

# U.S. Robotics I-modem Command Reference

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## Chapter 1 Using the AT Command Set

I-modems are controlled using AT commands.

To send AT commands to the I-modem, connect a computer with an EIA-232 serial port to the I-modem's serial port. The computer must be running a communications software package.

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 for Using AT Commands

---

- Type **AT** before each command and press **<Enter>**<sup>1</sup> after each command. Exceptions: **A/**, **A>**, and **+++**, which require neither **AT** nor **<Enter>**.

1. Angle brackets (< and >) are used in this manual to indicate the name of a key. Do not type the angle brackets when issuing a command.

## U.S. Robotics I-modem Command Reference

- 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 60 characters between **AT** and **<Enter>**. Spaces don't add to the count, but hyphens and parentheses do.

Here's an example:

**AT&K3X2DT5551234 <Enter>**

---

AT	Attention; a command follows.
&K3	Disable MNP5 data compression; use only V.42bis compression.
X2	Use the X2 result code subset.
DT	Dial the following number using tone dialing.
<Enter>	Send the commands.

---

---

### Basic AT Commands

---

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 the I-modem that a command is coming. AT must precede all commands except A/, A>, and +++.

---

### S-registers

---

[S-registers](#) are addresses of places in memory where various timing parameters, redefinitions of selected ASCII characters, and other configuration settings are stored.

Initially, the S-register settings for each of the templates are the same. As with any setting stored in [nonvolatile random access memory \(NVRAM\)](#), however, you can overwrite an S-register's stored value.

The default values listed in Table 4-2 are those that users typically require.

## Displaying S-register Settings

### All S-registers

To display the S-register settings in the NVRAM templates, issue the command:

```
ATI5 <Enter>
```

To display the S-register settings in [RAM](#) (the current configuration), issue the command:

```
ATI4 <Enter>
```

In both cases, S-register settings appear as a table seven columns wide, each entry of the form, "Smm=nnn" where *mm* is a register number between 0 and 67 and *nnn* is a decimal value between 0 and 255.

### One S-register

To display the contents of a register, use ATSr?, as in this example:

```
ATS19? <Enter>
```

```
000
```

```
OK
```

### Setting an S-register

To change a setting for an S-register in the current configuration, use the command

**ATSr=n <Enter>**

where  $r$  is the register's number and  $n$  is a decimal value from 0-255 (unless otherwise indicated) that specifies the setting.

**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.

**ATS13=8&W <Enter>**

$Sr=n$  Set S-register value:  $r$  is any S-register;  $n$  must be a decimal number between 0 and 255.

$Sr.b=n$  Alternative command for setting bit-mapped registers:  $r$  is the bit-mapped register,  $.b$  is the bit,  $n$  is 0 (off) or 1 (on).

## Bit-Mapped S-registers

### 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:

Bit			Value
7	27	=	128
6	26	=	64
5	25	=	32
4	24	=	16
3	23	=	8
2	22	=	4
1	21	=	2
0	20	=	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 decimal equivalent that is less than the decimal value. Subtract the decimal equivalent and mark the equivalent bit "1." Continue until the decimal value is zero.

**113**

113 - 64 = 49

01

49 - 32 = 17

011

17 - 16 = 1

0111

1 - 1 = 0

**01110001**

### Setting Bit-Mapped S-registers

You can set bit-mapped S-registers using either bits or decimal values. While it may be simpler for you to set the bits individually, I-modems display the S-register settings in decimal form.

#### Using Bits

Turning individual bits on and off is the more direct way to set bit-mapped S-registers. To do this, specify the S-register that you want to set, and then indicate which bits you want to turn on (1) or off (0). For example,

```
ATS13 .0=1 .4=1 .5=1 <Enter>
```

turns on bits 0, 4, and 5 of S-register 13.

#### Using Decimal Values

An alternative way to set bit-mapped S-registers is by adding the decimal values of the bits and entering the total. This example sets the same value as the one in *Using Bits*, above:

```
ATS13=49 <Enter>
```

### Getting a List of S-registers

To display a list of S-registers, issue the following command while in [Terminal mode](#):

**ATS\$ <Enter>**

Also, the command AT+I5 displays the values of the S-registers as part of the listing of NVRAM's contents.

More command lists are available. (See [Chapter 13, Displaying Help Screens](#).)

## Chapter 2 Modes of Operation

---

### Command and Online Modes

---

**Command mode.** When the I-modem is in Command mode, you can control it using AT commands.

**Online mode.** When the I-modem is in Online mode, it is connected over telephone lines with another device.

**Online Command mode.** By entering Online command mode, you can send the I-modem commands while you are online with another device.

#### Entering Online Command Mode

+++ Revert to [Command mode](#). Once the I-modem is online with another system, the only command it recognizes is an *escape code*, which you enter by pressing the plus key three times.

Depending on how bit 0 of [S-register](#) 14 is set, the I-modem will either revert to Command mode or hang up when you send the escape code. To be able to change operating modes without losing connections, make sure bit 0 of S-register 14 is OFF:

**ATS14.0=0&W <Enter>**

**Table 2.1. S-register 14, bit 0**

Bit	Value	Result
0	0	Revert to Command mode on escape code
0	1	Disconnect on escape code

Once the I-modem is set to revert to Command mode, when you type three pluses as described below, the I-modem will enter Command mode.

1. Wait one second after sending the last item of data.
2. Type +++ (Do not type the AT prefix or press Enter.)
3. Wait one second before typing any data.

You can change the characters used to revert to Command mode or change the wait time by resetting Register S2 or S12. See the [S-register Summary](#) in [Appendix A, Alphabetic Command Summary](#).

### Returning to Online Mode

On Changes from Command mode to Online mode.

**ATO <Enter>**

There are two ways to return online.

O0 Return online.

O1 Return online and retrain. You might use ATO1 to resynchronize if you experienced errors during a non-ARQ data transfer.

---

### Controlling Local Echo

---

There are two [local echo](#) settings, one for [Command mode](#) and one for [Online mode](#). The Command mode local echo setting determines whether the commands you type appear on

your screen. The Online-mode local echo setting determines whether the data that the I-modem transmits to another device appears on your screen.

### Command-Mode Local Echo

En     Enable or suppress Command-mode local echo.

E0     Command mode echo OFF. Your typed commands do not appear on your screen.

E1     Command mode echo ON. Your typed commands appear on your screen.

### Online-Mode Local Echo

Fn     Enable or suppress Online mode local echo.

You may see the term duplex used in place of online local echoing, although the term is not technically accurate.

F0     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.

F1 Online echo OFF. (Sometimes called full duplex.)

---

### Data and Fax Modes

---

Once you have started in Command mode, you can initialize the I-modem in Data or Fax mode.

**Data mode.** In Data mode, the I-modem is prepared to make calls to and receive calls from digital and analog devices, such as [terminal adapters](#) and modems.

**Fax mode.** In Fax mode, the I-modem is prepared to make calls to and receive calls from analog facsimile devices, such as fax modems and fax machines.

Fax operations require facsimile-compatible communications software that can send or receive Group III faxes. Follow the instructions in your fax software manual.

The I-modem's normal operating mode is Data mode. If your fax software is typical, it automatically switches the device to Fax mode when you run the program, and resets the device to Data mode when you exit the program.

You can always switch the operating mode manually using one of these commands:

**AT+FCLASS=0** (Switch to Data mode) **<Enter>**

**AT+FCLASS=1** (Switch to Class 1 Fax mode) **<Enter>**

**AT+FCLASS=2.0** (Switch to Class 2.0 Fax mode) **<Enter>**

If you are not sure whether the I-modem is in Data or Fax mode, type the following command:

**AT+FCLASS? <Enter>**

The I-modem returns a value of 0 to indicate Data mode, 1 to indicate Class 1 Fax mode, or 2.0 to indicate Class 2.0 Fax mode.

**Note** Whenever the I-modem is reset using the ATZ or ATZ! commands, by toggling the DTR signal or by turning the power off and then on, it will reset to Data mode.

### Chapter 3 Dialing, Answering, and Hanging Up

I-modems always make and receive calls over [ISDN](#) lines. Everyday actions, such as dialing and answering, are done differently over ISDN than they are over analog lines.

For instance, analog dialing is done by sending tones or pulses over the line. ISDN devices dial by sending digital signals over the line. Also, your analog phone rings because it receives a burst of voltage through the line. ISDN devices know they are receiving a call when they receive digital signals.

Despite the differences between analog 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 analog calls using a modem.

#### Dialing

Dn Dial the specified phone number and execute dial options.

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

### Dial Options

- T** Tone dial. This option is ignored because it is not necessary for ISDN dialing, but it is accepted for compatibility with today's communication software packages.
- P** Pulse dial. Accepted but ignored.
- ,** (Comma) Pause for the length of time specified by [S-Register 8](#). The default is 2 seconds.
- /** (Slash) Pause for 125 milliseconds.
- W** Wait for a second dial tone before continuing to dial.
- W** works only if the X3 (or greater) command has been issued (see [Chapter 5, Controlling Result Code Displays](#)). If an I-modem is set to X2 (or lower), it interprets the **W** as a 2-second pause.
- @** Wait for an answer (with X3 or higher).

Some online services answer the phone and return a tape-recorded request for information before processing transactions. Use the **@** command to tell an

I-modem to detect at least one ring, wait for 5 seconds of silence at the other end of the call, and then continue.

To use the @ command, set an I-modem to X3, X4, or X7. If it is set to X2 or lower, the I-modem will return an ERROR message when it encounters the @ character. If it's set to X5 or X6, the I-modem hangs up when it detects a voice answer.

;(Semicolon) Return to [Command mode](#) after dialing.

" Dial the 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.

R Reverse frequencies. 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.

X2-X7 Display different sets of result codes. See [Chapter 5, Controlling Result Code Displays](#).

- L Dial the last-dialed number. Start a command with ATDL instead of using A/ if you wish to send an I-modem non-Dial commands before dialing again.
- L? Display the last-dialed number.
- Sn Dial the number stored in [NVRAM](#) at position  $n$ , where  $n = 0*9$ . See [Chapter 4, Working with Memory](#), for instructions about saving phone numbers to memory.

In addition to the digits 0 through 9, I-modems also accept \* and #.

### Canceling Dialing

Any key Stop dialing or stop repeating.

If you press any key while an I-modem is dialing, the call is canceled. To retry the call, type A/

### Redialing

A/ Reissue the last command. Don't type AT or press <Enter>. For example:

A/

### Repeating a Command

- > Dial a number, wait 60 seconds for a connection, and then hang up. Wait 2 seconds, then redial. Make a maximum of 10 attempts. For example, if you know that the device you are calling is frequently busy, include the Repeat command:

**AT>DT1234567 <Enter> or**

**ATDT1234567> <Enter>**

To stop the repeating, press any key *during the pause between dial attempts*. If you press any key while an I-modem is dialing, that dial attempt is canceled but the cycle will continue.

- A> This command combines the features of both the A/ and > commands. An I-modem both dials the last-dialed number and repeats it, just as the > command does.

### Answering Calls

#### Force Answer Mode

- A Force an I-modem to go through the answer sequence when it hasn't received an incoming call.

### 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

---

Two commands apply to analog international calls above 1200 bps: *Bn* and *&Gn*.

*Bn* Handshake options.

- B0** ITU-T (formerly CCITT) answer sequence. Default. This is required to answer all V.34-type calls, as well as calls from overseas.
- B1** 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.
- &Gn** This setting applies only to analog 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.
- &G0** No guard tone. This is used in the United States and Canada. Default.
- &G1** This sets a 550-Hz guard tone, which is required in some European countries.
- &G2** This sets an 1800-Hz guard tone, which is required in the U.K. and some Commonwealth countries. &G2 requires the B0 setting.

### Call Detection

---

I-modems support Call Detection, which allows them to recognize whether an incoming call is analog 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 U.S. Robotics for Fax Class 1 applications.

To obtain a copy of the technical specification of U.S. Robotics' implementation of Call Detection for Fax Class 1, call our BBS at the number provided on the Customer Support Services card included with your multiport I-modem and download the file CALLSEL.TXT.

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

# Chapter 4

## Working with Memory

I-modems contain three types of memory that you can interact with: [random access memory \(RAM\)](#), [nonvolatile random access memory \(NVRAM\)](#), and [Flash memory](#).

### RAM

RAM holds the settings that apply to the current configuration. Any changes you make are active until you reset the I-modem or power it off.

### 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 I-modem's operating software. You can upgrade the software held in Flash memory by performing a software download. (See [Chapter 16, Downloading Software Upgrades](#).)

### What is Stored Where?

#### Current Settings

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

#### Saved Settings

Settings you save to the I-modem are stored in 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, 4-4, and 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 can be saved to NVRAM):

```
ATX6&W <Enter>
```

**Note** When writing a different default configuration to NVRAM, insert any additions *after* the  $\&Fn$  command, but *before*  $\&W$ . Otherwise, they will be overwritten by  $\&Fn$ .

