (XID Exchange) phase.

Disconnect Reasons for Dial Security

Disconnect Reason	Explanation
Mode Incompatible	The I-modem hung up because both devices were not set to the same error-control setting.
No Prompting in Non-ARQ	Prompting was enabled, but the I-modem hung up because the originating device was set for error control, and the answering device was set for non-error control. The answering device cannot prompt when it is set for non-error control.
No Prompting in Sync (External I-modems only)	The originating device did not send an Autopass password, and the answering device cannot prompt for a password in any synchronous mode.
Non-ARQ Mode	The I-modem hung up because the originating device was set for error control and the answering device was set for non-error control.
Prompting Not Enabled	The I-modem hung up because the originating device did not send an Autopass password, and prompting wasn't enabled.
Security Abort	The I-modem hung up because it received an invalid password three times.

Accepting and Rejecting Calls

The following table lists call types and the calls that are accepted and rejected when each call type is selected:

If the I-modem is set for	It accepts these calls	And fails these calls
Automatic service choice	V.110, V.120, X.75, and analogue	PPP and Clear-Channel Synchronous calls
V.120 rate adaption calls only	V.120	X.75, V.110, analogue, and PPP, Clear-Channel Synchronous calls
V.110 rate adaption calls only	V.110	X.75, V.120, analogue, and PPP, Clear-Channel Synchronous calls
X.75 rate adaption calls only	X.75	V.120, V.110, analogue, PPP, and Clear-Channel Synchronous calls
Modem or fax emulation only	Analogue modem or fax	X.75, V.110, V.120, and PPP, Clear-Channel Synchronous calls
Clear-Channel Synchronous	Clear-Channel Synchronous	X.75, V.110, V.120, analogue, and PPP calls
Internet Access Mode	PPP and analogue calls	X.75, V.110 and V.120, Clear-Channel Synchronous calls

Select a routing destination for incoming modem / fax calls. You can route modem or fax calls to the I-modem itself or a modem or fax machine attached to the I-modem's analogue port.

> **Note:** You can only select a routing destination for incoming modem / fax calls if ***P1** is blank.

Use the chart below to determine how the S-Register settings affect the routing of 3.1 kHz audio calls and speech calls.

To route incoming 3.1 kHz audio calls to the	**And incoming speech calls to the**	**Use these commands**
Data Port	N / A	**ATS67.3=1**
Analogue Device Port	Analogue Device Port	**ATS67.3=0** **ATS68.4=0**
Analogue Device Port	On-board analogue modem	**ATS67.3=0** **ATS68.4=1**
On-board analogue modem	Analogue Device Port	**ATS67.3=1** **ATS68.4=0**
On-board analogue modem	On-board analogue modem	**ATS67.3=1** **ATS68.4=1**

For example, **ATS67.3=1 <Enter>** sets incoming analogue calls to be routed to the I-modem's Data Port (or on-board analogue modem), unless the I-modem's Data Port (or on-board analogue modem) is occupied by another call.

Glossary

Cross-references in the following definitions are printed in boldface.

1B+D

In **ISDN BRI**, a common configuration of 1 **B-channel** and 1 **D-channel**.

UART

The fastest type of **UART** that is currently available.

2B+D

In **ISDN BRI**, a common configuration of 2 **B-channels** and 1 **D-channel**.

5ESS

See **AT&T 5ESS**.

Adaptive Speed Levelling (ASL)

Courier V.32*bis* and V.32*terbo* modems detect improved line conditions and shift upward again to the next higher speed. The modems at both ends of the connection adapt independently, each detecting and adjusting to line conditions. ASL keeps the modems online, always operating at the highest possible speed and constantly ensuring data integrity.

analogue signals

Continuous, varying waveforms, such as the voice tones carried over phone lines. Contrast with **digital signals**.

answer mode

A state in which the modem transmits at the predefined high frequency of the communications channel and receives at the low frequency. The transmit/receive frequencies are the reverse of the calling modem, which is in **originate mode**.

application (application program)

A computer program designed to perform a specific function, such as a word processor or a spreadsheet.

ARQ

See **Automatic Repeat Request**.

