

Chapter 1

Using the AT Command Set

Before You Start

Everything modems are controlled using *AT commands*.

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

General Rules for Using AT Commands

- ◆ Type **AT** before each command and press **<Enter>**¹ after each command. Exceptions: **A/**, **A>** and **+++**, which require neither **AT** nor **<Enter>**.
- ◆ You can leave zeroes 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 56 characters between **AT** and **<Enter>**. Spaces don't add to the count, but hyphens and parentheses do.

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.

Here's an example:

AT&K3X2DT5551234 <Enter>

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

Basic AT Commands

- A/ Re-execute 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 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 NVRAM, however, you can overwrite an S -Register's stored value.

The default values listed in Table 4 -1 are those that users typically require.

Displaying S-Register Help

To display a list of S -Registers and their functions, issue the following command while in Terminal mode:

ATS\$ <Enter>

Also, the command ATi5 displays the values of the S -Registers as part of the listing of NVRAM's contents.

More command lists are available. See Chapter 14, *Displaying Help Screens*.

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 70 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 BitMapped S-Registers

Certain registers are "bit -mapped." A bit -mapped register uses *one* number to describe a *collection* of settings. Bit -mapping allows us to pack a lot of information in a small space.

When the modem displays the value of an S-Register, *you* see a decimal value between 0 and 255. The 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

And each bit can be assigned a value corresponding to its number:

Table 1-1. Values Assigned to Bit Numbers.

Bit Number	Value
7	$2^7 = 128$
6	$2^6 = 64$
5	$2^5 = 32$
4	$2^4 = 16$
3	$2^3 = 8$
2	$2^2 = 4$
1	$2^1 = 2$
0	$2^0 = 1$

Converting Bits to Decimal Values

Starting with a string of eight 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

$$\begin{array}{cccccccc}
 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\
 0 & + 64 & + 0 & + 0 & + 8 & + 4 & + 2 & + 1 & = 79
 \end{array}$$

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, 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 bits 0, 4, and 5 on for 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>

Chapter 2

Modes of Operation

Command and Online Modes

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

Online mode. When the 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 modem commands while you are on line with another device.

Entering Online Command Mode

+++ Enter *online command mode*. Once the modem is on line with another system, the only command it recognizes is an *escape code*, or pressing the plus key three times.

Depending on how bit 0 of S -Register 14 is set, the modem will either enter online 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 modem is set to revert to Command mode, type three pluses as described below to 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 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 the 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.

NOTE: The setting of DIP switch 4 overrides the E *n* setting.

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*. Default.

Data and Fax Modes

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

Data mode. In data mode, the modem is prepared to make calls to and receive calls from other modems.

Fax mode. In fax mode, the 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 V.Everything's default 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 your modem is in Data or Fax mode, type the following command.

AT+FCLASS? <Enter>

The 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 modem is reset using the ATZ command, by using your communications software to drop 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

This chapter explains how to get your modem to perform the fundamental communication operations. Caller ID and distinctive ring support are also explained here.

Dialing

Dn Dial the specified phone number and execute *dial options*.

Example: **ATDT9825092 <Enter>**

NOTE: With the exception of the following Dial options, V.Everythings ignore any commands issued after the D in the same command string.

Dial Options

T Tone dial.

P Pulse dial.

, (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 dialing.

W works only if the X3 (or higher) command has been issued (see Chapter 5, *Controlling Result Code Displays*). If the modem is set to X2 or lower, it interprets the W as a two-second

pause, unless it detects a second dial tone within two seconds.

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

To use the @ command, set the modem to X3, X4 or X7. If it is set to X2 or lower, the modem will return an ERROR message when it encounters the @ character. If it's set to X5 or X6, the 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 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 the modem non -Dial commands before dialing again.

- L? Display the last -dialed number .
- Sn Dial the number stored in nonvolatile random access memory 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, V.Everythings also accept * and #.

Canceling Dialing

Any key Stop dialing or stop repeating.

If you press any key while the 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>.

Repeating a Command

> Dial a number, wait 60 seconds for a connection, and then hang up. Wait two 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 the 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. The modem both dials the last-dialed number and repeats it just as the > command does. Also can be used to repeat any command.

Carrier Loss Redial

You can set the modem to redial the last-dialed number after it loses carrier (carrier is the signal maintained between two modems while they are on line). This feature is useful for dialed-line connections that operate unattended.

S-Register 69, bit 1 enables and disables carrier loss redial. The default value is S69.1=0, carrier loss redial disabled. To enable carrier loss redial, send **ATS69.1=1 <Enter>**

S-Register 44 sets the number of seconds that the modem waits between losing the connection and redialing. It also defines the interval between dialing attempts in the event that the first attempt is not successful. When carrier loss redial is enabled, the modem will make 10 attempts to reconnect.

Example: **ATS44=20 <Enter>** sets a 20-second interval.

Answering Calls

Forcing the modem to Answer

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

ATA <Enter>

Auto Answer

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

NOTE: DIP switch 5 overrides the ATS0= n setting.

To enable Auto Answer, send the following command (this example instructs the 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 the 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 modem hangs up.

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

If a connection is made, the modem sends a CONNECT result code. When the call is disconnected by you or the remote user, the 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 the 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

Three commands apply to international calls above 1200 bps —
Bn, *&Gn*, and *&Pn*.

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 the modem is not required to answer V.34 -type calls.

&Gn This setting applies only to 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 U.S. and in 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.