### Saving a Phone Number to NVRAM

$\&Zn=s$  Write the phone number (s) to position (n) in memory. You can store up to 10 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 *DSn* command. In this example, &M0 (no error control) comes before DS2.

**AT&M0DS2 <Enter>**

**Note** The &Z*n=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>**

&Z*n*? Display the phone number stored in NVRAM at position *n*, where *n* = 0\*9.

### Former Courier DIP Switch Settings

This section is for the benefit of users who are familiar with U.S. Robotics Courier modems or Total Control modem pools.

Many of the DIP switches that were present on Courier V.34 modems are under software control in the I-modem. These are the default settings:

**Table 4-1. Former DIP Switches – Default Settings**

Former DIPSwitch Number	I-modem Default	
1	&D2	DTR normal
2	V1	Verbal result codes
3	Q0	Display result codes
4	E1	Echo off-line commands (command mode local echo)
5	S0=1	Auto answer on ring
6	&C1	Normal carrier detect (CD)
7	S14.1=1	Result codes orig. mode only
9	S14.0=1	Disconnect with +++

I-modems always read these settings from NVRAM first during power-on and reset, even if [DIP switch](#) 1 is set to OFF (load &F0 settings).

**Important** Resetting the I-modem or powering it off and then on will not change these “DIP switch” settings! The only way to change them is to issue the commands manually. Save a setting change by following a command with &W. For example, AT&D1&W<Enter>

---

### Displaying Saved Information

---

#### S-register Value (Sr?)

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 (&ZN?)

When you send this command, the I-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-Dialed Number (DL?)

At this command, the I-modem sends the number stored in the last-dialed number buffer:

**ATDL? <Enter>**

**Table 4-2. Default (NVRAM) S-register Settings**

<b>S-registers</b>		<b>NVRAM Default Setting</b>
S0	Auto Answer	0
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	7
S11	Tone duration, spacing, ms	70

**Table 4-2. Default (NVRAM) S-register Settings**

<b>S-registers</b>	<b>NVRAM Default Setting</b>
S12 Escape code guard time, 500 ms	50
S13 Bit-mapped functions*	0
S14 Bit-mapped functions*	0
S15 Bit-mapped functions*	0
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
S33 Bit-mapped functions*	0
S34 Bit-mapped functions*	0

**Table 4-2. Default (NVRAM) S-register Settings**

<b>S-registers</b>	<b>NVRAM Default Setting</b>
S38 Disconnect wait time, sec	0
S41 Allowable remote log-in attempts	0
S42 Remote Access ASCII character	126
S43 Remote guard 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
S57 Bit-mapped functions*	0
S67 Bit-mapped functions*	0
S68 Bit-mapped functions*	0

\* Bit-mapped registers have up to eight functions.

### Working with Flash Memory

The I-modem permanently stores three configuration “templates,” or prepared sets of commands, in Flash memory. You can retrieve a template and load it into current memory using the `&Fn` command.

`&Fn` Load one of the three configuration templates from Flash memory into current memory.

`&F0` No flow control (low performance).

`&F1` Hardware flow control.

`&F2` Software flow control.

All of the settings in each template are given in Table 4-3, 4-4, and Table 4-5. 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 (see Table 4-5).

For more information about hardware and software flow control, see [Chapter 10, Flow Control](#).

**Table 4-3. &F1 Hardware Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium
Speaker control	M1	ON during dial through connect
Result codes	Q0	Enabled
Verbal or numeric result codes	V1	Verbal result codes
Result code subset	<b>X7</b>	<b>Extended. Includes all codes except VOICE</b>
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

**Table 4-3. &F1 Hardware Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Transmit data hardware flow control	<b>&amp;H1</b>	<b>Hardware flow control</b>
Rec'd data software flow control	<b>&amp;I0</b>	<b>Disabled</b>
Analog data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control/synch	&M4	Normal/error control
Link rate select	&N0	Variable
Rec'd data hardware flow control	<b>&amp;R2</b>	<b>Enabled</b>
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Break handling	&Y1	Clear buffer, send immediately
Stored telephone number	&Z0*9=0	Blank
EXTERNALS ONLY: Synch Clock Speed	%N6	9600 bps
Call type	*V=0	Auto-detect the call type
Word length*	<b>8</b>	
Parity*	<b>0</b>	<b>None</b>

**Table 4-3. &F1 Hardware Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
DTE rate* (Kbps)	19.2	_

\* Detected by each I-modem from the AT prefix of the &W com-mand that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT ...&W string.

**Table 4-4. &F2 Software Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium
Speaker control	M1	ON during dial through connect
Result codes	Q0	Enabled
Verbal or numeric result codes	V1	Verbal result codes

**Table 4-4. &F2 Software Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Result code subset	<b>X7</b>	<b>Extended. Includes all codes except VOICE</b>
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	<b>&amp;H2</b>	<b>Software flow control</b>
Rec'd data software flow control	<b>&amp;I2</b>	<b>Enabled</b>
Analog 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	<b>&amp;R2</b>	<b>Enabled</b>
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Break handling	&Y1	Clear buffer, send immediately

**Table 4-4. &F2 Software Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Stored telephone number	&Z0*9=0	Blank
Externals only: V.25bis clock speed	%N6	9600 bps
Call type	*V=0	Auto-detect the call type
Word length*	<b>8</b>	
Parity*	<b>0</b>	<b>None</b>
DTE rate* (Kbps)	<b>19.2</b>	—

\* Detected by each I-modem from the AT prefix of the &W com-mand that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT ...&W string.

**Table 4-5. &F0 No Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
Online local echo	F1	Disabled
Training tone volume	L2	Medium

**Table 4-5. &F0 No Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Speaker control	M1	ON during dial through connect
Result codes	Q0	Enabled
Verbal or numeric result codes	V1	Verbal result codes
Result code subset	<b>X1</b>	<b>Basic</b>
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	<b>&amp;H0</b>	<b>Disabled</b>
Rec'd data software flow control	<b>&amp;I0</b>	<b>Disabled</b>
Analog 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	<b>&amp;R1</b>	<b>Disabled</b>
Data Set Ready	&S0	Always on

**Table 4-5. &F0 No Flow Control Template**

<b>NVRAM Options</b>	<b>Setting</b>	<b>Description</b>
Remote Digital Loopback (RDL)	&T5	Deny RDL
Break handling	&Y1	Clear buffer, send immediately
Stored telephone number	&Z0*9=0	Blank
Externals only: V.25bis clock speed	%N6	9600 bps
Call type	*V=0	Auto-detect the call type
Word length*	<b>7</b>	
Parity*	<b>1</b>	<b>Even</b>
DTE rate* (Kbps)	<b>9600</b>	–

\* Detected by each I-modem from the AT prefix of the &W com-mand that writes your defaults to NVRAM. Set your software to the desired word length, parity, and serial port rate defaults before sending the modem the AT ...&W string.

## **Saving ROM Templates to NVRAM**

To save one of the four templates in NVRAM and have it serve as the reset default, enter AT&Fn&W. For example, **AT&F1&W <Enter>**.

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

### Default Settings

If [DIP switch](#) 1 is OFF at power-on, the &F0 settings are loaded instead.

By default, the first time the I-modem is turned on, it loads the settings stored in NVRAM, which are the same as the settings in the &F1 template.

Until you save any changes to NVRAM, the defaults stored there are the same as the permanent [ROM](#) factory settings stored in &F1.

To view the &F1 settings, enter ATi5.

### Saving Templates in NVRAM

You can save any of the three templates, or save modified versions of them, in NVRAM for use as power-on defaults.

**&W** To substitute a template other than &F1, write the desired template to NVRAM using the &W command.

**AT&F2&W <Enter>**

To modify the &F*n* configuration in NVRAM, type your changes afterward and then save them to NVRAM, as in the following example (the original factory template remains intact):

**ATS10=40&A2&W <Enter>**

### Resetting I-modems

**Z** or **Z!** Resets and loads the NVRAM settings when DIP switch 1 is ON (factory setting). If DIP switch 1 is OFF, the I-modem resets and loads the &F0 configuration template (no flow control). Use **ATZ** or **ATZ!** to make changes to the DIP switch settings take effect immediately. Table 4-5. &F0 No Flow Control Template

## Chapter 5 Controlling Result Code Displays

This section explains how to control the display of result codes. “Result code” is just another way of saying “status message.”

---

### Result Code Display Commands

---

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

**Table 5-1. AT Commands That Control Result Code Display**

Command	Effect
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.

- Qn* Enable/suppress the display of result codes.
- Q0 Display result codes.
- Q1 Do not display result codes.
- Q2 Do not display result codes while in Answer mode (see [Chapter 2, Modes of Operation](#), for a description of modes).
- Vn* Display result codes in verbal or numeric form.
- V0 Display result codes in numeric form.
- V1 Display result codes in verbal form.
- Xn* Display one of the following sets of result codes. Default = X7 (see Tables 5-2 and 5-3).

**Table 5-2. Result Codes Sets for Xn Values**

Result Codes	Setting							
	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		.	.	.	.	.	.	.

**Table 5-2. Result Codes Sets for Xn Values**

Result Codes	Setting							
	X0	X1	X2	X3	X4	X5	X6	X7
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		•	•	•	•	•	•	•
<b>Functions</b>								
Wait for 2nd Dial Tone (W)				•	•	•	•	•
Wait for Answer (@)				•	•	•	•	•

**Table 5-3. 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 dialed; remote phone line is ringing.
12/VOICE	Voice answer at remote site; I-modem hangs up.

**Table 5-3. Result Code Meanings**

Result Code	Meaning
Wait for Another	The I-modem continues dialing as soon as it detects
Dial Tone (W)	another dial tone. See the dial options earlier in this chapter.
Wait for an Answer(@)	The I-modem continues dialing when it detects 5 seconds of silence on the line. (See the dial options earlier in this chapter.)

### Additional Result Code Subsets

**Note** ARQ (Automatic Repeat Request) is used in this manual to denote calls that use error control.

*&An* Enable or suppress the display of additional result code subsets.

*&A0* Do not display ARQ result codes. This setting pertains only to the display of codes and not to ARQ function.

*&A1* Display ARQ result codes.

## U.S. Robotics I-modem Command Reference

If the I-modem is set to X0 and the connection rate is 1200 bps-64 Kbps, result code 14 is displayed. The other result codes indicate connection rates and require a setting of X1 or higher.

---

### ARQ

---

14/CONNECT/ARQ	88/CONNECT 19200/ARQ
15/CONNECT 1200/ARQ	94/CONNECT 21600/ARQ
16/CONNECT 2400/ARQ	100/CONNECT 24000/ARQ
17/CONNECT 9600/ARQ	104/CONNECT 26400/ARQ
19/CONNECT 4800/ARQ	108/CONNECT 28800/ARQ
22/CONNECT 12000/ARQ	152/CONNECT 31200/ARQ
24/CONNECT 7200/ARQ	156/CONNECT 33600/ARQ
26/CONNECT 14400/ARQ	168/CONNECT 56000/ARQ
47/CONNECT 16800/ARQ	169/CONNECT 64000/ARQ

---

&A2 Display modulation indicators (HST, V32, VFC, V34, or DIGITAL).