ASCII

American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as $, !, and /. Supported by almost every computer and terminal manufacturer.

ASL

See **Adaptive Speed Levelling**.

asymmetrical modulation

A transmission technique that splits the communications channel into one high-speed channel and one slower channel. During a call under asymmetrical modulation, the modem with the greatest amount of data to transmit is allocated the high speed channel. The modem with less data is allocated the slow, or back channel (450 bps). The modems dynamically reverse the channels during a call if the volume of data transfer changes.

AT&T 5ESS

A make and model of **central-office switch**. Before **NI-1**, AT&T and Northern Telecom implemented proprietary protocols to handle ISDN calls. That’s why it’s important to know whether an

AT&T 5ESS **central office switch** is using **“Custom”** or **NI-1 call-control signalling**.

This protocol is used in the United States only.

asynchronous transmission

Data transmission in which the length of time between transmitted **characters** may vary.

Because the time lapses between transmitted characters are not uniform, the receiving modem must be signalled as to when the data bits of a character begin and when they end. The addition of s**tart** and s**top bits** to each character serves this purpose.

Auto Answer

A feature in modems enabling them to answer incoming calls over the phone lines without the use of a telephone receiver.

auto dial

A feature in modems enabling them to dial phone numbers over the phone system without the use of a telephone transmitter.

Automatic Repeat Request (ARQ)

A general term for error-control protocols that feature error detection and automatic retransmission of defective blocks of data. See **HST**, **MNP**, and **V.42**.

Basic Rate Interface (BRI)

A unit of **ISDN** service that provides up to two 64-kbps **B-channels** and one 16-kbps **D-channel** over an ordinary telephone line.

baud rate

The number of discrete signal events per second occurring on a communications channel. Although not technically accurate, baud rate is commonly used to mean **bit rate**.

B-channel

In **ISDN**, a 64-kbps channel for passing **circuit-switched** (or packet-switched) digital information. The "B" stands for "bearer."

binary digit (bit)

A 0 or 1, reflecting the use of a binary numbering system (only two digits). Used because the computer recognises either of two states, OFF or ON. Shortened form of binary digit is **bit**.

BISYNC

Binary Synchronous Control. A protocol developed by IBM for software applications and communicating devices operating in synchronous environments. The protocol defines operations at the link level of communications (for example, the format of data **frames** exchanged between modems over a phone line). Also see **Protocol**, **HDLC**, **SDLC**.

bit

See **binary digit**.

bit-mapping

A technique that lets one decimal number (in this case, a number between 0 and 255) stand for up to eight separate **binary** settings.

bit rate

The number of **binary digits**, or bits, transmitted per second (**bps**). Communications channels using telephone channel modems are established at set bit rates, commonly 300, 1200, 2400, 4800, 9600, 14400, and 28800.

bps

The bits (**binary digits**) per second rate.

BRI

See **Basic Rate Interface**.

buffer

A memory area used as temporary storage during input and output operations. An example is the modem's command buffer. Another is the Transmit Data flow control buffer used for flow control and to store copies of transmitted **frames** until they are positively acknowledged by the receiving modem.

byte

A group of **binary digits** stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers) or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte (K) is equal to 1,024 bytes or characters; 64K indicates 65,536 bytes or characters.

call-control signalling

Messages carried over the telephone network that route, set up, and tear down calls. In **ISDN**, call control signalling goes on over the **D-channel** and is kept apart from the data carried on the **B-channels**.

call indicate

A call originating tone defined by **ITU-T** recommendation **V.8**.

CAPI

See **Common-ISDN-Application Interface**.

carrier

A continuous frequency capable of being either modulated or impressed with another information-carrying signal. Carriers are generated and maintained by modems via the transmission lines of the telephone companies.

CCITT

Formerly an international organisation that defined standards for telegraphic and telephone equipment. It has been incorporated into its parent organisation, International Telecommunication Union (**ITU**). Telecommunication standards are now covered under Telecommunications Standards Sector (TSS). ITU-T replaces CCITT.

central office (CO)

The facility to which devices, such as telephones, fax machines, modems, and **terminal adapters**, within a specific geographic area of a public telephone network are connected.

central office switch

A device, located at the telephone company's central office, to which devices, such as telephones, fax machines, modems, and **terminal adapters** are connected.

character

A representation, coded in **binary digits**, of a letter, number, or other symbol.

characters per second (cps)

A data-transfer rate generally estimated from the **bit rate** and the **character** length.