&P Sets the ratio of the off-hook/on-hook (make/break) interval, for pulse dialing. The default setting is for North America. Change the setting in the United Kingdom and some commonwealth countries.

&P0 North American make/break ratio (39/61).

&P1 United Kingdom make/break ratio (33/67).

Call Detection

The modem supports Call Detection , which allows it recognize whether an incoming call is data or fax when the modem is controlled by fax-capable communications software. Because Call Detection automates recognition of different calls from multiple users, it is especially useful for Bulletin Board Systems.

Call Detection is an optional Fax 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 unit and download the file CALLSEL.TXT.

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

Caller ID Functions

Caller ID is a service provided by local telephone companies. When you subscribe to caller ID, your phone company begins providing you real-time information about incoming calls.

The caller ID signal includes the date and time of the call, the phone number of the calling device, and, optionally, the name of the calling party. The signal is sent between the first and second rings and must be decoded and displayed by a device connected to your phone line. The modem has the ability to decode and display the caller ID information.

Service Types

You can subscribe to Basic or Extended caller ID service. *Basic* service offers you the date and time of the call and the calling party's telephone number. *Extended* service provides the billing name associated with the calling party's telephone number in addition to the Basic service information.

The information the modem actually receives depends on the service type to which you've subscribed, the information that the calling party's telephone company provides, and whether the equipment in between supports caller ID. At minimum, you will always receive the date and time that a call arrived.

If a call arrives without a caller ID signal, the modem will send OUT OF AREA in place of the phone number and name. If the caller ID information has been blocked by the user at the other end, the modem will send PRIVATE in place of the phone number and name.

Applications of Caller ID Technology

You can use caller ID to screen calls, keep a record of calls, or prevent unauthorized access to your network. Third-party database and telephony applications such as security, call logging, and black-listing applications exploit the caller ID information provided by the V.Everything.

How the modem Handles Caller ID

When the modem receives the caller ID signal, it stores the information in memory. You can access the information at any time by sending **ATI15 <Enter>**.

```
ati15
USRobotics V.Everything Modem CID Status...

80 1E 01 08 31 30 31 35 32 30 33 38 02 0A 37 30
38 35 35 35 30 30 30 31 07 0C 55 2E 53 2E 52 4F
42 4F 54 49 43 53 22

DATE = 1015
TIME = 2038
NUMBER = 8475550001
NAME = U.S.ROBOTICS

OK
```

Using the #CID command (described below), you can have the modem send the information to your computer between the first and second RING messages. The caller ID information is displayed only once.

```
RING
DATE = 1015
TIME = 2038
NUMBER = 8475550001
NAME = U.S.ROBOTICS
RING
```

The information remains in memory until you either reset the modem or it receives another valid caller ID signal.

Auto-Answer and Caller ID

S0=1 tells the modem to answer on the first ring. Because caller ID information is transmitted between the first and second rings, if you have set S0=1, the modem will not receive the caller ID signal.

NOTE: To be sure the modem receives the caller ID signal when auto-answer is enabled, set S0=2 or higher or make sure your communications software is set to answer on 2 or more rings.

Presentation Formats

The modem sends the caller ID information to your computer either *formatted* or *unformatted*. Formatted presentation is a translation of the caller ID signal into ASCII text. Unformatted presentation is a hexadecimal representation of the caller ID signal.

```
RING
DATE = 1015
TIME = 2038
NUMBER = 8475550001
NAME = U.S.ROBOTICS
RING
```

Figure 3-1. Formatted Caller ID Information.

```

RING
801E01083130313532303338020A37303835353530303031070C552E532E524F424F5449435322
RING
RING

```

Figure 3-2. Unformatted Caller ID Information.

Commands

#CID=*n*

<i>n</i>	Caller ID Action
0	Disable Caller ID detection and reporting
1	Enable Caller ID with formatted output
2	Enable Caller ID with unformatted output
3	Enable Caller ID with formatted output and name suppressed
4	Enable Caller ID but do not transmit the information to your computer—retain it in the modem's memory
#CID?	Display the current caller ID setting.
#CID=?	Display the Caller ID actions that are available

Example: **AT#CID=1 <Enter>**

The default setting is 0, caller ID detection and reporting disabled.

#\$

Displays a help screen for the octothorpe (#) command.

Example: **AT#\$ <Enter>**

I15

Displays the latest caller ID information, in both unformatted and formatted forms.

Example: **ATI15 <Enter>**

References

For more information about Calling Number Delivery (CND), refer to Bellcore documents TR-TSY-000030 and TR-TSY-000031. To obtain Bellcore documents, contact:

Bellcore Customer Service
8 Corporate Place
Room 3A184
Piscataway, NJ 08854-4196
(800)521-2673

Distinctive Ring Support

Distinctive ring is a service provided by local telephone companies that permits the assignment of multiple phone numbers to one line. Each phone number is associated with a different ring pattern, and devices that recognize distinctive ring, like the V.Everything, can be set to answer only on certain incoming ring patterns.

For example, a fax machine, answering machine, telephone, and modem could all share the same line. Each device would have its own phone number and respond only to calls intended for that number.

There are four ring patterns in common use:

Ring	Description
A	1.2 to 2.0 seconds on, 4.0 seconds off.
B	0.8 second on, 0.4 second off, 0.8 second on, 4.0 seconds off.
C	0.4 second on, 0.2 second off, 0.4 second on, 0.2 second off, 0.8 second on, 4.0 seconds off.
D	0.3 second on, 0.2 second off, 1.0 second on, 0.2 second off, 0.3 second on, 4.0 seconds off.