**Note** If your software cannot handle the added modulation information, select &A1 or &A0.

<b>HST</b>	<b>ARQ/HST</b>
28/CONNECT 4800/HST	29/CONNECT 4800/ARQ/HST
23/CONNECT 9600/HST	27/CONNECT 9600/ARQ/HST
30/CONNECT 7200/HST	34/CONNECT 7200/ARQ/HST
31/CONNECT 12000/HST	32/CONNECT 12000/ARQ/HST
35/CONNECT 14400/HST	36/CONNECT 14400/ARQ/HST
53/CONNECT 16800/HST	57/CONNECT 16800/ARQ/HST
86/CONNECT 19200/HST	89/CONNECT 19200/ARQ/HST
92/CONNECT 21600/HST	95/CONNECT 21600/ARQ/HST
<b>V32</b>	<b>ARQ/V32</b>
38/CONNECT 4800/V32	39/CONNECT 4800/ARQ/V32
33/CONNECT 9600/V32	37/CONNECT 9600/ARQ/V32
40/CONNECT 7200/V32	44/CONNECT 7200/ARQ/V32
41/CONNECT 12000/V32	42/CONNECT 12000/ARQ/V32
45/CONNECT 14400/V32	46/CONNECT 14400/ARQ/V32
83/CONNECT 16800/V32	84/CONNECT 16800/ARQ/V32

## U.S. Robotics I-modem Command Reference

<b>HST</b>	<b>ARQ/HST</b>
87/CONNECT 19200/V32	90/CONNECT 19200/ARQ/V32
93/CONNECT 21600/V32	96/CONNECT 21600/ARQ/V32
<b>VFC</b>	<b>ARQ/VFC</b>
119/CONNECT 2400/VFC	121/CONNECT 2400/ARQ/VFC
123/CONNECT 4800/VFC	125/CONNECT 4800/ARQ/VFC
127/CONNECT 7200/VFC	129/CONNECT 7200/ARQ/VFC
131/CONNECT 9600/VFC	133/CONNECT 9600/ARQ/VFC
135/CONNECT 12000/VFC	137/CONNECT 12000/ARQ/VFC
139/CONNECT 14400/VFC	141/CONNECT 14400/ARQ/VFC
143/CONNECT 16800/VFC	145/CONNECT 16800/ARQ/VFC
147/CONNECT 19200/VFC	149/CONNECT 19200/ARQ/VFC
97/CONNECT 21600/VFC	98/CONNECT 21600/ARQ/VFC
101/CONNECT 24000/VFC	102/CONNECT 24000/ARQ/VFC
105/CONNECT 26400/VFC	106/CONNECT 26400/ARQ/VFC
109/CONNECT 28800/VFC	110/CONNECT 28800/ARQ/VFC
<b>V34</b>	<b>ARQ/V34</b>
120/CONNECT 2400/V34	122/CONNECT 2400/ARQ/V34

## U.S. Robotics I-modem Command Reference

<b>HST</b>	<b>ARQ/HST</b>
124/CONNECT 4800/V34	126/CONNECT 4800/ARQ/V34
128/CONNECT 7200/V34	130/CONNECT 7200/ARQ/V34
132/CONNECT 9600/V34	134/CONNECT 9600/ARQ/V34
136/CONNECT 12000/V34	138/CONNECT 12000/ARQ/V34
140/CONNECT 14400/V34	142/CONNECT 14400/ARQ/V34
144/CONNECT 16800/V34	146/CONNECT 16800/ARQ/V34
148/CONNECT 19200/V34	150/CONNECT 19200/ARQ/V34
111/CONNECT 21600/V34	112/CONNECT 21600/ARQ/V34
113/CONNECT 24000/V34	114/CONNECT 24000/ARQ/V34
115/CONNECT 26400/V34	116/CONNECT 26400/ARQ/V34
117/CONNECT 28800/V34	118/CONNECT 28800/ARQ/V34
153/CONNECT 31200/V34	154/CONNECT 31200/ARQ/V34
157/CONNECT 33600/V34	158/CONNECT 33600/ARQ/V34
<b>DIGITAL</b>	<b>ARQ/DIGITAL</b>
163/CONNECT 56000/DIGITAL	164/CONNECT 56000/ARQ/DIGITAL
166/CONNECT 64000/DIGITAL	167/CONNECT 64000/ARQ/DIGITAL

&A3 Default. Display error control (LAPM, HST, MNP, SYNC, V120, or NONE) and data- compression type (V42BIS, MNP5) indicators.

In the following example, the devices negotiated error control for the call (ARQ), used V.34 modulation, are using the LAPM error-control [protocol](#), and are using *V.42bis* compression.

### **CONNECT 28800/ARQ/V34/LAPM/V42BIS**

**Note** The numeric identifiers for &A3 result codes are the same as those used for &A2. If you request numeric display (V0) and &A3, you won't be able to distinguish &A2 from &A3 codes. Also, &A3 result codes may not be compatible with some software.

## Chapter 6 Controlling EIA-232 Signaling

The EIA-232<sup>1</sup> interface deals with the signals and voltages used when data is exchanged between a computer and a serial device, such as a modem or serial printer.

While external I-modems have *physical* serial ports, internal I-modems have *virtual* serial ports. Even though you can't see the internal I-modem's serial port, the commands described in this chapter affect its internal serial communications.

---

### Controlling EIA-232 Signaling

---

#### Data Terminal Ready

Your computer sends a Data Terminal Ready (DTR) signal to the I-modem when it is ready to send and receive data (use `&Dn` to tell the I-modem how to deal with the DTR signal).

---

1. The EIA-232 standard was formerly known as RS-232 (RS stands for Recommended Standard).

**&Dn** Tell the I-modem how to deal with the DTR signal.

**&D0** Operate as though the DTR signal is always ON.

**&D1** Use a change in the DTR signal to enter [Command mode](#). Most communications software packages have a method for toggling DTR—refer to your software’s manual for details.

**&D1** functions similarly to the escape code (+++). Return online with the *On* command, or hang up with the *ATH* command.

**&D2** 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.

To change the DTR recognition time, set [S-register](#) 25. (See [Appendix A, Alphabetic Command Summary](#).)

### Data Set Ready

Data Set is another name for the I-modem. Under normal conditions, the I-modem sends a Data Set Ready (DSR) signal to your computer when it is ready to send and receive data.

Do not change the default setting of &S0 unless you know that your installation requires a different setting. Few communications programs, if any, will require the I-modem to control DSR (&S1).

**&Sn** Control how the I-modem sends the DSR signal.

**&S0** Send the DSR signal at all times. Default.

**&S1** When originating a call, send the DSR signal after dialing when the I-modem detects the remote analog device's answer tone. When answering a call, send DSR after the I-modem sends its answer tone.

**&S2** Use this option for specialized equipment such as automatic callback units. After sending Carrier Detect (CD), send a pulsed DSR signal, followed by a Clear to Send (CTS) signal.

**&S3** Same as &S2, but do not send the CTS signal.

**&S4** Send a DSR signal to your computer at the same time the I-modem sends the CD signal.

**&S5** Send DSR normally (with CTS) after sending CD.

To change the DSR pulse time (in 20-second increments), set [S-register](#) 24. (See [Appendix A, Alphabetic Command Summary](#).)

### Carrier Detect

Carrier is another way of saying “ready signal from the device on the other end of the connection.” Under normal conditions, the I-modem sends a Carrier Detect (CD) signal in response to receiving the carrier from the device on the other end.

**&Cn** Control how the I-modem sends the CD signal.

**&C0** CD always ON.

**&C1** Send CD normally: The I-modem sends a CD signal when it connects with another analog device, and drops the CD signal when it disconnects.

## Chapter 7 Controlling Data Rates

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.

**Note** Your software may use terms such as *locked serial port* (fixed rate) or *auto-baud* (variable rate).

**&Bn** Set the serial port rate as variable or fixed.

**&B0** Variable rates. Allows the I-modem to change its serial port rate to match the connection rate.

**&B1** 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.

For the greatest throughput, set the serial port to 115200, 57600, or 38400 bps for high-speed calls, and to at least 9600 bps for 2400-bps calls.

**Note** The serial port rate *must be equal to or higher than* the **&Nn** rate.

**&B2** Set the serial port rate as fixed for ARQ calls and variable for non-ARQ calls (see [Chapter 11, Handshaking, Data Compression, and Error Control](#), for more information about ARQ) *when answering only*. 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.

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

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.

---

### Connection Rates

---

The I-modem can be set to a *fixed* or *variable* connection rate for analog calls. Set a variable rate to have each I-modem negotiate with the remote device for the highest possible connection rate. Set a fixed rate to connect only at a specified rate. You might use a fixed rate to filter calls for security or other reasons.

**Note** The connection rate must always be lower than or equal to the serial port rate.

&Nn Connection rate for analog calls: variable or fixed.

**&N0** Variable rates. Negotiate for the highest possible rate.

**&N1-&N16** Fixed rate. Connect only if the remote device is operating at the rate you specify.

<b>&amp;N1</b>	300 bps	<b>&amp;N9</b>	16.8 Kbps
<b>&amp;N2</b>	1200 bps	<b>&amp;N10</b>	19.2 Kbps
<b>&amp;N3</b>	2400 bps	<b>&amp;N11</b>	21.6 Kbps
<b>&amp;N4</b>	4800 bps	<b>&amp;N12</b>	24.0 Kbps
<b>&amp;N5</b>	7200 bps	<b>&amp;N13</b>	26.4 Kbps
<b>&amp;N6</b>	9600 bps	<b>&amp;N14</b>	28.8 Kbps
<b>&amp;N7</b>	12.0 Kbps	<b>&amp;N15</b>	31.2 Kbps
<b>&amp;N8</b>	14.4 Kbps	<b>&amp;N16</b>	33.6 Kbps

## Chapter 8 Remote Access

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

This feature might be helpful if you have problems connecting with another device: you could grant the other device's administrator access to your I-modem to check or correct its configuration.

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

Please review these terms before you continue:

---

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

---

## Setting Up Remote Access

---

### At the Host I-modem

1. Prepare to send AT commands.

See [Chapter 1, 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:

---

<b>View-Only</b>	Only allows guest users to view the I-modem's configuration.
<b>View-and-Change</b>	Allows guest users to view and change the I-modem's configuration.

---

Remote-access passwords can be up to **eight** alphanumeric characters long, and are not case-sensitive.

`%Pn` Assign a remote-access password.

`%P0` Assign a **view-only** password.

**AT%P0=password <Enter>**

`%P1` Assign a **view-and-change** password.

**AT%P1=password <Enter>**

### Other Remote-Access Commands

#### Displaying a Remote-Access Password

To display a remote-access password, type:

**AT%P0? <Enter> or AT%P1? <Enter>**

### Erasing a Remote-Access Password

To erase a remote-access password, type:

**AT%P0= <Enter> or AT%P1= <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.

### Disabling Remote Access

To disable remote access entirely, set [S-Register 41](#) to 0:

**ATS41=0 <Enter>**

---

## 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 U.S. Robotics. 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 con-

nection.

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 8-1. 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** Be careful 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.
%Fn	Change data format (parity and data bits).
%Cn	Control whether and when to apply changes to the configuration.

%Bn Change the host I-modem's serial port rate.

%B0	110 bps	%B6	9600 bps
%B1	300 bps	%B7	19200 bps

## U.S. Robotics I-modem Command Reference

%B2	600 bps	%B8	38400 bps
%B3	1200 bps	%B9	57600 bps
%B4	2400 bps	%B10	115200 bps
%B5	4800 bps		

*%Fn* Change 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.

*%Cn* Control whether and when to apply changes to the configuration.

*%C0* Defer changes. Default. Any changes you make to the configuration are deferred until the call is ended; they take effect for ensuing connections.

**Note** Even though, by default (%C0), the changes you make do not take effect until the next connection, the new configuration is reflected immediately in inquiry responses (ATI*n*).

%C1 Restore the original configuration. Use this command to cancel any changes made during remote access and restore the original configuration.

**Note** 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.

%C2 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.

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.

## Chapter 9 Dial Security

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

A few terms need to be explained before we go any further:

---

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

- Set up an account for yourself.
- Identify your account as the Administrative Account.
- Set up guest-user accounts.
- Enable local (host) security.
- Choose a Dial Security method.
- Enable Dial Security.
- 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 `%An` command to set up user accounts. Figure 9-1 shows the five fields to concern yourself with.

**Note** The `%An` command is automatically written to [NVRAM](#). It does not require you to send `&W`.

**AT%A0=password,y,y,n,5551000**

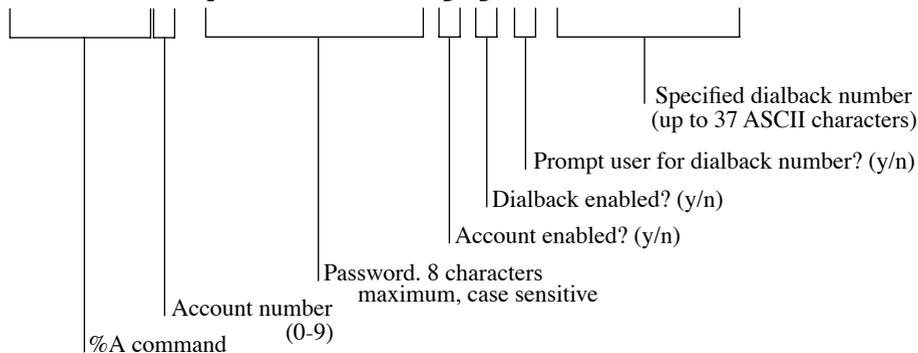


Figure 9-1. Adding Accounts: How to Format the `%An` command

### 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,1708555555 <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.

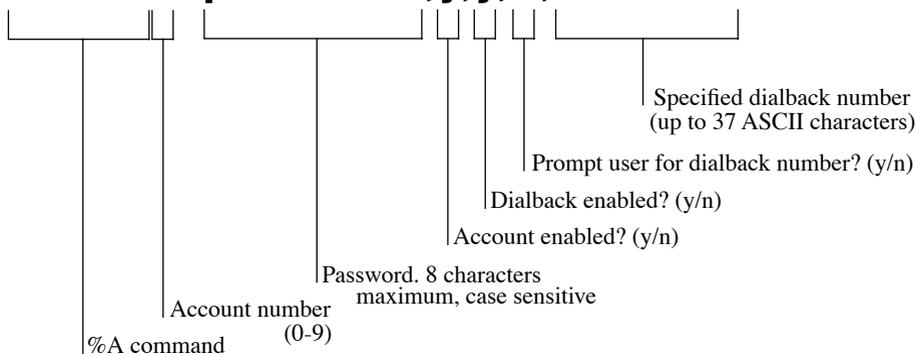
Once you set the administrative password, you cannot view or modify the guest account profiles unless you enter the correct administrative password.