For example, at 2400 bps, 8-bit characters with **start** and **stop bits** (for a total of 10 **bits** per character) will be transmitted at a rate of approximately 240 characters per second (cps). Some protocols, such as U.S. Robotics **HST** and **MNP**, employ advanced techniques such as longer transmission **frames** and **data compression** to increase cps.

circuit-switched data (CSD)

A type of switching in which one call makes up a circuit (the circuit is not shared with other calls), and data is passed across the circuit.

circuit-switched voice (CSV)

A type of switching in which one call makes up a circuit (the circuit is not shared with other calls), and speech or **3.1 kHz audio** is passed across the circuit.

Class 1/EIA-578

An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 1 faxes.

Class 2.0/EIA-592

An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 2.0 faxes.

CO

See **central office**.

COM port

See **serial port**, **EIA-232**.

Common-ISDN-Application Interface

Common-ISDN-Application Interface (CAPI) is an ISDN application programming interface standard designed to simplify the development of ISDN applications.

cps

See **characters per second**.

CPU

Central processing unit.

CRC

See **cyclic redundancy check**.

CSD

See **circuit-switched data**.

CSV

See **circuit-switched voice**.

CSV/D

Alternating circuit-switched voice and data. See **circuit-switched voice** and **circuit-switched data**.

"Custom"

AT&T's **call-control signalling** protocol that was implemented before the advent of **NI-1**.

cyclic redundancy check (CRC)

An error-detection technique consisting of a cyclic algorithm performed on each block or **frame** of data by both sending and receiving modems. The sending modem inserts the results of its computation in each data block in the form of a CRC code. The receiving modem compares its results with the received CRC code and responds with either a positive or negative acknowledgement. In the ARQ protocol implemented in 3Com high-speed modems, the receiving modem accepts no more data until a defective block is received correctly.

data B-channel

Your I-modem distinguishes between the data B-channel and the **analogue device B-channel**. All I-modems need a **CSV/D B-channel** over which to pass **V.120**, fax / modem, and, optionally, **V.110** data.

data communications

A type of communications in which computers and terminals are able to exchange data over an electronic medium.

data compression

When the transmitting modem detects redundant units of data, it recodes them into shorter units of fewer bits. The receiving modem then decompresses the redundant data units before passing them to the receiving computer.

data compression table

A table of values assigned for each character during a call under data compression. Default values in the table are continually altered and built during each call: the longer the table, the more efficient throughput gained.

If a destructive Break is sent during a call (see the &Y command), causing the modems to reset the compression tables, you can expect diminished throughput.

data communication equipment (DCE)

In this manual, the term applies to modems that establish and control the data link via the telephone network.

Data mode

The mode in which the fax modem is capable of sending and receiving data files. A standard modem without fax capabilities is always in Data mode.

Data Over Voice

Data Over Voice (DOV) is a feature that allows your I-modem to make more cost effective 3.1 kHz analogue calls while allowing the
I-modem to send digital data at 56 kbps.

data set

Another way of saying "modem."

data terminal equipment (DTE)

The device that generates or is the final destination of data.

DBA

See **Dynamic Bandwidth Allocation**.

DCE

See **data communication equipment**.

D-channel

In **ISDN BRI**, a 16-kbps channel for call control signalling or for passing packet-mode (for example, X.25) data. In **ISDN PRI**, a 64-kbps channel for call-control signalling or for passing packet-mode data. The "D" stands for "delta."

default

Any setting assumed, at startup or reset, by the computer's software and attached devices, and operational until changed by the user.

digital loopback

A test that checks the modem's RS-232 interface and the cable that connects the terminal or computer and the modem. The modem receives data (in the form of **digital signals**) from the computer or terminal, and immediately returns the data to the screen for verification.

digital signals

Discrete, uniform signals. In this manual, the term refers to the **binary digits** 0 and 1.