These are graphical depictions of each ring pattern.



Command

S70

bit	value	Distinctive Ring Recognition
0	1	Enable recognition of Ring A
1	2	Enable recognition of Ring B
2	4	Enable recognition of Ring C
3	8	Enable recognition of Ring D

Example: **ATS70.0=1.3=1 <Enter>**

This example enables the recognition of ring types A and D only. When a call comes in with a ring type A or D, the Courier will send the result code RING A or RING D, respectively. The modem will ignore other ring types. Another way to send the same command is **ATS70=9 <Enter>**. See Chapter 1, *Using the AT Command Set*, for details about setting S-Registers.

If S70 is set to 0 (the default) the modem detects ring types A and B, sending the result code RING for either ring type. This

function is identical to that of other U.S. Robotics modems that do not support distinctive ring.

If only one ring type is enabled, the modem will recognize only the enabled ring type and ignore all others. It will send the result code RING only when it detects the ring type that's enabled.

If more than one ring type is enabled, the modem will recognize only the enabled ring types and ignore the others. When a call arrives, the modem will send its ring type in the result code, for example, RING C.

Result Codes

Verbal	Numeric
RING A	170
RING B	171
RING C	172
RING D	173

Chapter 4

Working with Memory

Everything modems contain three types of memory that you can interact with: random access memory (RAM), non-volatile random access memory (NVRAM), and Flash memory.

RAM

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

NVRAM

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

Flash

Flash memory holds the modem's operating software. You can upgrade the software held in flash memory by performing a software download. See Chapter 17, *Upgrading the Software*.

What is Stored Where?

Current Settings

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

Saved Settings

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

Permanent Settings

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

Working with RAM

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

ATX6 <Enter>

Working with NVRAM

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

ATX6&W <Enter>

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

Saving a Phone Number to NVRAM

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

IMPORTANT: Do not include modem commands in &Z n=s.

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

AT&Z2=555-6789 <Enter>

To dial the phone number you saved, type:

ATDS2 <Enter>

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

AT&M0DS2 <Enter>

NOTE: The &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.

Saving a Command String to NVRAM

&ZC=*s* Store command string *s* in NVRAM. The command string can be up to 30 characters long; spaces do not count.

&ZC? Display the stored command string.

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?)

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

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

Last-Dialed Number (DL?)

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

```
ATDL? <Enter>
```

Table 4-1. Default (NVRAM) S-Register Settings.

S-Registers	Default Setting	
S0	Auto Answer	0
S1	Counts & stores rings from incoming call	0
S2	Escape code character	43
S3	Carriage Return character	13
S4	Line Feed character	10
S5	Backspace character	8
S6	Wait time for dial tone, in seconds	
S7	Wait time for carrier, in seconds	60
S8	Dial pause, sec.	2
S9	Carrier Detect time, 100 ms.	6
S10	Carrier loss waittime, 100 ms.	7
S11	Tone duration, spacing, ms.	70
S12	Escape code guard time, 500 ms.	50
S13	Bit-mapped functions*	0
S14	Bit-mapped functions*	1
S15	Bit-mapped functions*	0
S16	Test modes	0
S18	&T test timeout	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
S32	Voice/data switch (external models only)	9
S33	Bit-mapped functions*	0
S34	Bit-mapped functions*	0
S38	Disconnect wait time, sec.	0
S41	Allowable remote login attempts	0
S42	Remote Access ASCII character	126
S43	Remote guard time, 500 ms.	200
S44	Leased line delay timer	15
S51	Bit-mapped functions*	0
S53	Bit-mapped functions*	0
S54	Bit-mapped functions*	64
S55	Bit-mapped functions*	0
S56	Bit-mapped functions*	0
S69	Bit-mapped functions*	0
S70	Bit-mapped functions*	0

*Bit-mapped registers have up to eight functions.

Working with Flash Memory

The 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 `&F n` command.

`&F n` 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 4-2, Table 4-3, and Table 4-4. The settings that change from template to template appear in **bold** type.

If DIP switch 1 is OFF when the modem is reset or powered on, or if you load template `&F0`, the `&F0` settings take effect. See Table 4-4.

See Chapter 10, *Flow Control*, for more information about hardware and software flow control.

Table 4-2. &F1 Hardware Flow Control Template.

NVRAM Options	Setting	Description
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
On-line 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	X7	Extended. Includes all codes except VOICE
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Carrier Detect	&C1	Normal operations
Data Terminal Ready	&D2	Normal operations
Guard tone	&G0	U.S./Canada
Transmit data hardware flow control	&H1	Hardware flow control
Rec'd data software flow control	&I0	Disabled
Analog data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control/sync	&M4	Normal/error control
Link rate select	&N0	Variable
Pulse dialing type	&P0	U.S./Canada
Rec'd data hardware flow control	&R2	Enabled
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Externals only: synchronous transmit clock source	&X0	Courier
Break handling	&Y1	Clear buffer, send immediately
Stored telephone number	&Z0-9=0	Blank
Externals only: synch clock speed	%N6	9600 bps
Caller ID	#CID=0	Caller ID disabled
Word length*	8	
Parity*	0	None
DTE rate* (Kbps)	19.2	—

* Detected by the modem from the AT prefix of the &W command 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 4-3. &F2 Software Flow Control Template.