**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 `%An` 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).

```
AT%A0=password,y,y,n,5551000
```



**Figure 9-2. 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 U.S. Robotics 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](#) 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 U.S. Robotics 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 analog 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).

## U.S. Robotics I-modem Command Reference

**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 9-1. The AT110 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 (%E)

Use the `%E=n` command to make system edits.

---

<code>%E=1</code>	Erase local-access password.
<code>%E=2</code>	Erase Autopass password.
<code>%E=3</code>	Erase passwords in accounts 0–9.
<code>%E=4</code>	Erase phone numbers in accounts 0*9.
<code>%E=5</code>	Disable Account, Dialback, and New Number fields in accounts 0*9.

---

To edit or overwrite an individual account or an individual account field, use the `%An=` command described in [Setting Up Dial Security](#) earlier in this chapter.

### 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 AT\$53.0=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=PWn <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.

#### Dialing 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 dialing in to the host for remote access will have access to the I10 screen and all Dial Security accounts.

# Chapter 10

## 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.

&R*n* Alter hardware flow control for received data.

- &R0** 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.
- &R1** Ignore the RTS signal. &R1 is required if your computer or software does not support RTS.
- &R2** Default. Hardware flow control enabled. The I-modem sends data to your computer only upon receipt of the RTS signal.
- &In** Alter software flow control for received data.
- &I0** 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.
- &I1** 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 signaling between the remote computer and remote device. See &I2.

&I2 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.

**Note** 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.

&I3 Hewlett Packard–Host mode. Applies only to I-modems attached to an HP mainframe that uses the ENQ/ACK proto-col. 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 Enable flow control when the connection is not under error control. For this to work, the remote device must also have &I5 capability.

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.

**&Hn** Alter the transmit-data flow control.

**&H0** Disable transmit data flow control.

**&H1** Hardware flow control. Requires that your computer and software support Clear to Send (CTS) at the EIA-232 interface.

**&H2** Software flow control. Requires that your software support XON/XOFF signaling.

&H3 Use both hardware and software flow control. If you are unsure about what your equipment supports, select this option.

## Chapter 11

# 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 six different ways: Universal Connect, Internet access, clear-channel [synchronous](#), [V.120](#) only, [V.110](#) only, or analog modem/fax emulation.

## 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.

Call	Call Type	Protocol
1	64 Kbps Digital	<a href="#">V.120</a>
2	56 Kbps Digital	<a href="#">V.120</a>
3*	£19.2 Kbps Digital	<a href="#">V.110</a>
4	3.1 kHz Audio	V.34/V.FC/V.32terbo/etc.

### \*A Note About V.110 Connections

[V.110](#) connections are not attempted by default. The I-modem attempts a V.110 connection only if you set S67.0=1. When V.110 is enabled, the I-modem makes the V.110 attempt third in the Universal Connect sequence.

### 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.

## U.S. Robotics I-modem Command Reference

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 <a href="#">V.120</a>	Connects at 64 Kbps V.120	S67.1=1.2=0	Ends connection attempt
56 Kbps <a href="#">V.120</a>	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. 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 11-1.

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, Analog 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.

### Analog Modem or Fax Emulation

The I-modem does not try to make a digital connection and works only in Analog mode. If you know you'll make and receive only analog calls, this setting shortens the connect time.

### Analog Mode Handshaking

When making analog 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 analog 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 analog 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 analog 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 analog device is operating, and then adjusts to that rate.

When the I-modem answers a call from an analog 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 analog device does not have V.FC capability, the I-modem listens to the device's answer tones to identify what standard rate the remote analog device is operating at, and then adjusts to that rate.

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

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

On these analog 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.Protocols*) is used by I-modems operating in V.32terbo and V.32bis modes.

### **Other V. Protocols**

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

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

ASL (used in *V.32terbo* and *V.32bis* 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** When answering using *V.32terbo*, I-modems shift their serial port rate up to 38.4 Kbps (for 21.6 Kbps connections) if the calling *V.32terbo* device dials in at 21.6 Kbps. The answering *V.32terbo* device then sends data to its computer at 38.4 Kbps. *V.32bis* 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.32terbo* and/or *V.32bis*. (See Register S34, in [Appendix A, Alphabetic Command Summary](#).)

**Note** 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 analog connections with

“V.” [protocol](#) and HST modems in both Originate and Answer modes at a variety of speeds.

When originating an analog 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.22bis* 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.

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### Error Control

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I-modems employ error-control techniques only during [V.120](#) and analog connections.

**Note** High-speed analog 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 analog device is not set for error control. If your I-modem connects with a remote analog 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 analog 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.

### V.42 Error Control

This international standard includes a two-stage hand-shaking process:

- A *Detection* phase that is based on an exchange of predefined characters.

- A Link Access Procedures for Modems (LAPM) nego-ti-ation 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.

### Error-Control Commands

**&Mn** Enable ARQ (error control) or enable [synchronous](#) protocols. The 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 analog calls above 2400 bps.

**&M1** Online synchronous mode without *V.25bis*. External I-modems only.

**&M4** Normal/ARQ mode. Operate in Normal mode (&M0) if an ARQ connection can't be made.

**Note** 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.

**&M5** Enter ARQ [asynchronous](#) mode. The I-modem hangs up if it can't make an ARQ connection.

&M6 Start V.25*bis* synchronous mode, using a character-oriented link protocol similar to BISYNC. (External I-modems only.)

&M7 Start V.25*bis* synchronous mode, using the HDLC link protocol. (External I-modems only.)

---

## Data Compression

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I-modems employ different data compression techniques during analog 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.

### Analog

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.42bis 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 com-compressed data, but disables MNP5.

### Data Compression Commands

**&Kn** Enable/disable data compression.

**&K0** Disable analog and TurboPPP data compression.

**&K1** 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).

**&K2** Enable data compression. Use this setting to keep the I-modem from disabling compression.

**&K3** 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.

### 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 soft-ware to 230400, 115200, 57600, or 38400 bps 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:

---

<b>Kermit</b>	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.
<a href="#">XMODEM</a>	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).
<a href="#">YMODEM</a>	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 signaling).**

## Chapter 12 Querying

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

The most commonly used inquiry commands are:

---

<b>ATI4</b>	Current settings
<b>ATI5</b>	<a href="#">NVRAM</a> settings
<b>ATI6</b>	Link diagnostics summary
<b>ATI12</b>	ISDN configuration summary

---

*In*      Display the results of a query.

**I0**      Display a four-digit product code. If you have a problem and you call U.S. Robotics' Technical Support Department, you may be asked for this product code.

## U.S. Robotics I-modem Command Reference

- I1 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.
- I2 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.
- I3 Display the multiport I-modem's banner, or product title.
- I4 Display the I-modem's current configuration. (See Figure 12-1.)

---

```
ati4
USRobotics Courier I-modem with ISDN/V.34 Settings...

B0 C1 E1 F1 L2 M1 Q0 V1 X7
BAUD=115200 PARITY=N WORDLEN=8
DIAL=PULSE ON HOOK TIMER

&A3 &B1 &C1 &D2 &G0 &H1 &I0 &K1 &L0 &M4 &N0 &P0 &R2 &S0
&T5 &X0 &Y1 %N6 *C4 *V1=0 *V2=0

S00=000 S01=000 S02=043 S03=013 S04=010 S05=008 S06=002 S07=060
```

## U.S. Robotics I-modem Command Reference

```
S08=002 S09=006 S10=007 S11=055 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=000 S28=008 S29=020 S30=000 S31=000
S32=009 S33=000 S34=000 S35=000 S36=000 S37=000 S38=000 S39=000
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=064 S68=000
```

```
LAST DIALED #:
```

```
OK
```

---

**Figure 12-1. Current Configuration (I4)**

- I5     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. (See Figure 12-2.)

---

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

```
DIAL=TONE    B0   E1   F1   L2   M1   Q0   V1   X7
```

# U.S. Robotics I-modem Command Reference

BAUD=115200 PARITY=N WORDLEN=8

&A3 &B1 &C1 &D2 &G0 &H1 &I0 &K1 &L0 &M4 &N0 &P0  
&R2 &S0 &T5 &X0 &Y1 %N6 \*C4 \*V1=0 \*V2=0

S00=001 S02=043 S03=013 S04=010 S05=008 S06=002 S07=060 S08=002  
S09=006 S10=007 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=000 S28=008  
S29=020 S31=000 S32=009 S33=000 S34=000 S35=000 S36=000 S37=000  
S38=000 S39=000 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=064 S68=000

STORED PHONE NUMBERS

0:	1:
2:	3:
4:	5:
6:	7:
8:	9:

OK

Figure 12-2. Saved (NVRAM) Configuration (I5)

- I6 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 *Kn* 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 with ISDN/V.34 Link Diagnostics...

Chars sent                0      Chars Received            0
Chars lost                 0
Octets sent                0      Octets Received           0
Blocks sent                7      Blocks Received           5
Blocks resent              0

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

Data Compression          NONE
Equalization              Long
```

```
Fallback Protocol          Disabled
Speed                      SYNC
Last Call                  64000
                           00:01:32

Disconnect Reason is      Normal call clearing

OK
```

**Figure 12-3. Link Diagnostics Screen (I6)**

---

<b>Term Used in I6</b>	<b>Meaning</b>
------------------------	----------------

---

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 <a href="#">protocol</a> 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 Bliers.
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).

<b>Term Used in I6</b>	<b>Meaning</b>
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. (See Chapter 11 for more detail.)
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.
<a href="#">Protocol</a>	Indicates the error-control protocol negotiated (LAPM, HST, MNP, or NONE) or SYNC for a <a href="#">synchronous</a> 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 Table 12–2, Disconnect Reasons.)
Dial Security Disconnect Reason	Possible reasons the answering I-modem may have hung up during a Dial Security session. (See Table 12–3, Dial Security Disconnect Reasons.)

## Disconnect Reasons

Table 12-2 explains the disconnect reasons that are displayed in the ATI6 response. Messages pertaining to analog connections are indicated *by italics*.

<b>Disconnect Reason</b>	<b>Explanation</b>
A Rootless Tree	The I-modem received an invalid V.42bis (compression) frame.
Bearer capability not authorized	You have requested a <a href="#">B-channel</a> 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.

## U.S. Robotics I-modem Command Reference

<b>Disconnect Reason</b>	<b>Explanation</b>
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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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.
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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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.
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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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 <a href="#">B-channel</a> capability, but only restricted is available.
<a href="#">Protocol</a> 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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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.
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.

<b>Disconnect Reason</b>	<b>Explanation</b>
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 <a href="#">B-channel</a> 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.

## U.S. Robotics I-modem Command Reference

<b>Disconnect Reason</b>	<b>Explanation</b>
User busy	Though the user's equipment is compatible with the call, it has no resources to handle the call.
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

Table 12-3. Dial Security Disconnect Reasons

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 <a href="#">synchronous</a> 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.

- 17      Display the product configuration. If you have a problem and call U.S. Robotics' Technical Support staff, you may be asked to read this screen.

I10 Display the Dial Security Account status. For security administrators only, unless local security is disabled (S53=0 or S53.2=0).

---

```
ati10
U.S. Robotics Total Control I-modem with ISDN/V.34

                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 12-4. Dial Security Account Status Screen (I10)

- I11 Displays a connection report that U.S. Robotics Technical Support representatives use to help you solve problems.
  - I12 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 with ISDN/V.34 ISDN Switch Settings...