DIP switch

DIP stands for dual in-line package.

directory number (DN)

The **ISDN** equivalent of an ordinary telephone number, except that often the area code is left off.

DMS-100

See **Northern Telecom DMS-100**.

This protocol is used in the United States only.

DN

See **directory number**.

DSR

See **data set ready**.

DSS 1

Central-office switch and protocol type.

DTE

See **Data Terminal Equipment**.

duplex

Indicates a communications channel capable of carrying signals in both directions. See **half duplex**, **full duplex**.

Dynamic Data Bandwidth Allocation

Dynamic Data Bandwidth Allocation is a cost savings feature that helps you save money by only using the second B-channel when it is need for data transfers, and then dropping the second B-channel when it is not needed. Dynamic Bandwidth Allocation determines the need for the second B-channel by measuring the amount of data sent or received during a set period of time.

echo

See **local echo**.

EIA

Electronic Industries Association, which defines electronic standards in the United States.

EIA-232

A technical specification published by the Electronic Industries Association that establishes mechanical and electrical interface requirements among computers, terminals, modems, and communication lines.

equalisation

A compensation circuit designed into modems to counteract certain distortions introduced by the telephone channel. Two types are used: fixed (compromise) equalisers and those that adapt to channel conditions. 3Com high-speed modems use adaptive equalisation.

error control

Various techniques which check the reliability of characters (**parity**) or blocks of data. V.42, MNP, and HST error-control protocols use error detection (**CRC**) and retransmission of errored frames (**ARQ**).

ETSI NET 3

Central-office switch and protocol type.

EuroISDN

Central-office switch and protocol type.

expansion bus

A series of slots inside a computer that allow for adding feature cards.

facsimile (fax)

A method for transmitting the image on a printed page from one point to another.

fax

See **facsimile**.

fax mode

The mode in which the fax modem is capable of sending and receiving files in a facsimile format.

File Transfer Protocol (FTP)

A TCP/IP application that allows users of an Internet to send (put) and receive (get) files.

Flash memory

A form of memory that can be electrically erased and reprogrammed without the need to remove it from the circuit board.

flow control

A mechanism that compensates for differences in the flow of data input to and output from a modem or other device.

frame

A data communications term for a block of data with header and trailer information attached. The added information usually includes a frame number, block size data, error-check codes, and Start/End indicators.

Frame Size (X.75)

Frame size is the number of data bytes sent in an X.75 frame.

France VNx

Central-office switch and protocol type.

FTP

See **File Transfer Protocol**.

full duplex

Signal flow in both directions at the same time. In microcomputer communications, may refer to the suppression of the online **Local Echo**.

half duplex

Signal flow in both directions, but only one way at a time. In microcomputer communications, may refer to activation of the online **Local Echo**, which causes the modem to send a copy of the transmitted data to the screen of the sending computer.

handshaking

A sequence that two modems undertake while connecting to agree on the parameters of the conversation that will ensue. During handshaking, the modems negotiate the speed of the connection, whether **error control** and **data compression** will be used and in what form, and so forth.

hardware flow control

A form of **flow control** that uses electronic signals to start and stop the flow of data.

HDLC

See **High Level Data Link Control**.

High-Level Data Link Control (HDLC)

A standard protocol developed by the International Standards

Organisation for software applications and communicating devices operating in synchronous environments. The protocol defines operations at the link level of communications (for example, the format of data **frames** exchanged between modems over a phone line). See **Bisync**, **Protocol**, **SDLC**.

High-Speed Technology (HST)

3Com' proprietary signalling scheme, design, and error- control protocol for high-speed modems. HST incorporates trellis-coded modulation, for greater immunity from variable phone line conditions, and asymmetrical modulation for more efficient use of the phone channel at speeds of 4800 bps and above. HST also incorporates **MNP**-compatible error-control procedures adapted to asymmetrical modulation.

HST

See **High-Speed Technology**.

Hz (Hertz)

A frequency measurement unit used internationally to indicate one cycle per second.

ISDN

See **Integrated Services Digital Network** .

Industry Standard Architecture (ISA)

The most common type of computer expansion bus. Other types include Extended Industry Standard Architecture (EISA) and Microchannel Architecture (MCA).