NVRAM Options	Setting	Description
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
On-line local echo	F1	Disabled
Speaker control	M1	ON during dial through connect
Result codes	Q0	Enabled
Verbal or numeric result codes	V1	Verbal result codes
Result code subset	X7	Extended. Includes all codes except VOICE
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Carrier Detect	&C1	Normal operations
Data Terminal Ready	&D2	Normal operations
Guard tone	&G0	U.S./Canada
Transmit data hardware flow control	&H2	Software flow control
Rec'd data software flow control	&I2	Enabled
Analog data compression	&K1	Enabled
Normal or leased lines	&L0	Normal lines
Error control/sync	&M4	Normal/error control
Link rate select	&N0	Variable
Pulse dialing type	&P0	U.S./Canada
Rec'd data hardware flow control	&R2	Enabled
Data Set Ready	&S0	Always on
Remote Digital Loopback (RDL)	&T5	Deny RDL
Externals only: synchronous transmit clock source	&X0	Courier
Break handling	&Y1	Clear buffer, send immediately
Stored telephone number	&Z0-9=0	Blank
Externals only: V.25bis clock speed	%N6	9600 bps
Caller ID	#CID=0	Caller ID disabled
Word length*	8	
Parity*	0	None
DTE rate* (Kbps)	19.2	—

* Detected by the modem from the AT prefix of the &W command 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. &F0 No Flow Control Template.

NVRAM Options	Setting	Description
Handshake option	B0	ITU-T answer sequence
Transmitter	C1	Enabled
Command mode echo	E1	Enabled
On-line 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	X1	Basic
Protocol response codes	&A3	Full protocol codes
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Carrier Detect	&C1	Normal operations
Data Terminal Ready	&D2	Normal operations
Guard tone	&G0	U.S./Canada
Transmit data hardware flow control	&H0	Disabled
Rec'd data software flow control	&I0	Disabled
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	&R1	Disabled
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: V.25bis clock speed	%N6	9600 bps
Word length*	7	
Parity*	1	Even
DTE rate* (Kbps)	9600	—

* Detected by the modem from the AT prefix of the &W command 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 three templates in nonvolatile memory and have it serve as the reset default, enter `AT&F n&W`. For example: `AT&F1&W <Enter>`

NOTE: DIP switch settings override AT commands at power on. Make sure DIP Switch 10 is ON, or the `&F0` template will be loaded!

Default Settings

If DIP switch 10 is OFF at power -on, the `&F0` settings are loaded instead.

By default, the first time the 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>`

- Z Resets and loads the NVRAM settings when DIP switch 10 is ON (factory setting). If DIP switch 10 is OFF, the modem resets and loads the &F0 configuration template (no flow control). Use ATZ to make changes to the DIP switch settings take effect immediately.

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 if they are, in what format they are displayed.

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

Command	Effect
<i>Qn</i>	Enables or suppresses the display of result codes.
<i>Vn</i>	Displays result codes in verbal or numeric form.
<i>Xn</i>	Uses a specified set of result codes.
<i>&An</i>	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.)

NOTE: DIP switch 3 overrides the *Qn* setting at power-on or reset.

- Vn Display result codes in verbal or numeric form.
- $V0$ Display result codes in numeric form.
- $V1$ Display result codes in verbal form.

NOTE: DIP switch 2 overrides the Vn setting at power-on or reset.

$S14.1=n$ Control when result codes are displayed.

$S14.1=0$ Display result codes when originating a call, answering a call, and when retraining.

$S14.1=1$ Display result codes only when originating a call.

NOTE: DIP switch 7 overrides the $S14.1=n$ setting at power-on or reset.

Xn Display one of the following sets of result codes.
 Default = X7.

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 (Incoming)	•	•	•	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•	•	•	•
4/ERROR	•	•	•	•	•	•	•	•
5/CONNECT 1200		•	•	•	•	•	•	•
6/NO DIAL TONE			•		•		•	•
7/BUSY				•	•	•	•	•
8/NO ANSWER				•	•	•	•	•
10/CONNECT 2400		•	•	•	•	•	•	•
11/RINGING (Outgoing)						•	•	•
12/VOICE						•	•	
13/CONNECT 9600		•	•	•	•	•	•	•
18/CONNECT 4800		•	•	•	•	•	•	•
20/CONNECT 7200		•	•	•	•	•	•	•
21/CONNECT 12000		•	•	•	•	•	•	•
25/CONNECT 14400		•	•	•	•	•	•	•
43/CONNECT 16800		•	•	•	•	•	•	•
85/CONNECT 19200		•	•	•	•	•	•	•
91/CONNECT 21600		•	•	•	•	•	•	•
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•
151/CONNECT 31200		•	•	•	•	•	•	•
155/CONNECT 33600		•	•	•	•	•	•	•
170/RING A		•	•	•	•	•	•	•
171/RING B		•	•	•	•	•	•	•
172/RING C		•	•	•	•	•	•	•
173/RING D		•	•	•	•	•	•	•
Functions								
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), or 33600 (155) bps.
6/NO DIAL TONE	Dial tone not detected during the default 2 seconds, set in Register S6.
7/BUSY	Busy signal detect; modem hangs up.
8/NO ANSWER	After waiting 5 seconds for an answer, modem hangs up; returned instead of NO CARRIER when the @ option is used.
11/RING	The modem has dialed; remote phone line is ringing.
12/VOICE	Voice answer at remote site; modem hangs up.
170/RING A	Incoming distinctive ring detected. <i>See Distinctive Ring Support</i> in Chapter 3. Same meaning for RING B (171), RING C (172), and RING D (173).
Wait for Another Dial Tone (W)	The modem continues dialing as soon as it detects another dial tone. See the dial options earlier in this chapter. Requires X3 or higher.
Wait for an Answer(@)	The modem continues dialing when it detects 5 seconds of silence on the line. See the dial options earlier in this chapter. Requires X3 or higher.