Switch Protocol *W 2 US National ISDN-1
Multipoint *M 1 Multi-point
Dialing Mode *O 1 Overlap Sending mode
SPID *S1 84755511110111 Voice SPID
*S2 84755511120111 Data SPID
Directory No. *P1 5551111 Voice Directory Number (DN1)
*P2 5551112 Data Directory Number (DN2)
TEI *T1 00 Automatic TEI
*T2 00 Automatic TEI

Physical Interface: Active
Data Link Layer : Active

OK
```

---

Figure 12-5. ISDN Settings Screen (I12)

# Chapter 13

## Displaying Help Screens

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

**Important 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 13-1.)

---

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

&$  HELP, Ampersand Commands      Kn   n=0 Call Duration Mode
%$  HELP, Percent Commands         n=1 Real Time Clock Mode
A/   Repeat Last Command           Ln   n=0 Low Speaker Volume
A>   Continuously Repeat Command   n=1 Low Speaker Volume
AT   Command Mode Prefix           n=2 Med Speaker Volume
A    Answer Call                   n=3 Hi Speaker Volume
Bn   n=0 V.32 originate mode       Mn   n=0 Speaker Off
     n=1 HST originate mode        n=1 Speaker On Until CD
Cn   n=0 Transmitter Off           n=2 Speaker Always On
     n=1 Transmitter On            n=3 Speaker Off During Dial
Dn   Dial a Telephone Number       On   n=0 Return Online
     n=0..9#*TPR,;"W@!()-         n=1 Return Online & Retrain
DL   Dial Last Phone Number        n=2 Return Online & Speed Shift
DSn  Dial Stored Phone Number      P    Pulse Dial
D$   HELP, Dial Commands           Qn   n=0 Result Codes Sent
En   n=0 No Command Echo           n=1 Quiet (No Result Codes)
     n=1 Echo Command Chars        n=2 Verbose/Quiet On Answer
```

## U.S. Robotics I-modem Command Reference

Fn	n=0	Online Echo	Sr=n	Sets Register "r" to "n"
	n=1	No Online Echo	Sr?	Query Register "r"
Hn	n=0	On Hook (Hang Up)	S\$	HELP, S Registers
	n=1	Off Hook	T	Tone Dial
In	n=0	Product Code	Vn	n=0 Numeric Responses
	n=1	Checksum		n=1 Verbal Responses
	n=2	<a href="#">RAM</a> Test	Xn	n=0 Basic Result Codes
	n=3	Modem Identification		n=1 Extended Result Codes
	n=4	Current Settings		n=2-7 Advanced Result Codes
	n=5	<a href="#">NVRAM</a> Settings	Z	Software Reset
	n=6	Link Diagnostics	Z!	Hardware Reset
	n=7	Product Configuration	+++	Escape Code
	n=10	Dial Security Status	\$	HELP, Command Summary
	n=11	V.FC Link Screen		
	n=12	ISDN Configuration		

OK

---

Figure 13-1. 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 13-2.)

# U.S. Robotics I-modem Command Reference

---

at&\$

HELP, Ampersand Commands (CTRL-S to Stop, CTRL-C to Cancel)

&An	n=0 Disable /ARQ Result Codes	&Pn	n=0 N.American Pulse Dial
	n=1 Enable /ARQ Result Codes		n=1 UK Pulse Dial
	n=2 Enable /Modulation Codes	&Rn	n=0 CTS Follows RTS
	n=3 Enable /Extra Result Codes		n=1 Ignore RTS
&Bn	n=0 Floating DTE Speed		n=2 RX to DTE/RTS high
	n=1 Fixed DTE Speed	&Sn	n=0 DSR Always On
	n=2 DTE Speed Fixed When ARQ		n=1 Modem Controls DSR
&Cn	n=0 CD Always On		n=2 Pulse DSR, CTS=CD
	n=1 Modem Controls CD		n=3 Pulse DSR
&Dn	n=0 Ignore DTR		n=4 DSR = DCD
	n=1 Online Command Mode	&Tn	n=0 End Test
	n=2 DTE Controls DTR		n=1 Reserved (ALB)
&Fn	n=0 Load Factory Configuration		n=3 Digital Loopback (DLB)
	n=1 Hardware Flow Control Cnfg.		n=4 Grant Remote DLB
	n=2 Software Flow Control Cnfg.		n=5 Deny Remote DLB
&Gn	n=0 No Guard Tone		n=6 Remote Digital Loopback
	n=1 550 Hz Guard Tone		n=7 Remote DLB With Self Test
	n=2 1800 Hz Guard Tone		n=8 Reserved
&Hn	n=0 Disable TX Flow Control	&W	Store Configuration
	n=1 CTS	&Xn	n=0 DCE Synchronous Clock
	n=2 Xon/Xoff		n=1 DTE Synchronous Clock
	n=3 CTS and Xon/Xoff		n=2 RX Clock is Source
&In	n=0 Disable RX Flow Control	&Yn	n=0 Destructive
	n=1 Xon/Xoff		n=1 Destructive/Expedited
	n=2 Xon/Xoff Chars Filtered		n=2 Nondest./Expedited



## U.S. Robotics I-modem Command Reference

	n=3	HP Enq/Ack Host Mode	n=3	Nondest./Unexpedited
	n=4	HP Enq/Ack Terminal Mode	&Zn=s	Store Phone Number
	n=5	Xon/Xoff for non-ARQ Mode	&Zn=L	Store Last Phone Number
&Kn	n=0	Disable Data Compression	&Zn?	Query Phone Number
	n=1	Auto Data Compression		
	n=2	Enable Data Compression		
	n=3	Selective Data Compression		
&Ln	n=0	Reserved		
	n=1	Reserved		
&Mn	n=0	Normal Mode		
	n=1	Synchronous Mode		
	n=4	ARQ/Normal Mode		
	n=5	ARQ Mode		
	n=6	V.25bis		
	n=7	V.25bis HDLC		
&Nn	n=0	Highest Modem Link Speed		
	n=1	300 bps		
	n=2	1200 bps		
	n=3	2400 bps		
	n=4	4800 bps		
	n=5	7200 bps		
	n=6	9600 bps		
	n=7	12000 bps		
	n=8	14400 bps		
	n=9	16800 bps		
	n=10	19200 bps		
	n=11	21600 bps		
	n=12	24000 bps		
	n=13	26400 bps		

```
n=14 28800 bps
n=15 31200 bps
n=16 33600 bps
```

OK

---

**Figure 13-2. Ampersand Commands Help Screen (AT&\$)**

---

### S-Registers (S\$)

---

When you send ATSS\$, 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                S40 Reserved
S1 Counts # of Rings                 S41 # of Allowed Login Attempts
S2 Escape Code Char                  S42 Remote Escape Code Char
S3 Carriage Return Char              S43 Remote Escape Code Time (1/50sec)
S4 Line Feed Char                     S44 Leased Line Delay Timer (sec)
S5 Backspace Char                     S47 Reserved
S6 Wait Time/Dial Tone (sec)          S51 Bit Mapped
```

## U.S. Robotics I-modem Command Reference

S7	Wait Time/Carrier (sec)	1 = MNP/V.42 Disabled in V.22
S8	Comma Time (sec)	2 = MNP/V.42 Disabled in V.22bis
S9	Carrier Detect Time (1/10sec)	4 = MNP/V.42 Disabled in V.32
S10	Carrier Loss Time (1/10sec)	8 = Reserved
S11	Dial Tone Spacing (ms)	16 = Reserved
S12	Escape Code Time (1/50sec)	32 = Reserved
S13	Bit Mapped	64 = Reserved
	1 = Reset On DTR Loss	128 = Enable phone exclusion delay
	2 = Do Originate in Auto Answer	S53 Bit Mapped
	4 = No Pause Before Result Codes	1 = Enable Dial Security
	8 = Do DS0 On DTR	2 = Enable Autopass Fallback
	16 = Do DS0 On Reset	4 = Enable Local Access Psw
	32 = Disable HST	8 = Reserved
	64 = Disable MNP Level 3	16 = Reserved
	128 = Hardware Reset	32 = Reserved
S14	Bit Mapped	64 = Reserved
	1 = Escape Code Hang Up	128 = Reserved
	2 = Result Code Orig Only	S54 Bit Mapped
S15	Bit Mapped	1 = Disable 2400 symbol rate
	1 = Disable High-Freq EQ	2 = Disable 2743 symbol rate
	2 = Disable Online Fallback	4 = Disable 2800 symbol rate
	4 = Disable 450 bps Back Channel	8 = Disable 3000 symbol rate
	8 = Reduced Non-ARQ TX Buffer	16 = Disable 3200 symbol rate
	16 = Disable MNP Level 4	32 = Disable 3429 symbol rate
	32 = Set DEL=Backspace	64 = Disable V.8 Call Indicate
	64 = Unusual MNP-Incompatibility	128 = Disable V.8 Mode
	128 = Custom Applications	S55 Bit Mapped
S16	Test Modes	1 = Disable 8S-2D trellis code
	1 = Reserved	2 = Disable 16S-4D trellis code



## U.S. Robotics I-modem Command Reference

2 = Dial Test	4 = Disable 32S-2D trellis code
4 = Test Pattern	8 = Disable 64S-4D trellis code
8 = Remote Digital Loopback	16 = Reserved
16 = Reserved	32 = Reserved
32 = Reserved	64 = Reserved
64 = Reserved	128 = Reserved
128 = Reserved	S56 Bit Mapped
S17 Reserved	1 = Disable Non linear coding
S18 &Tn Test Timeout (sec)	2 = Disable TX level deviation
S19 Inactivity Timeout (min)	4 = Disable Pre-emphasis
S20 Reserved	8 = Disable Pre-coding
S21 Break Length (1/100sec)	16 = Disable Shaping
S22 Xon Char	32 = Disable V34+
S23 Xoff Char	64 = Disable V.34
S24 DSR Pulse Time (1/50sec)	128 = Disable V.FC
S25 DTR Recognition Time (1/100sec)	S67 Misc. ISDN Configuration
S26 RTS/CTS Delay Time (1/100sec)	1 = Enable V.110 in Automode
S27 Bit Mapped	2 = Fix Connection Rate for Digital Calls
1 = V21 Mode	4 = Connect at 64K (else 56K)
2 = Disable TCM	8 = AT&T 5ESS Custom: Route Analog to Data Port
4 = Disable V32	16 = Enable Data Link Delay
8 = Disable 2100hz	32 = Map LEDs to B-Channels
16 = Disable MNP Handshake	64 = Disable B-Chan. LED Blink
32 = Disable V.42	128 = Reserved
48 = Disable V.42 Detect Phase	S68 ISDN Universal Connect
64 = Reserved	1 = Disallow Analog Connects Over Digital Connections
128 = Unusual SW-Incompatibility	
S28 V32 Handshake Time (1/10sec)	
S29 Reserved	

## U.S. Robotics I-modem Command Reference

```
S30 Reserved
S31 Reserved
S32 Reserved
S33 Reserved
S34 Bit Mapped
    1 = Disable V.32bis
    2 = Disable Enhanced V32 mode
    4 = Disable Quick V32 retrain
    8 = Enable V23 Fallback
   16 = Change MR to DSR
   32 = Enable MI/MIC
   64 = Disable RA Busy Msg
  128 = Disable Turbo
S35 Reserved
S36 Reserved
S37 Reserved
S38 Disconnect Wait Time (sec)
S39 Reserved

    2 = Disable Enhanced
        Universal Connect
    4 = Disable Turbo PPP
    8 = Disable Multilink PPP
   16 = Reserved
   32 = Reserved
   64 = Reserved
  128 = Reserved
S69 Bit Mapped
    1 = Disable Extrn. PnP
    2 = Reserved
    4 = Reserved
    8 = Reserved
   16 = Reserved
   32 = Reserved
   64 = Reserved
  128 = Reserved

OK
```

---

**Figure 13-3. S-Registers Help Screen (AT\$)**

---

## 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 13-4.)

---

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

%An= Security Account Information %Fn Remote DTE Data Format
      Command Structure                n=0 8, No parity
%An=pw,acct e,dial b,new#,ph#         n=1 7, Mark parity
      n = (0-9)                         n=2 7, Odd parity
      pw = Password                     n=3 7, Even parity
      acct e = Account Enable           %L=PWn Security Local Access Psw
      dial b = Dial Back Enable         PWn = (0-9)
      new# = New Dial Back #           %Nn V.25bis Synchronous Clock Rate
      ph# = Dial Back Phone #          n=0 RESERVED
%Bn Remote DTE Data Rate               n=1 RESERVED
      n=0 110 bps                       n=2 1200 bps
      n=1 300 bps                       n=3 2400 bps
      n=2 600 bps                       n=4 4800 bps
      n=3 1200 bps                      n=5 7200 bps
      n=4 2400 bps                      n=6 9600 bps
      n=5 4800 bps                      n=7 12000 bps
```

	n=6	9600	bps		n=8	14400	bps
	n=7	19200	bps		n=9	16800	bps
	n=8	38400	bps		n=10	19200	bps
	n=9	57600	bps	%Pn=s	Store Remote Access Pswd		
	n=10	115200	bps	n=0	Query Access Only		
%Cn	n=0	Defer Configuration		n=1	Full Configuration		
	n=1	Revert Configuration		%Pn?	Query Remote Access Pswd		
	n=2	Execute Configuration		n=0	Query Access Only		
%E=n	Erase Account Information			n=1	Full Configuration		
	n=1	Erase Local Access Psw		%S=	Psw To Grant Local Access		
	n=2	Erase Autopass Psw		%T	Touch Tone recognition		
	n=3	Erase Accounts Psw		%V=PWn	Security Autopass Psw		
	n=4	Erase Accounts Phone #		PWn =	(0-9)		
	n=5	Erase Accounts Status					

OK

---

Figure 13-4. 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 13-5.