Integrated Services Digital Network (ISDN)

An international standard for providing end-to-end digital service over the public telecommunications network. The aim of ISDN is to integrate the transmissions of a number of different devices, including computers, telephones, and fax machines, into one digital network.

interrupt request (IRQ)

A number that must be assigned to devices that plug into your computer's expansion bus.

IRQ

See **interrupt request**.

ISA

See **Industry Standard Architecture**.

ITU-T

International Telecommunication Union-Telecommunication sector (formerly referred to as CCITT). An international organisation that defines standards for telegraphic and telephone equipment

jumper

A switch composed of pins and a **shunt**. The shunt's position on the pins determines the jumper setting.

kbps

Kilobits per second, or one thousand bits per second.

LAPD

See **Link Access Procedure for the D-channel**.

LAPM

See **Link Access Procedure for Modems**.

Link Access Procedure for the D-channel (LAPD)

An **error control protocol** incorporated in ITU-T Recommendation I.440 and I.441.

Link Access Procedure for Modems (LAPM)

Link Access Procedure for Modems, an error control **protocol** incorporated in ITU-T Recommendation V.42. Like the **MNP** and **HST** protocols, LAPM uses cyclic redundancy checking (**CRC**) and retransmission of corrupted data (**ARQ**) to ensure data reliability.

local echo

A modem feature that enables the modem to send copies of keyboard commands and transmitted data to the screen. When the modem is in Command mode (not online to another system) the local echo is invoked through the ATE1 command. The command causes the modem to display typed commands. When the modem is online to another system, the local echo is invoked through the ATF0 command. This command causes the modem to display the data it transmits to the remote system.

MB

Megabyte, or one thousand **bytes**.

Microcom Networking Protocol (MNP)

An asynchronous error-control protocol developed by Microcom, Inc. and now in the public domain. The protocol ensures error-free transmission through error detection (**CRC**) and retransmission of errored frames. U.S. Robotics modems use MNP Levels 1–4 and Level 5 data compression. MNP Levels 1–4 have been incorporated into ITU-T Recommendation V.42. Compare with **HST**.

MNP

See **Microcom Networking Protocol**.

ML-PPP

See **Multilink PPP**.

modem

A device that transmits/receives computer data through a communications channel such as radio or telephone lines. The Courier is a telephone channel modem that modulates, or transforms, **digital signals** from a computer into the **analogue** form that can be carried successfully on a phone line. It also demodulates signals received from the phone line back to digital signals before passing them to the receiving computer.

Multilink PPP

A protocol that allows your I-modem to use both B-channels to achieve an overall data rate of 128 kbps.

multipoint

A circuit that is made up of three or more connected stations. Contrast with **point-to-point**.

National ISDN-1 (NI-1)

Bellcore's standard definition of protocols and services for BRI and PRI lines. NI-1 allows devices and switches to connect regardless of their manufacturers.

This protocol is used in the United States only.

National ISDN-2 (NI-1)

Bellcore's standard definition of protocols and services, mostly for PRI lines. NI-2 allows devices and switches to connect regardless of their manufacturers.

This protocol is used in the United States only.

NI-1

See **National ISDN-1**.

NI-2

See **National ISDN-1**.

NIUF

See **North American ISDN Users' Forum** .

nonvolatile random access memory (NVRAM)

User-programmable random access memory whose data is retained when modem power is turned off. Used in Courier modems to store a user-defined default configuration loaded into random access memory (**RAM**) at power on.

North American ISDN Users' Forum (NIUF)

An organisation formed in 1988 to give ISDN users a say about the implementation of ISDN and ISDN applications. The NIUF's mission is to "hasten the availability of interoperable, conforming ISDN products which meet users' needs."

Northern Telecom DMS-100

A make and model of **central office switch**. Before **NI-1**, AT&T and Northern Telecom implemented proprietary protocols to handle ISDN calls. That's why it's important to know whether an NT DMS-100 **central office switch** is using proprietary (often referred to as simply DMS-100) or **NI-1 call control signalling**.

This protocol is used in the United States only.