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.

If the modem is set to X0 and the connection is at any rate from 1200 bps to 33.6 Kbps, Result code 14 is displayed. The other result codes indicate the connection rate and require a setting of X1 (or higher).

ARQ

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

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

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

HST

28/CONNECT 4800/HST
23/CONNECT 9600/HST
30/CONNECT 7200/HST
31/CONNECT 12000/HST
35/CONNECT 14400/HST
53/CONNECT 16800/HST
86/CONNECT 19200/HST
92/CONNECT 21600/HST

V32

38/CONNECT 4800/V32
33/CONNECT 9600/V32
40/CONNECT 7200/V32
41/CONNECT 12000/V32
45/CONNECT 14400/V32
83/CONNECT 16800/V32
87/CONNECT 19200/V32
93/CONNECT 21600/V32

ARQ/HST

29/CONNECT 4800/ARQ/HST
27/CONNECT 9600/ARQ/HST
34/CONNECT 7200/ARQ/HST
32/CONNECT 12000/ARQ/HST
36/CONNECT 14400/ARQ/HST
57/CONNECT 16800/ARQ/HST
89/CONNECT 19200/ARQ/HST
95/CONNECT 21600/ARQ/HST

ARQ/V32

39/CONNECT 4800/ARQ/V32
37/CONNECT 9600/ARQ/V32
44/CONNECT 7200/ARQ/V32
42/CONNECT 12000/ARQ/V32
46/CONNECT 14400/ARQ/V32
84/CONNECT 16800/ARQ/V32
90/CONNECT 19200/ARQ/V32
96/CONNECT 21600/ARQ/V32

VFC

119/CONNECT 2400/VFC
 123/CONNECT 4800/VFC
 127/CONNECT 7200/VFC
 131/CONNECT 9600/VFC
 135/CONNECT 12000/VFC
 139/CONNECT 14400/VFC
 143/CONNECT 16800/VFC
 147/CONNECT 19200/VFC
 97/CONNECT 21600/VFC
 101/CONNECT 24000/VFC
 105/CONNECT 26400/VFC
 109/CONNECT 28800/VFC

V34

120/CONNECT 2400/V34
 124/CONNECT 4800/V34
 128/CONNECT 7200/V34
 132/CONNECT 9600/V34
 136/CONNECT 12000/V34
 140/CONNECT 14400/V34
 144/CONNECT 16800/V34
 148/CONNECT 19200/V34
 111/CONNECT 21600/V34
 113/CONNECT 24000/V34
 115/CONNECT 26400/V34
 117/CONNECT 28800/V34
 153/CONNECT 31200/V34
 157/CONNECT 33600/V34

ARQ/VFC

121/CONNECT 2400/ARQ/VFC
 125/CONNECT 4800/ARQ/VFC
 129/CONNECT 7200/ARQ/VFC
 133/CONNECT 9600/ARQ/VFC
 137/CONNECT 12000/ARQ/VFC
 141/CONNECT 14400/ARQ/VFC
 145/CONNECT 16800/ARQ/VFC
 149/CONNECT 19200/ARQ/VFC
 98/CONNECT 21600/ARQ/VFC
 102/CONNECT 24000/ARQ/VFC
 106/CONNECT 26400/ARQ/VFC
 110/CONNECT 28800/ARQ/VFC

ARQ/V34

122/CONNECT 2400/ARQ/V34
 126/CONNECT 4800/ARQ/V34
 130/CONNECT 7200/ARQ/V34
 134/CONNECT 9600/ARQ/V34
 138/CONNECT 12000/ARQ/V34
 142/CONNECT 14400/ARQ/V34
 146/CONNECT 16800/ARQ/V34
 150/CONNECT 19200/ARQ/V34
 112/CONNECT 21600/ARQ/V34
 114/CONNECT 24000/ARQ/V34
 116/CONNECT 26400/ARQ/V34
 118/CONNECT 28800/ARQ/V34
 154/CONNECT 31200/ARQ/V34
 158/CONNECT 33600/ARQ/V34

&A3 Default. Display error control (LAPM, HST, MNP, SYNC, 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.42 *bis* 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 -232¹ 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 mouse.

Modem Pool modems have *virtual* serial ports. Even though ports are not visible, the commands described in this chapter affect their internal serial communications.

Controlling EIA232 Signaling

Data Terminal Ready

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

NOTE: DIP switch 1 overrides the `&Dn` setting at power-on or reset.

- `&Dn` Tell the 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.

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

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

&D2 Respond normally to the DTR signal. The 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*.

Carrier Detect

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

NOTE: DIP switch 6 overrides the `& Cn` setting at power-on or reset.

`&Cn` Control how the modem sends the CD signal.

`&C0` CD always ON.

`&C1` Send CD normally: the modem sends a CD signal when it connects with another analog device and drops the CD signal when it disconnects.

Data Set Ready

Data Set is another name for a modem. Under normal conditions, a 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 modem to control DSR (`&S1`).

- &Sn** Control how the 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 modem detects the remote analog device's answer tone. When answering a call, send DSR after the 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 (CS) signal.
 - &S3** Same as &S2, but do not send the CS signal.
 - &S4** Send a DSR signal to your computer at the same time that the modem sends the CD signal.
 - &S5** Send DSR normally (with CS), after sending CD.
- To change the DSR pulse time (in 20 -second increments), set S -Register 24 . See Appendix A, *Alphabetic Command Summary*.