# U.S. Robotics I-modem Command Reference

---

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

\*S1=n..n Voice Service Profile Identifier (SPID0)  
\*S2=n..n Data Service Profile Identifier (SPID1)  
\*P1=n..n Voice Directory Number (DN0)  
\*P2=n..n Data Directory Number (DN1)  
\*V1=n Voice Bearer Capability (DN0)  
    n=0 3.1 Khz 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 for Async-to-sync PPP  
\*W=n ISDN Switch Protocol Type  
    n=0 AT&T 5ESS Custom  
    n=1 Northern Telecom DMS-100  
    n=2 US National ISDN-1  
    n=3 US National ISDN-2  
\*M=n Bus Configuration .  
    n=0 Point to Point  
    n=1 Multipoint  
\*O=n Dialing Mode  
    n=0 En-Bloc mode  
    n=1 Overlap Sending mode



## U.S. Robotics I-modem Command Reference

```
*T1=nn    Voice channel TEI
           nn=0    Automatic assignment
           nn=1-63 Fixed TEI assignment
*T2=nn    Data channel TEI
           nn=0    Automatic assignment
           nn=1-63 Fixed TEI assignment
*Cn       Audio port volume
           n=0    minimum
           :
           n=9    maximum
```

OK

---

Figure 13-5. 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 13-6.)

---

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

## U.S. Robotics I-modem Command Reference

```
0-9 Digits to Dial
* Auxiliary Tone Dial Digit
# Auxiliary Tone Dial Digit
T Tone Dialing
P Pulse Dialing
R Call an Originate Only Modem
, Pause (Wait for S8 Time)
; Remain in Command Mode After Dialing
" Used to Dial Alpha Phone #'s
W Wait for 2nd Dial Tone (X3-X7)
@ Wait for an Answer (X3-X7)
! Flash Switch Hook
```

---

**Figure 13-6. Dial Commands Help Screen (ATD\$)**

# Chapter 14

## Testing

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 tele-phone line. Figure 14-1 shows the data flow during digital loopback testing.

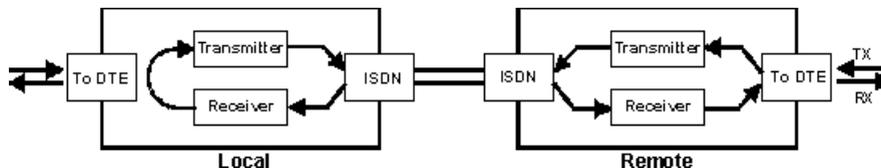


Figure 14-1. Data Flow During Digital Loopback

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!** 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)

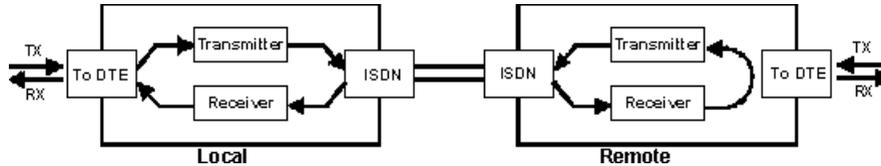
To stop a test, send an &T0 command, or set Register S18 to a specified number of seconds (for example, S18=10). When the

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 14-2.



**Figure 14-2. 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 signaling. 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 loop-back 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

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Register S16 is a bit-mapped register. (See Chapter 1, Using the AT Command Set, for instructions for setting bit-mapped registers.)

Table 14-1. [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=80**.

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 digi-

tal 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**.

## Chapter 15 Troubleshooting

This chapter is divided into three sections:

1. Problems that occur before connecting.
2. Problems that occur after connecting.
3. What to do if you still have problems.

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### Problems That Occur Before Connecting

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#### 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 Signaling](#).
- Although it is a rare condition, 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 are appearing 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).

### The I-modem won't accept your [directory number \(DN\)](#)

The I-modem accepts only seven-digit DNs. Try sending the \*P command, this time leaving off the area code.

### After you dial, the I-modem reports **NO CARRIER** and then hangs up

- You may not have set the correct SPIDs. Send AT112 and check the Physical Interface and Data Link Layer entries. Both should read **Active**. If you have set the wrong [SPID](#), Data Link Layer reads **Active (Incorrect SPID)**.
- Your I-modem may not be set to use the correct central-office switch. Often the order confirmation from your local telephone company lists the switch hardware type prominently, when what you are interested in is the switch [protocol](#). For example, you might be told that your central-office switch is a [Northern Telecom DMS-100](#) running [National ISDN-1](#). In this case, you should set the switch type as National ISDN-1.
- Set the bus configuration as **multipoint** (AT\*M=1), unless your [central office switch](#) is running [AT&T 5ESS](#) Custom and you have requested point-to-point service.
- Try increasing S7 and decreasing S9 to allow more time for the connection.
- Try calling a different device. If you are trying to connect to an older modem at 2400 bps or less, it may not support error control. Try sending AT&M0, and then try the call again. Reset the I-modem (send ATZ) after you finish the call.

### **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 Signaling](#).

### **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.

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## **Problems that Occur After Connecting**

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### **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 Kbps, 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: AT\$34=3 or AT\$34.0=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.

### **Can't make 64 Kbps connections**

Your long distance telephone service provider may not have ISDN support through its entire network. As is usual in telecommunications, the slowest link determines the fastest connection speed.

### **Connects at 64 Kbps or 56 Kbps, but can't pass data**

Your telephone company may be providing incorrect connection speed information. Try forcing the connection speed to 56 Kbps by sending `ATS67.1=1` and `ATS67.2=0`. If you still can't pass data, try forcing the connection speed to 64 Kbps by sending `ATS67.1=1` and `ATS67.2=1`. Any problems will likely be confined to one phone number, so after the call, change the setting back to auto-sense, `ATS67.1=0`.

### **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 com-muni-cations 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-muni-cations 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, Analog 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 Bn 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, `&Nn`, 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, Alphanumeric 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

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The problems described above are the most common ones users encounter. If the suggestions we've given don't clear up the difficulties, try the following:

1. Review the manual carefully to see if you've missed something.
2. Call or visit your dealer, who will probably be able to assist you. This is much more efficient (and time-saving) than returning the product to U.S. Robotics.
3. If your dealer can't help you, refer to the Customer Service Access Card provided in this package. This card lists several important U. S. Robotics numbers. Your I-modem is warranted for 5 years from the date of purchase.
4. If you call us, the Service Representative you talk with will give you a Service Repair Order (SRO) number. **Products without an SRO number will not be accepted.**
5. If you return the I-modem to us, please follow these procedures:
  - a. Ship the unit, postage-prepaid, in its original container. If you don't have the original container, pack the unit in a corrugated cardboard box with plenty of packing material.

- b.** Be sure to include your SRO number inside the package, along with your name and address. Put your return address and SRO number on the shipping label, as well.
- c.** Ship the package to:

**Cor/Sys Technical Support  
U.S. Robotics Access Corp.  
8100 North McCormick Boulevard  
Skokie, Illinois 60076-2999**

**Note** U.S. Robotics will not accept packages sent COD, so be sure to send the modem postage-paid.

U.S. Robotics will repair your I-modem and return it to you via United Parcel Service.

# Chapter 16

## Analog 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 analog, [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 analog synchronous mode:

- **Dial Using V.25bis Software.** Configure the I-modem to enter synchronous mode when you power it on. Then run communications software that uses the V.25bis [protocol](#) to control the dialing 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

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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.25bis Software

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To make [synchronous](#) connections using V.25bis 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.25bis [protocol](#), HDLC or character-oriented, is being used for dialing and answering at the host computer and then set the I-modem to dial using it.

&M6 Dial using a 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.

**&M7** Dial using the High Level Data Link Control (HDLC) protocol. HDLC ignores parity.

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

2. Set the offline 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 offline 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  $\&Nn$  is set for  $2*10$ , the I-modem ignores the  $\%Nn$  rate and uses the  $\&Nn$  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 ( $\%Nn$ ) and that you set the connection rate ( $\&Nn$ ) to match. This avoids dramatic changes in the rate produced when the connection rate adjusts to the offline clock speed.

Example: **AT&N10%N10&W <Enter>** selects a connection rate and an offline 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 **Xn** 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.

**S0=0** Disables Auto Answer.

**S0=1** Enables Auto Answer.

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 dialing, an offline 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.

### Dialing Using V.25bis

Your communications software, which must support *V.25bis*, handles the dialing. Once the synchronous connection is made and the I-modem is in synchronous mode, *V.25bis*

commands are no longer necessary and are ignored. For dialing 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.25bis Reference

**Note** The commands and result codes described in this section are sent and recognized by your V.25bis 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: <b>CRN18005551234</b>
CRS	Call Request with memory location	Instructs the I-modem to dial a number stored in memory. Example: <b>CRS3</b>
DIC	Disregard incoming call	Instructs the I-modem to disregard an incoming call – overrides auto answer for this call.
PRNn	Program number	Stores a number in <a href="#">NVRAM</a> . Example: <b>PRN3; 18005551234</b>
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	Ringling
CNX	Connect
INC	Incoming call
INV	Invalid action
LS	List of numbers
LSF	List of forbidden numbers

## U.S. Robotics I-modem Command Reference

---

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 Dialing 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 Signaling.

### 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&X0 <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, and &X0, which identifies the I-modem as the source of synchronous timing signals.

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

## U.S. Robotics I-modem Command Reference

---

&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>**

### Dialing

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&X0&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 autodialing 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 dialing 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](#).

## Chapter 17 Upgrading the I-modem's Software

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

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 with ISDN/V.34 Configuration Profile...