NT-1

Network Termination 1. A device that terminates the 2-wire **U-interface** line from the telephone company and converts **U-interface** signals to **S/T-interface** signals and vice versa.

NT-1 devices are used primarily in Japan.

NVRAM

See **nonvolatile random access memory** .

online fallback

A feature that allows high-speed error-control modems to monitor line quality and fall back to the next lower speed if line quality degrades. The modems fall forward as line quality improves.

originate mode

A state in which the modem transmits at the predefined low frequency of the communications channel and receives at the high frequency. The transmit / receive frequencies are the reverse of the called modem which is in **Answer mode**.

parallel transmission

The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See **Serial Transmission**.

parity

An error-detection method that checks the validity of a transmitted character. Character checking has been surpassed by more reliable and efficient forms of block-checking, including **XMODEM**-type protocols and the **ARQ** protocol implemented in Courier modems.

The same type of parity must be used by two communicating computers, or both may omit parity. When parity is used, a parity bit is added to each transmitted character. The bit's value is 0 or 1, to make the total number of 1's in the character even or odd, depending on which type of parity is used.

Plug and Play ISA

A variation of the standard **ISA** bus that attempts to automate the troublesome process of resolving the **IRQ** and **COM port** conflicts that can arise when new devices are installed in **ISA**-bus computers.

point-to-point

A circuit that connects two stations directly.

PPP Dialler

Allows your I-modem to connect to the internet using TCP/IP.

PRI

See **Primary Rate Interface**.

Primary Rate Interface (PRI)

In North America and Japan, a unit of **ISDN** service that provides up to 23 64-kbps **B-channels** and one 64-kbps **D-channel** over a T1 line.

In Europe, a unit of **ISDN** service that provides up to 30 64-kbps **B-channels** and one 64-kbps **D-channel** over an E1 line.

protocol

A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

provisioning

Another way of saying “setting up telephone lines.”

RAM

See **random access memory**.

random access memory (RAM)

Random Access Memory. Memory that is available for use when the modem is turned on, but that clears of all information when the power is turned off. The modem's RAM holds the current operational settings, a flow control **buffer**, and a command buffer.

rate adaption

Also referred to as rate adaptation. **V.120** and **V.110** are rate adaption protocols: they allow devices that communicate at speeds of less than 64 kbps to adapt their rates to 64 kbps to fill the entire **B-channel**.

read-only memory (ROM)

Permanent memory, not user-programmable. The Courier's factory settings are stored in ROM and can be read (loaded) into RAM as an operational configuration if DIP switch S10 is ON at power-on.

remote access

A feature that allows a remotely located user to view the Courier's configuration screens and change the Courier's configuration. Password protection is available.

remote digital loopback

A test that checks the phone link and a remote modem's transmitter and receiver. Data entered from the keyboard is transmitted from the initiating modem, received by the remote modem's receiver, looped through its transmitter, and returned to the local screen for verification.

remote echo

A copy of the data received by the remote system, returned to the sending system and displayed on the screen. Remote echoing is a function of the remote system.

result code

Another way of saying “status message.” Your I-modem sends result codes to your terminal (for example, to indicate the status of a connection).

RJ11

The Universal Standard Order Code (USOC) standard for wiring a single-line, two-wire phone network interface, typically, passing tip and ring signals, from the public switched network.

RJ45

A USOC standard 8-wire connector.

ROM

See **read-only memory**.

S/T-interface

The name given to the signalling interface between an **NT-1** and a **terminal adapter** or an **ISDN** terminal.

serial port

A computer port that enables the transmission of data characters, one bit at a time, using a single electrical path. Also known as a communications port, or **COM port**. On IBM-compatible PCs, this is a port for **asynchronous**, serial data transmission and, in the case of modems, for data reception. Data is transmitted one bit at a time (serially) to devices such as a modem, a serial mouse, or a serial printer.

serial transmission

The sequential transfer of data characters, one bit at a time, using a single electrical path. Also see **Parallel Transmission**.

software flow control

A form of **flow control** that uses **XON** and **XOFF** characters to start and stop the flow of data.

start bit

The signalling bit attached to the beginning of each character before characters are transmitted during **Asynchronous Transmission**.

stop bit

The signalling bit attached to the end of each character before characters are transmitted during **Asynchronous Transmission**.