Chapter 7

Controlling Data Rates

You can set the V. Everything 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 modem. Connection rates pertain to data transferred between the modem and the device at the other end of a connection.

Serial Port Rates

The modem can be set to a *fixed* or *variable* serial port rate. Set a fixed rate to get the highest possible throughput and the best performance. Set a variable rate to allow the 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 *autobaud* (variable rate).

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

&B0 Variable rates. Allows the modem to change its serial port rate to match that of the connection rate.

&B1 Fixed rate. Default. The 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: If you fix a serial port rate, it *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 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, 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.

Modems store the rate of the command in NVRAM along with the settings. Each time it makes an ARQ connection, the modem checks NVRAM for the specified serial port rate.

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

Connection Rates

The modem can be set to a *fixed* or *variable* connection rate. Set a variable rate to have the 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.

&Nn Connection rate: variable or fixed.

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

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

&N1	300 bps	&N9	16.8 Kbps
&N2	1200 bps	&N10	19.2 Kbps
&N3	2400 bps	&N11	21.6 Kbps
&N4	4800 bps	&N12	24 Kbps
&N5	7200 bps	&N13	26.4 Kbps
&N6	9600 bps	&N14	28.8 Kbps
&N7	12 Kbps	&N15	31.2 Kbps
&N8	14.4 Kbps	&N16	33.6 Kbps

Chapter 8

Remote Access

You can set up the V.Everything so that 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 modem to check or correct its configuration.

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

Please review these terms before you continue:

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

Setting Up Remote Access

At the Host 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 login attempts available to the remote user. A setting of zero allows no login attempts, disabling remote access.

ATS41=1&W <Enter>

NOTE: This method will not work if the modem is attached to certain synchronous devices. See Chapter 12, *Dedicated/Leased Line and Synchronous Applications*

3 Set one or two remote-access passwords.

You can set two passwords to allow different levels of access to the modem:

View-Only Allows guest users only to *view* the modem's configuration.

View-and-Change Allows guest users to *view and change* the 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 RemoteAccess Password

To display a remote -access password, type:

AT%P0? <Enter>

or

AT%P1? <Enter>

Erasing a RemoteAccess 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 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 four (4) seconds.
 - b Type four tildes: ~~~~
 - c Pause four (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:

**USRoboticsV.Everything Remote Access Session
Serial Number 000000000123456**

Password (Ctrl-C to cancel)?

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

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

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

Remote Access granted

Remote->

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

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

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

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

Quitting a Remote Access Session

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

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

NOTE: Before you disconnect, send **ATI5 <Enter>** to the remote modem and check its S41 setting. Make sure S41 is set for a value of 1 or greater. If S41 is set to 0, once you disconnect, you won't be able to access the remote modem again. To prevent this, send **ATS41=1&W <Enter>** (or greater) before you disconnect.

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 AT commands.

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 AT commands, except those commands that cannot be used while online (for example, ATD or ATA). You can also use <i>remote configuration</i> commands.

NOTE: Be careful not to send ATZ or you will lose the connection!

Remote Configuration Commands

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

%B <i>n</i>	Change the host modem's serial port rate.
%F <i>n</i>	Change data format (parity and data bits).
%C <i>n</i>	Control whether or when to apply changes to the configuration.
<hr/>	
%B <i>n</i>	Change the host modem's serial port rate.
%B0	110 bps
%B1	300 bps
%B2	600 bps
%B3	1200 bps
%B4	2400 bps
%B5	4800 bps
%B6	9600 bps
%B7	19200 bps
%B8	38400 bps
%B9	57600 bps
%B10	115200 bps
%F <i>n</i>	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 or when to apply changes to the configuration.

%C0 Defer changes. Default. Any changes that 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 that 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. 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 that 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.

NOTE: Before you disconnect, send **ATI5 <Enter>** to the remote modem and check its S41 setting. Make sure S41 is set for a value of 1 or greater. If S41 is set to 0, once you disconnect, you won't be able to access the remote modem again. To prevent this, send **ATS41=1&W <Enter>** (or greater) before you disconnect.

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:

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

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

There are two forms of Dial Security, each of which 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. Repeat these steps for each channel that needs dial security.

- 1) Set up an account for yourself.
- 2) Identify your account as the Administrative Account.

- 3) Set up guest users' accounts.
- 4) Enable local (host) security.
- 5) Choose a Dial Security method.
- 6) Enable Dial Security.
- 7) Activate the Dial Security settings.

1 Set up an account for yourself.

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

Use the %A *n* command to set up user accounts. Table 9-1 shows the five fields to concern yourself with.

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

Table 9-1. Adding Accounts: How to Format theA%n command.

	Account Number	Password	Account Enabled ?	Dialback Enabled?	Allow New Number?	Dialback Number
Options	0–9	8 characters maximum, case sensitive	YES/NO	YES/NO	YES/NO	Up to 37 ASCII characters, 32-127 (0–9)

Dialback at a Specified Number

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

AT%A0=nanook,y,y,n,1847555555 <Enter>

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

NOTE: Expect a pause of approximately 1.5 minutes before the modem dials back. You cannot alter the duration of the pause.