Product type           US/Canada External
Options                HST,V32bis,Terbo,V.FC,V34+
Fax Options            Class 1/Class 2.0
Clock Freq             20.16Mhz
```

## U.S. Robotics I-modem Command Reference

Eprom	768k
<a href="#">Ram</a>	256k
Supervisor date	04/02/96
DSP date	09/28/95
Supervisor rev	2.0.0
DSP rev	2.0.0
OK	

---

Check the Supervisor and Digital Signal Processor (DSP) dates. The best way to find out the current shipping version of the I-modem's software is to call U.S. Robotics Technical Support at (800) 550-7800.

---

### Getting New Operating Software

---

There are two ways to get the newest version of the I-modem's operating software:

- Call the U.S. Robotics Bulletin Board Service (BBS) at **(847) 982-5092**. From the main menu, select **Files** and then select area 5, **USR Courier**. Download the newest I-modem file with the extension XMD.

- Over the Internet, ftp to **ftp.usr.com**. Log in as *anonymous* and then enter your Internet e-mail address as your password. From the **sys/pcb/dl05** directory, get the newest I-modem file with the extension XMD.

---

### **Sending New Software to the I-modem**

---

1. Start a communications software package, such as Quick Link II or MacComCenter. Adjust the settings, if necessary, so 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 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 XMD 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 XMD 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

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.
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.

## Appendix A 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.

3Wait 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.
- Bn** 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.
- Cn** Enable or disable the transmitter.
- C0** Transmitter disabled; for receiving only.
- C1** Transmitter enabled.
- Dn** 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.

**Notes** 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 dialing.

" Dial the letters that follow.

W Wait for a second dial tone before continuing dialing (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-dialed number.
- L Dial the last-dialed number.
- $Sn$  Dial the number stored in memory at position  $n$ , where  $n = 0*9$ . Store the number in memory using the &Z command.
- \$ Display help for the dial commands.
- $En$  [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.
- Notes** If double characters appear on the screen, both the I-modem's local echo and your software's local echo are on.

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- Fn* 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.)
- Hn* Go on or off hook.
- H0** Go on hook (hang up).
- In* 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.
- Kn*    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`.
- On*    Return online. Use with the escape code (+++) to toggle between command and online modes.

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- O0 Return online (normal).
- O1 Return online and retrain. Use O1 if there were errors in a non-ARQ data transfer.
- Qn 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.
- Sr=n Set [S-register](#) value: *r* is any S-register; *n* must be a decimal number between 0 and 255.
- Sr.b=n Set a bit-mapped register: *r* is the S-register, *b* is the bit, and *n* is 0 (off) or 1 (on).
- Sr? Query contents of S-register *r*.

**Note** See the [S-registers](#) listing later in this appendix.

**Vn** Display result codes in words or numbers.

**V0** Display result codes in numeric form.

**V1** Display result codes in verbal form.

**Xn** Control the amount of information displayed in the result codes. The default is **X7** (all codes except 12/VOICE). For result codes in [synchronous](#) operations, see [Chapter 16, Analog Synchronous Applications](#).

**Table A-1. Result Code Sets for ATXn Values**

Result Codes	Setting							
	X0	X1	X2	X3	X4	X5	X6	X7
0/OK	.	.	.	.	.	.	.	.
1/CONNECT	.	.	.	.	.	.	.	.
2/RING	.	.	.	.	.	.	.	.
3/NO CARRIER	.	.	.	.	.	.	.	.
4/ERROR	.	.	.	.	.	.	.	.

**Table A-1. Result Code Sets for ATXn Values**

Result Codes	Setting							
	X0	X1	X2	X3	X4	X5	X6	X7
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		•	•	•	•	•	•	•

**Table A-1. Result Code Sets for ATXn Values**

Result Codes	Setting							
	X0	X1	X2	X3	X4	X5	X6	X7
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•
151/CONNECT 31200		•	•	•	•	•	•	•
155/CONNECT 33600		•	•	•	•	•	•	•
162/CONNECT 56000		•	•	•	•	•	•	•
165/CONNECT 64000		•	•	•	•	•	•	•
<b>Functions</b>								
Wait for 2nd Dial Tone (W)				•	•	•	•	•
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.
- &An Enable or disable the display of additional result code subsets. (Also, see the *Xn* 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).

**&Bn** Set the serial port rate to variable or fixed.

**Note** The serial port rate *must be equal to or higher than* the &Nn 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, regard-less of the connection rate.

**&B2** When answering calls, use the fixed rate for ARQ calls and variable rates for non-ARQ calls.

**&Cn** 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.

**&Dn** 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 *On* command, or hang up with the *Hn* command.

**&D2** Normal DTR operations. The modem will not accept commands unless your computer sends a DTR signal. Dropping DTR ends a call.

**&Fn** 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&Fn. To write a template to [NVRAM](#), enter AT&Fn&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.
- &Gn** Set guard tones for international calls.
  - &G0** No guard tone. Use this in the United States and Canada.
  - &G1** This sets a 550 Hz guard tone, and is used in some European countries.
  - &G2** This sets an 1800 Hz guard tone, and is used in the U.K. and some Commonwealth countries. **&G2** requires the **B0** setting.
- &Hn** Transmit data flow control. Prevents the I-modem's buffer for data transmitted to the I-modem by its attached com-puter 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 signaling.
- &H3** Use both hardware and software flow control. If you are unsure about what your equipment supports, select this option.
- &In** 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 proto-col. 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.
- &Kn 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** Line type.

**&L0** Normal.

**&Mn** 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.25bis [synchronous](#) mode using a character-oriented link [protocol](#) similar to BISYNC.
- &M7 V.25bis synchronous mode using the HDLC link protocol.
- &Nn Connection rate variable or fixed (analog 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- &N16 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.

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&N1	300 bps	&N9	16800 bps
&N2	1200 bps	&N10	19200 bps
&N3	2400 bps	&N11	21600 bps
&N4	4800 bps	&N12	24000 bps
&N5	7200 bps	&N13	26400 bps
&N6	9600 bps	&N14	28800 bps
&N7	12000 bps	&N15	31200 bps
&N8	14400 bps	&N16	33600 bps

**&Rn** 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.

- &Sn** 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 dialing, 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.
- &Tn** 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.
- &W Write the current settings to [NVRAM](#).
- &Yn 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=555-6789 <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.

$\&Zn=L$  stores the last-dialed number in position  $n$ .

$\&Zn?$  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.

$\%An$  Create and configure security accounts.

$\%Bn$  Remotely configure an I-modem's serial port rate.

$\%B0$	110 bps	$\%B6$	9600 bps
$\%B1$	300 bps	$\%B7$	19,200 bps
$\%B2$	600 bps	$\%B8$	38,400 bps
$\%B3$	1200 bps	$\%B9$	57,600 bps
$\%B4$	2400 bps	$\%B10$	115,200 bps
$\%B5$	4800 bps		

$\%Cn$  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.

## U.S. Robotics I-modem Command Reference

**%E=4** Erase phone numbers in accounts 0\*9.

**%E=5** Disable Account, Dialback, and New Number fields in accounts 0\*9.

**%Fn** 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.

**%Nn** Set the offline clock speed for [synchronous](#) mode. External I-modems only.

---

<b>%N0</b>	Reserved	<b>%N6</b>	9600 bps
<b>%N1</b>	Reserved	<b>%N7</b>	12,000 bps
<b>%N2</b>	1200 bps	<b>%N8</b>	14,400 bps
<b>%N3</b>	2400 bps	<b>%N9</b>	16,800 bps

## U.S. Robotics I-modem Command Reference

%N4	4800 bps	%N10	19,200 bps
%N5	7200 bps		

*%Pn=* Disable password security ( $n=0$  or  $n=1$ ) when no character follows the equal sign.

*%Pn=s* Set the following password (*s*) for viewing privileges only ( $n = 0$ ), or view and configuration privileges ( $n = 1$ ).

*%Pn?* Display password *n*.

*%S=n* Access the security accounts. Does not disable security.

*%T* Enable the recognition of tone frequencies of analog dialing 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=PWn* 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 analog device jack.

\*C0Off

\*C9Highest volume

\*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* Dialing mode. I-modems with an Analog Device Port only.

## U.S. Robotics I-modem Command Reference

- \*O=0 En-bloc dialing. Dials similarly to a cellular telephone. To complete the call, press # after dialing the number.
- \*O=1 Overlap dialing. Dials like a standard analog telephone.
- \*Pn=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.
- \*Rn Internal I-modem only. Adjusts the ringing signal volume. 0 is quietest and 9 is loudest.
- \*Sn=s Set the [Service Profile ID \(SPID\)](#) that was assigned to you by your telephone company.
- \*S1= The SPID for the Voice B-channel.
- \*S2= The SPID for the Data B-channel.

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\* $Tn=s$  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.

\* $Vn=s$  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	<a href="#">V.120</a> rate adaption only

## U.S. Robotics I-modem Command Reference

---

n	Call Type
2	<a href="#">V.110</a> rate adaption only
3	Modem or fax only
4	Clear-channel <a href="#">synchronous</a>
5	Asynchronous to synchronous PPP conversion

---

\*W=n Set the switch [protocol](#) used telephone company's [central office](#).

---

n	Switch Protocol Type
0	<a href="#">AT&amp;T 5ESS</a> Custom
1	<a href="#">Northern Telecom DMS-100</a>
2	<a href="#">National ISDN-1</a>
3	<a href="#">National ISDN-2</a>

---

## 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. <sup>a</sup>
S3	13	Stores the ASCII decimal code for the Carriage Return character. Valid range is 0*127. <sup>a</sup>
S4	10	Stores the ASCII decimal code for the Line Feed character. Valid range is 0*127. <sup>a</sup>
S5	8	Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function. <sup>a</sup>
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.

**Table A-1. S-registers: Their Functions and Default Settings**

Register	Default	Function												
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.												
S10	7	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 dialed 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. See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.												
		<table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Reset when DTR drops.</td> </tr> <tr> <td>1</td> <td>2</td> <td>Reverse normal Auto Answer operation: On incoming RING, enter Originate Mode and look for an answer tone.</td> </tr> <tr> <td>2</td> <td>4</td> <td>Disable 250 ms pause before result code display.</td> </tr> </tbody> </table>	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.
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.												

**Table A–1. S-registers: Their Functions and Default Settings**

Register	Default	Function
		3      8      On DTR signal, autodial the number stored in <a href="#">NVRAM</a> 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.32terbo 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).
S14	1	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)
		<b>Bit      Value      Result</b>
		0      1      Disconnect on escape code.
		1      2      Send result codes only when originating a call.
S15	0	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)

**Table A–1. [S-registers](#): Their Functions and Default Settings**

Register	Default	Function																								
		<table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Disable the I-modem's extra high-frequency equalization if it causes problems on shorter-link calls – for HST modulation only.</td> </tr> <tr> <td>1</td> <td>2</td> <td>Disable online fallback.</td> </tr> <tr> <td>2</td> <td>4</td> <td>Disable 450 bps back channel – HST only.</td> </tr> <tr> <td>3</td> <td>8</td> <td>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).</td> </tr> <tr> <td>4</td> <td>16</td> <td>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.</td> </tr> <tr> <td>5</td> <td>32</td> <td>Set Backspace key to delete.</td> </tr> <tr> <td>6</td> <td>64</td> <td>Some earlier 2400 bps MNP I-modems, not made by U.S. Robotics or Microcom, were not fully compatible with the MNP <a href="#">protocol</a>. 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.</td> </tr> </tbody> </table>	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 <a href="#">protocol</a> . 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.
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**Table A–1. S-registers: Their Functions and Default Settings**

Register	Default	Function									
		<p>7            128            Custom applications only.</p> <p>*The default 1.5K byte non-ARQ buffer allows data transfer with X- and YI-modem-type File Transfer Protocols without using flow control.</p> <p>The 128-byte option allows remote users with slower modems to stop your transmitted data from scrolling off their screens. When remote users send your computer an XOFF (&lt;Ctrl-S&gt;) and you stop transmitting, the data in transit doesn't exceed the size of their screen.</p>									
S16	0	<p>Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a>, for instructions on setting bit-mapped registers.) For testing, see <a href="#">Chapter 14, Testing</a>.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>4</td> <td>Test pattern.</td> </tr> <tr> <td>3</td> <td>8</td> <td>Remote digital loopback.</td> </tr> </tbody> </table>	Bit	Value	Result	2	4	Test pattern.	3	8	Remote digital loopback.
Bit	Value	Result									
2	4	Test pattern.									
3	8	Remote digital loopback.									
S18	0	<p>Test timer for software-initiated loopback testing (&amp;Tn); 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.</p>									
S19	0	<p>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.</p>									

**Table A–1. S-registers: Their Functions and Default Settings**

Register	Default	Function
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. <sup>a</sup>
S23	19	Stores the ASCII code for the XOFF character. <sup>a</sup>
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 <a href="#">synchronous</a> mode.
S27	0	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about setting bit-mapped registers.)
	<b>Bit</b>	<b>Value</b> <b>Result</b>
	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 is part of the ITU-T V.32 recommendation, but is rarely used.

**Table A-1. S-registers: Their Functions and Default Settings**

Register	Default	Function	
	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 AT16 screen.
Error control handshaking options: Select the total value of bits 4 and 5.			
<b>Bit 4</b>	<b>Bit 5</b>	<b>Result</b>	
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.	

**Table A–1. [S-registers](#): Their Functions and Default Settings**

Register	Default	Function												
S28	8	<p>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.</p> <p>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).</p> <p>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).</p>												
S34	0	<p>Bit-mapped register. See <a href="#">Chapter 1, Using the AT Command Set</a>, for instructions about how to set bit-mapped registers.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Disable V.32bis. Used for troubleshooting; U.S. Robotics Technical Support may ask you to disable V.32bis for testing purposes.</td> </tr> <tr> <td>1</td> <td>2</td> <td>Disable the I-modem's enhanced, proprietary V.32bis modulation. Used for troubleshooting.</td> </tr> <tr> <td>2</td> <td>4</td> <td>Disable the faster retrains that occur during proprietary V.32terbo modulation. Used for troubleshooting.</td> </tr> </tbody> </table>	Bit	Value	Result	0	1	Disable V.32bis. Used for troubleshooting; U.S. Robotics Technical Support may ask you to disable V.32bis for testing purposes.	1	2	Disable the I-modem's enhanced, proprietary V.32bis modulation. Used for troubleshooting.	2	4	Disable the faster retrains that occur during proprietary V.32terbo modulation. Used for troubleshooting.
Bit	Value	Result												
0	1	Disable V.32bis. Used for troubleshooting; U.S. Robotics Technical Support may ask you to disable V.32bis for testing purposes.												
1	2	Disable the I-modem's enhanced, proprietary V.32bis modulation. Used for troubleshooting.												
2	4	Disable the faster retrains that occur during proprietary V.32terbo modulation. Used for troubleshooting.												

**Table A-1. S-registers: Their Functions and Default Settings**

Register	Default	Function
		3      8      Enable V.23. Required for some British connections.
		6      64      Disable the remote-access busy message.
		7      128      Disable V.32terbo.
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.

**Table A–1. S-registers: Their Functions and Default Settings**

Register	Default	Function												
S51	0	Bit-mapped register. See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.												
		<table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Disable MNP/V.42 for V.22 (1200 bps)</td> </tr> <tr> <td>1</td> <td>2</td> <td>Disable MNP/V.42 for V.22bis (2400 bps)</td> </tr> <tr> <td>2</td> <td>4</td> <td>Disable MNP/V.42 for V.32/V.32bis/V.32terbo (9600/14400/19200/21600 bps).</td> </tr> </tbody> </table>	Bit	Value	Result	0	1	Disable MNP/V.42 for V.22 (1200 bps)	1	2	Disable MNP/V.42 for V.22bis (2400 bps)	2	4	Disable MNP/V.42 for V.32/V.32bis/V.32terbo (9600/14400/19200/21600 bps).
Bit	Value	Result												
0	1	Disable MNP/V.42 for V.22 (1200 bps)												
1	2	Disable MNP/V.42 for V.22bis (2400 bps)												
2	4	Disable MNP/V.42 for V.32/V.32bis/V.32terbo (9600/14400/19200/21600 bps).												
S53	126	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)												