SDLC

See **Synchronous Data Link Control**.

shunt

A small, plastic-and-metal piece used to cover sections of pins on a jumper. The shunt interconnects certain pins which, depending on the way the shunt is placed, determine functions.

S-register

An area of **NVRAM** that is used to store a setting.

switch

See **central-office switch**.

Synchronous Data Link Control (SDLC)

A protocol developed by IBM for software applications and communicating devices operating in IBM's Systems Network Architecture (SNA). The protocol defines operations at the link level of communications, for example, the format of data **frames** exchanged between modems over a phone line. See **BISYNC**, **Protocol**, **HDLC**.

synchronous transmission

A form of transmission in which blocks of data are sent at strictly timed intervals. Because the timing is uniform, no **start** or **stop bits** are required. Compare **Asynchronous Transmission**.

Some mainframes only support synchronous communications unless their owners have installed a synchronous adapter and appropriate software.

TEI

See **Terminal Endpoint Identifier**.

terminal

A device whose keyboard and display are used for sending and receiving data over a communications link. Differs from a microcomputer in that it has no internal processing capabilities. Used to enter data into or retrieve processed data from a system or network.

terminal adapter

A device that connects another device that is not **ISDN**-ready to the **ISDN S/T-interface**. By converting **EIA-232** or **V.35** signals, for example, to **S/T-interface** signals, a terminal adapter makes a device that is not **ISDN**-ready able to communicate over the **ISDN**.

Terminal Endpoint Identifier (TEI)

A one- or two-digit number that identifies a given connection with the **central-office switch**. TEIs may be dynamic or fixed. Dynamic TEIs are assigned automatically by the switch with each call. Fixed TEIs require you to set the TEI in your **ISDN** device.

Terminal mode

An operational mode required for microcomputers to transmit data. In Terminal mode the computer acts as if it were a standard terminal such as a teletypewriter, rather than a data processor. Keyboard entries go directly to the modem, whether the entry is a modem command or data to be transmitted over the phone lines. Received data is output directly to the screen. The more popular communications software products control Terminal mode as well as enable more complex operations, including file transmission and saving received files.

throughput

The amount of actual user data transmitted per second without the overhead of protocol information such as Start and Stop bits or frame headers and trailers. Compare with **characters per second**.

transmission rate

See also **bit rate**.

TurboPPP

UART

See Universal Asynchronous Receiver / Transmitter.

U-interface

The name given to the signalling interface between the telephone company's equipment and an **NT-1**. A U-interface typically takes the form of an **RJ45** jack and, in the United States, it marks the line of demarcation between the customer's and the telephone company's equipment.

U-interface primarily occurs in the United States.

Universal Asynchronous Receiver/Transmitter (UART)

A computer chip that controls the signalling that goes on through a computer's **serial port**.

UTP (Unshielded Twisted Pair)

Twisted insulated copper wires bundled into an unshielded cable, commonly used in telephone wiring systems. Grades of UTP include DTP (Datagrade Twisted Pair) and DIW (Distributed Inside Wire).

ITU-T recommendation that defines procedures for starting and ending sessions of data transmission.

An **ITU-T** standard for facsimile operations that specifies modulation at 14.4 kbps, with fallback to 12 kbps.

Fax

An **ITU-T** standard for facsimile operations at 300 bps
U.S. Robotics or compatible fax devices then transmit or receive at higher speeds.

An **ITU-T** standard for modem communications at 300 bps. Modems made in the United States or Canada follow the Bell 103 standard. However, the modem can be set to answer V.21 calls from overseas.

A **ITU-T** standard for modem communications at 1200 bps, compatible with the Bell 212A standard observed in the United States and Canada.

V.22*bis*

An **ITU-T** standard for modem communications at 2400 bps. The standard includes an automatic link negotiation fallback to 1200 bps and compatibility with Bell 212A / V.22 modems.

An **ITU-T** standard for modem communications at 1200 bps with a 75 bps back channel. Used in the U.K.

An **ITU-T** standard for modem communications. Among other things, V.25 specifies an answer tone different from the Bell answer tone. All U.S. Robotics modems can be set with the B0 command so that they use the V.25 2100 Hz tone when answering overseas calls.