Dialback at a New Number

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

```
AT%A0=nanook,y,y,y,
```

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,,
```

NOTE: Count your commas! There should always be four (4) 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 modem.

3 Set up guest users' accounts.

Use the %A *n* command to set up guest user accounts in the same way that you did to set up your administrative account. You can set up nine guest accounts.

Table 9-2. Adding Accounts: How to Format theA%n command.

	Account Number	Password	Account Enabled ?	Dialback Enabled?	Allow New Number?	Dialback Number
Options	0-9	8 characters maximum, case sensitive	YES/NO	YES/NO	YES/NO	Up to 37 ASCII characters, 32-127 (0-9)

After you have enabled the guest accounts, make sure that your guest users know their passwords and the login 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 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 modems.

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 modems is under V.42 error control (that is, both modems must be set to &M4 or &M5).

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 modem.
- ◆ **If the guest includes a valid password** the host permits a secure connection.

Password Prompted

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 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 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 prompting capability in analog synchronous mode.

Prompting is more flexible than Autopass because:

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

6 Enable Dial Security.

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

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

AT S53.0=1&W <Enter>

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

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

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

NOTE: You must use the &W command to save the settings in NVRAM. If you don't, the next time you reset or power down the modem, Dial Security will be disabled.

```

at10
USRobotics Courier V.Everything

                                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=PWz  AUTOPASS PASSWORD:[NO PSW] %V=PWz