		<table border="1"> <thead> <tr> <th>Bit</th> <th>Value</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Dial security enabled.</td> </tr> <tr> <td>1</td> <td>2</td> <td>Prompting enabled.</td> </tr> <tr> <td>2</td> <td>4</td> <td>Local-access password protection enabled.</td> </tr> </tbody> </table> <p><b>NOTE:</b> Enabling local-access password protection disables the &amp;Zn=s command (which stores up to 10 phone numbers) because stored phone numbers occupy the same space in <a href="#">NVRAM</a> as the dialback numbers for Dial Security accounts.</p>	Bit	Value	Result	0	1	Dial security enabled.	1	2	Prompting enabled.	2	4	Local-access password protection enabled.
Bit	Value	Result												
0	1	Dial security enabled.												
1	2	Prompting enabled.												
2	4	Local-access password protection enabled.												

**Table A–1. S-registers: Their Functions and Default Settings**

Register	Default	Function																											
S54	64	Symbol rate bit-mapped register used primarily by U.S. Robotics Technical Support for debugging purposes.																											
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Bit	Value	Result																											
0	1	Disable 2400 symbol rate.																											
1	2	Disable 2743 symbol rate.																											
2	4	Disable 2800 symbol rate.																											
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4	16	Disable 3200 symbol rate.																											
5	32	Disable 3429 symbol rate.																											
6	64	Disable Call Indicate (CI).																											
7	128	Disable V.8.																											
S55	0	Trellis code bit-mapped register used primarily by U.S. Robotics Technical Support for debugging purposes.																											
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Bit	Value	Result																											
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1	2	Disable 16S-4D mapping.																											
2	4	Disable 32S-2D mapping.																											

**Table A-1. S-registers: Their Functions and Default Settings**

Register	Default	Function		
S56	0	3      8      Disable 64S-4D mapping.		
		Bit-mapped register primarily used by U.S. Robotics Technical Support for debugging purposes.		
		<b>Bit</b>	<b>Value</b>	<b>Result</b>
		0	1	Disable non-linear coding.
		1	2	Disable TX level deviation.
		2	4	Disable preemphasis.
		3	8	Disable precoding.
		4	16	Disable shaping.
S67	0	6      64      Disable V.34.		
		7      128      Disable V.FC.		
		Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)		
		<b>Bit</b>	<b>Value</b>	<b>Result</b>
		0	1	Enable <a href="#">V.110</a> fallback while originating or answering, when the I-modem is set to autodetect (*V2=0).
1	2	Use a fixed network rate.		

**Table A-1. [S-registers](#): Their Functions and Default Settings**

Register	Default	Function
		2      4      Fix the network rate at 64 Kbps (otherwise 56 Kbps).
		3      8 <a href="#">AT&amp;T 5ESS</a> with 1 DN only: Route incoming analog calls to the Data port (otherwise to the Analog Device port).
		4      16     Enable a 45-65 second link delay. For compliance with Bellcore NWT 1953.
		5      32     Map B1 LED = <a href="#">B-channel</a> 1 and B2 LED to B-channel 2 (otherwise map B1 LED to Analog Device port and B2 LED to Data port).
		6      64     Disable all blinking patterns for B-channel LEDs.
S68	0	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)
		<b>Bit      Value      Result</b>
		0      1      Do not allow analog calls over digital data connections.
		1      2      Disable voice fallback in Universal Connect.
		2      4      Disable TurboPPP.
		3      8      Disable multilink PPP.

**Table A-1. [S-registers](#): Their Functions and Default Settings**

Register	Default	Function						
S69	0	Bit-mapped register. (See <a href="#">Chapter 1, Using the AT Command Set</a> , for instructions about how to set bit-mapped registers.)						
		<table border="1"><thead><tr><th>Bit</th><th>Value</th><th>Result</th></tr></thead><tbody><tr><td>0</td><td>1</td><td>Disable Plug and Play signaling. (For external I-modems only.)</td></tr></tbody></table>	Bit	Value	Result	0	1	Disable Plug and Play signaling. (For external I-modems only.)
Bit	Value	Result						
0	1	Disable Plug and Play signaling. (For external I-modems only.)						

a. See [Appendix B, ASCII Chart](#).

## Appendix B ASCII Chart

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

## U.S. Robotics I-modem Command Reference

Dec	Hex	Char									
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	^	126	7E	~
31	1F	US	63	3F	?	95	5F	_	127	7F	DEL

## Appendix C Fax Information for Programmers

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### Fax Service Class 1 Commands

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+FCLASS?	What mode is in use—Data or Fax?
+FCLASS=n (0,1,2,0)	Class identification and control.
+FCLASS=?	What Fax class is in use?
+FTS=n (0,255)	Stop transmission and pause, 10 ms.
+FRS=n (0,255)	Wait for silence, 10 ms.
+FTM=n (3,24,48,72,73,74,96,121,122,145,146)	Transmit data with carrier.
+FRM=n (3,24,48,72,73,74,96,121,122,145,146)	Receive data with carrier.
+FTH=n (3,24,48,72,73,74,96,121,122,145,146)	Transmit HDLC data with carrier.
+FRH=n (3,24,48,72,73,74,96,121,122,145,146)	Receive HDLC data with carrier.

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### FAX Service Class 2.0 Commands

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In addition to the standard Class 2.0 fax commands, U.S. Robotics implements the following optional Class 2.0 fax commands :

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+FNS=0,1	Pass-through, nonstandard negotiation byte string.
+FCR=0,1	Capability to receive.
+FAA=0,1	Adaptive Answer mode.
+FCT=0-255 sec.	Phase C Timeout
+FHS=0-255	Hangup Status Code, read only.
+FMS=0-3	Minimum Phase C Speed.
+FBS?=500,100	Buffer size, read only.

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### Fax Mode Flow Control Setting

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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](#).

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### FCC Notice

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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

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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.

**Note** Cross-references in the following definitions are [blue underlined](#).

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### Symbols and Numerics

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#### **1B+D**

In ISDN [BRI](#), a common configuration of 1 [B-channel](#) and 1 [D-channel](#).

#### **16550 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](#).

### A

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#### **Adaptive Speed Leveling (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.

#### **analog device B-channel**

The I-modem distinguishes between an analog device [B-channel](#) and a data B-channel. The analog device B-channel applies only to I-modems that have an analog device jack. Any device you plug in to the analog device jack, like a telephone, fax machine, or modem, needs a B-channel that supports circuit-switched voice (CSV).

#### **analog 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 re-verse 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 Leveling](#).

### **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 signaling.

### **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 signaled as to when the data bits of a character begin and when they end. The addition of start and stop 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](#).

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## **B**

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### **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 accu-rate, 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 recognizes 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.

### C

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#### **call-control signaling**

Messages carried over the telephone network that route, set up, and tear down calls. In ISDN, call control signaling 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.

#### **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 organization that defined standards for tele-graphic and telephone equipment. It has been incorporated into its parent organization, International Telecommunication Union (ITU). Telecommunication standards are now covered under

Telecommunications Standards Sector (TSS). ITU-T replaces CCITT. For example, the Bell 212A standard for 1200 bps communication in North America was referred to as CCITT V.22. It is now referred to as ITU-T V.22.

### **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 USR 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](#).

### **Command mode**

When the I-modem is in Command mode, you can control it using AT commands.

### **COM port**

See [serial port](#), [EIA-232](#).

### **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 signaling [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 acknowledgment. In the ARQ [protocol](#) implemented in U.S. Robotics

high-speed modems, the receiving modem accepts no more data until a defective block is received correctly.

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### D

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#### **data B-channel**

The I-modem distinguishes between the data [B-channel](#) and the analog 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 set**

Another way of saying “modem.”

### **data terminal equipment (DTE)**

The device that generates or is the final destination of data.

### **DCE**

See [data communication equipment](#).

### **D-channel**

In ISDN [BRI](#), a 16-Kbps channel for call control signaling or for passing packet-mode (for example, X.25) data. In ISDN [PRI](#), a 64-Kbps channel for call-control signaling 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. See [SPID](#).

### **DMS-100**

See [Northern Telecom DMS-100](#).

### **DN**

See [directory number](#).

### **DTE**

See [data terminal equipment](#).

### **duplex**

Indicates a communications channel capable of carrying signals in both directions. See [half duplex](#), [full duplex](#).

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## **E**

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### **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.

### **equalization**

A compensation circuit designed into modems to counteract certain distortions introduced by the telephone channel. Two types are used: fixed (compromise) equalizers and those that adapt to channel conditions. U.S. Robotics high-speed modems use adaptive equalization.

### **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).

### **expansion bus**

A series of slots inside a computer that allow for adding feature cards.

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## **F**

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### **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.

### **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.

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## **H**

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### **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 Organization 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)

U.S. Robotics' proprietary signaling scheme, design, and error-control [protocol](#) for high-speed modems. HST incorporates trellis-coded modulation, for greater immunity from variable phone line conditions, and asym-metrical 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.

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## I

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### 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 organization that defines standards for tele-graphic and tele-phone equipment. For example, the Bell 212A standard for 1200 bps communication in North America is observed internationally as ITU-T V.22. For 2400 bps communication, most U.S. manufacturers observe *V.22bis*.

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## J

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### jumper

A switch composed of pins and a [shunt](#). The shunt's position on the pins determines the jumper setting.

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## K

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### Kbps

Kilobits per second, or one thousand bits per second.

### L

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#### **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.

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## M

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### **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](#).

### **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 [analog](#) 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.

### **multipoint**

A circuit that is made up of three or more connected stations. Contrast with [point-to-point](#).

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## **N**

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### **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.

### **National ISDN-2 (NI-2)**

Bellcore's standard definition of protocols and services, mostly for [PRI](#) lines. NI-2 allows devices and switches to connect regardless of their manufacturers.

### **NI-1**

See [National ISDN-1](#).

### **NI-2**

See [National ISDN-2](#).

### **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 organization 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 signaling.

### 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.

### NVRAM

See [nonvolatile random access memory](#).

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## O

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### Online command mode

By entering Online command mode, you can send the I-modem commands while you are online with another device.

### **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.

### **Online mode**

When the I-modem is in Online mode, it is connected over telephone lines with another device.

### **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](#).

### P

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#### **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.

### **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.”

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## **R**

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### **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.” The 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

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#### **SDLC**

See [Synchronous Data Link Control](#).

#### **S/T-interface**

The name given to the signaling 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](#).

### **Service Profile Identifier (SPID)**

A unique number, similar to an ordinary 10-digit telephone number but with up to four digits appended, that is assigned to each device that connects to the ISDN. A SPID identifies the services to which you have subscribed and is required to be set correctly at your device. SPIDs apply only in North America.

### **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 signaling bit attached to the beginning of each character before characters are transmitted during [asynchronous transmission](#).

### **stop bit**

The signaling bit attached to the end of each character before characters are transmitted during [asynchronous transmission](#).

### **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.

### **SPID**

See [Service Profile Identifier](#).

### **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.

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## T

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### **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 with-out the overhead of [protocol](#) information such as Start and Stop bits or frame headers and trailers. Compare with [characters per second](#).

### **transmission rate**

See [bit rate](#).

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## U

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### **UART**

See [Universal Asynchronous Receiver/Transmitter](#).

### **U-interface**

The name given to the signaling 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.

### **Universal Asynchronous Receiver/Transmitter (UART)**

A computer chip that controls the signaling 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).

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## **V**

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### **V.8**

ITU-T recommendation that defines procedures for starting and ending sessions of data transmission.

### **V.17**

An ITU-T standard for facsimile operations that specifies modulation at 14.4 Kbps, with fallback to 12 Kbps.

### **V.21 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.

### **V.21**

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.

### **V.22**

A ITU-T standard for modem communications at 1200 bps, compatible with the Bell 212A standard observed in the United States and Canada.

### **V.22bis**

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.

### **V.23**

An ITU-T standard for modem communications at 1200 bps with a 75 bps back channel. Used in the U.K.

### **V.25**

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.25bis**

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.27ter**

An ITU-T standard for facsimile operations that specifies modulation at 4800 bps, with fallback to 2400 bps.

### **V.29**

An ITU-T standard for facsimile operations that specifies modulation at 9600 bps, with fallback to 7200 bps.

### **V.32**

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.32bis**

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.32terbo**

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.

### **V.34**

An ITU-T standard that allows data rates as high as 33.6 Kbps.

### **V.35**

An ITU-T standard trunk interface between a device and a packet network, using signaling of at least 19200 bps.

### **V.42**

An ITU-T standard for modem communications that defines a two-stage process of detection for LAPM error control.

### **V.42bis**

An extension of ITU-T V.42 that defines a specific data compression scheme for use with V.42 error control.

### **V.110**

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.

### V.120

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.

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## W

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### word length

The number of bits in a data character without parity, start or stop bits.

### X

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#### **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.

### Y

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#### **YMODEM**

An error-correcting [File Transfer Protocol](#) that is related to, but faster than, [XMODEM](#).

### Z

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#### ZMODEM

An error-correcting [File Transfer Protocol](#) that is related to, but faster than, [XMODEM](#) or [YMODEM](#).