V.25*bis*

An **ITU-T** standard for synchronous communications between the mainframe or host and the modem using the HDLC or character-oriented protocol. Modulation depends on the serial port rate and setting of the transmitting clock source, &X.

V.27*ter*

An **ITU-T** standard for facsimile operations that specifies modulation at 4800 bps, with fallback to 2400 bps.

An **ITU-T** standard for facsimile operations that specifies modulation at 9600 bps, with fallback to 7200 bps.

An **ITU-T** standard for modem communications at 9600 bps and 4800 bps. V.32 modems fall back to 4800 bps when line quality is impaired, and fall forward again to 9600 bps when line quality improves.

V.32*bis*

An **ITU-T** standard that extends the V.32 connection range: 4800, 7200, 9600, 12K, and 14.4 kbps. V.32*bis* modems fall back to the next lower speed when line quality is impaired, and fall back further as necessary. They fall forward to the next higher speed when line quality improves.

V.32*terbo*

Modulation scheme that extends the V.32 connection range: 4800, 7200, 9600, 12000, 14400, 16800, 19200, and 21600 bps. V.32*terbo* modems fall back to the next lower speed when line quality is impaired, and fall back further as necessary. They fall forward to the next higher speed when line quality improves.

An **ITU-T** standard that allows data rates as high as 33.6 kbps.

An ITU-T standard trunk interface between a device and a packet network, using signalling of at least 19200 bps.

An **ITU-T** standard for modem communications that defines a two-stage process of detection for **LAPM** error control.

V.42*bis*

An extension of **ITU-T** V.42 that defines a specific data compression scheme for use with V.42 error control.

A **rate-adaption** protocol for the **B-channel**. V.110 employs bit repetition and positioning techniques to fill the 64-kbps channel. Can carry **asynchronous** data at speeds of up to 19.2 kbps. V.110 does not provide any **error control**.

An **asynchronous rate-adaption** protocol for the **B-channel**. V.120 is a **frame**-oriented **protocol** based on **LAPD**, and it employs statistical multiplexing techniques to fill the 64-kbps channel. Multiple data streams can be mapped to one 64-kbps channel using V.120.

V.Fast Class (V.FC)

A proprietary modulation scheme developed by Rockwell International for data communication speeds up to 28.8 kbps.

Window Size (X.75)

Window size is the number of frames sent before and expected acknowledge.

word length

The number of bits in a data character without parity, start or stop bits.

x2

x2 is a groundbreaking new technology that allows analogue modems to receive data from your I-modem at speeds up to 56 kbps and send data to your I-modem at V.34 speeds.

See **x2 server mode** and **x2 symmetric mode**.

x2 Server Mode

Using x2 Server Mode, you can accept calls from x2 client modems. Using this mode, the x2 client modem that connects to your I-modem can receive data at speeds up to 56 kbps and send data at V.34 speeds.

x2 Symmetric Mode

Using x2 Symmetric Mode, your I-modem can connect at speeds of 56 or 64 kbps in both directions over a 3.1 kHz voice call (*V2=3). For x2 Symmetric Mode to work, our I-modem must connect to a modem using x2 Symmetric Mode, such as another I-modem.

X.75 is a popular protocol present in many European Terminal Adapters (TAs) that allows your I-modem to take full advantage of the 64-kbps B-channel. Originally designed for packet-switched signalling, X.75 is used as the data-link layer for ISDN telematic services.

XMODEM

The first of a family of error-control software **protocols** used to transfer files between modems. These protocols are in the public domain and are available from many bulletin board services.

XON/XOFF

Standard **ASCII** control characters used to tell a device to stop / resume transmitting data. In most systems typing <Ctrl>-S sends the XOFF character. Some devices, including the Courier, understand <Ctrl>-Q as XON; others interpret the pressing of any key after <Ctrl>-S as XON.

YMODEM

An error-correcting **File Transfer Protocol** that is related to, but faster than, XMODEM.

ZMODEM

An error-correcting **File Transfer Protocol** that is related to, but faster than, XMODEM or YMODEM.

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