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

```

Figure 9-1. The AT10 Screen. Bold Characters Indicate the Commands Used To Control the Adjacent Fields.

7 Send ATZ to activate the Dial Security settings!

NOTE: Make sure that DIP switch 10 is OFF, which tells the modem to load the settings stored in NVRAM. If DIP switch 10 is ON, the settings in ROM (&F0) are loaded, disabling Dial Security. You can retrieve the Dial Security settings by setting DIP switch 10 OFF and then resetting the modem using ATZ or by powering off the 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. Modems will accept an invalid password entry, but will lock you out 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.

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

To edit or overwrite an individual account, or an individual account field, use the % A*n*= command described in *Setting Up Dial Security*, on page 9-1.

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 that you have enabled Dial Security by entering ATS53.0=1),

- ◆ they must know the password
- ◆ if you have enabled Dialback, they must set their device to auto-answer

1 If the host has security enabled, get a password from the host's administrator. Passwords are 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 V.Everything modems only:

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

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

AT%V=PW*n* <Enter>

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

ATI10 <Enter>

Your autopass password appears beside AUTOPASS PASSWORD.

- d** Once the autopass password is set, enable **your** modem's Dial Security by sending the following command:

ATS53.0=1&W <Enter>

- 3** If Dialback is enabled at the host modem's site, set your modem to answer the host 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 the following command:

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 Security accounts.

Chapter 10 Flow Control

Everything 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. Everything supports either, 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

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

Software Flow Control

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 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 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 also 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 receiving the Request to Send (RTS) signal, pause before sending CS. The delay is required by some synchronous mainframes and does not apply to asynchronous calls.

- &R1 Ignore the Request to Send (RTS) signal. &R1 is required if your computer, cable, or software does not support RTS.
- &R2 Default. Hardware flow control enabled. The modem sends data to your computer only on receipt of the RTS signal.
- &In Alter software flow control for received data.
- &I0 Default. Disable software (XON/XOFF) flow control. Recommended for non -ARQ (Normal mode) calls, but see &I5.
- While the modem is online, the only characters it recognizes are +++, the escape sequence.
- &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 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 modem's buffer may overflow. For more reliable control in non -ARQ mode, see &I5.

- &I3 Hewlett Packard—Host mode. Applies only to modems attached to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only.
- &I4 Hewlett Packard—Terminal mode. Applies only to 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, a 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, a 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 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 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. Default. Requires that your computer and software support Clear to Send (CTS) at the serial (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, modems go through a link negotiation process with the remote device. Another name for the negotiation process is “handshaking.”

Everything's default to V.34 modulation and try for the highest possible speed when they attempt to connect with another modem: 33.6 Kbps. 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 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).

V.34

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

When the modem answers a call, it sends out a series of answer tone signals until both devices negotiate the best connection rate.

Selective Reject

Selective Reject is an optional part of the ITU V.42 (LAPM) specification. This feature improves performance on noisy lines by reducing the amount of overhead incurred when the protocol must resend data due to errors.

When selective reject is active, only the frame that contained the error is resent, instead of the frame plus all of the following unacknowledged frames. You can disable selective reject by sending **ATS51.6=1 <Enter>**.

Attaining Speeds Above 28.8 Kbps

V.34 connections at 21.6, 24, and 26.4 Kbps are common. To get connections of 28.8, 31.2, and 33.6 Kbps, line quality must be *pristine* end-to-end. In addition, 31.2 and 33.6 Kbps connection rates are possible only when the device to which you are connecting also runs software that supports speeds above 28.8 Kbps.

Controlling the V.8 Call Indicate Tone

The V.8 protocol speeds call negotiation and specifies a call indicate tone. Providing the call indicate tone is optional. For compatibility, we ship the modem with the call indicate tone disabled.

To enable the call indicate tone, send **ATS54.6=0 <Enter>**.

If you enable the V.8 call indicate tone, expect to hear a sound like a fast ringing signal while the call is being connected.

Fast Class (V.FC) Handshaking

After trying V.34, the 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 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 modem listens to the device's answer tones to identify what standard rate the remote analog device is operating at, and adjusts to that rate.

When a modem answers a call, it sends out a series of answer tone signals until both devices negotiate the best connection rate.

HST

We recommend that V.Everythings 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, the modem set to B1 sends out a Bell answer tone, which is the prevalent standard in the U.S. and Canada for connections at 2400 bps and lower. At higher speeds, the 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, a modem sending out the Bell answer tone (B1) won't be recognized by V. protocol modems. The calling modem, instead, will wait until it detects a tone it recognizes. The V.22 *bis* tone used at 2400 bps.

If you want to have your 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.

USR V.32terbo to USR V.32terbo

On these connections, 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 normal with most devices.

ASL (described below in *Other V.Protocol Operations*) is used by U.S. Robotics devices operating in V.32 *terbo* and V.32 *bis* modes.

Lower-Speed "V." Protocols

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

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

ASL (used in V.32 *terbo* and V.32 *bis* modes) is a technique that allows the '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: Answering V.32 *terbo* devices shift their serial port rate up to 38.4 Kbps (for 21.6 Kbps connections) if the calling V.32 *terbo* device dials in at 21.6 Kbps. The answering V.32 *terbo* device then sends data to its computer at 38.4 Kbps. V.32 *bis* devices shift their serial port rate to 19.2 Kbps in order to make 14.4 Kbps connections. If your computer does not support these higher serial port rates, disable V.32 *terbo* and/or V.32 *bis*. See Register S34, in Appendix A, *Alphabetic Command Summary*.

NOTE: 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*.

Error Control

NOTE: High speed calls are highly vulnerable to errors unless the data is protected by error control. The operations described below take place even if the modem or the remote device is not set for error control. If your modem connects with a remote device at 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 calls (above 2400 bps) should always be under error control. The operations defined in an error control protocol include the following:

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

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

V.42 Error Control

This international standard includes a two-stage handshaking process:

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

MNP Error Control

This protocol 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 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 Online synchronous mode without V.25 *bis*.
- &M4 Normal/AR Q mode. Default. Operate in Normal mode (&M0) if an ARQ connection can't be made.

NOTE: When 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 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.
- &M7 Start V.25 *bis* synchronous mode, using the HDLC link protocol.

Data Compression

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

If a 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 modem is set to &A3 (see Chapter 5, *Controlling Result Code Displays*).

V.42bis versus MNP5 Data Compression

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

Modems use 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 modem deletes the oldest unused strings.

V.42 *bis* compression is more efficient than MNP5 compression in part because it dynamically deletes entries that are no longer used. In addition, it works better with files that are already compressed. These include .ZIP files downloaded from many Bulletin Boards and 8-bit binary files, which seem to 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 modem to **&K3**. This allows V.42 *bis* compression to work dynamically with the compressed data, but disables MNP5.

Data Compression Commands

- &K n** Enable/disable data compression.
- &K0** Disable data compression.
- &K1** Auto enable/disable. Default. 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 modem from disabling compression.
- &K3** Enable selective data compression. The 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 modem's advanced performance features. In many instances, experimentation and experience will indicate what works best for your applications.

Maximum throughput results when:

- ◆ The communications software allows fixing the serial port rate higher than the connection rate, by setting the software to 115200, 57600, or 38400 bps and setting the modem to &B1.

If the software automatically switches serial port rates to follow the connection rate, the 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 modems to be already compressed. Disable MNP5 compressing by sending the V.Everything &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 only and with hardware flow control, we recommend the most current version of ZMODEM.

For example, certain public domain file transfer protocols have the following effects:

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

still reduced by the protocol's error control overhead.

The protocols listed above further reduce throughput when an error control connection is established. The accuracy of the data is checked both by the file transfer protocol and the 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 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

Dedicated/Leased Line and Synchronous Applications

Dedicated and Leased-Line Applications

V. Everything does not need to be connected to the public switched telephone network. You can connect a standard phone cable between the V. Everything and another modem and make connections without even dialing.

Alternatively, you can connect the modem to a line that you lease from the telephone company. Such lines are often referred to as *dedicated* (to a pair of modems) or *private* lines.

Required Cabling

Use a standard 2-wire telephone cable. If you are leasing a line from the telephone company, request a 2-wire line. If the telephone company makes only 4-wire lines available, you'll need a 4-wire to 2-wire converter at each end of the connection. If the phone company does not install the converters, you have to supply them.

For optimal operations, we recommend that the physical length of the cable not exceed 5 miles.

Setting the Modem

You can use the modem in either smart or dumb mode (determined by the position of DIP switch 8).

If the modem is set to &L1 and the remote modem has a comparable setting, the modems automatically connect when they are powered on. They also reconnect, without any operator intervention, if a disturbance on the line is severe enough to break the connection.

- 1 Set your terminal or communications software to the rate at which you want the modems to communicate.

For example, use a terminal/software setting of 19.2 Kbps and, if both modems have the capability, they will connect at 14.4 Kbps.

- 2 Send the modem the following command:

AT&B1&S2&H1&L1&W <Enter>

&B1 fixes the modem's serial port rate at the same rate you selected when setting up your communications software. &S2 causes the modem to send a Clear to Send (CTS) signal *only* after it sends the Carrier Detect (CD) signal, that is, only after it connects with the remote modem. &H1 enables hardware (CTS) flow control. &L1 forces the modems off hook at power on and enables them to re-establish the connection should it be broken. &W writes the settings to nonvolatile memory (NVRAM) as power-on defaults.

NOTE: We recommend using the &S2 setting to delay CTS until after the connection is made, as a precaution.

If the modems are in the process of connecting or reconnecting, the modem interprets any keyboard data entry, including an accidental key stroke, as a *key-press abort*, and hangs up. Delaying CTS until after carrier detection prevents this from happening. However, you have to set the modem for hardware flow control, &H1.

If your software or machine does not support Clear to Send (CTS), don't include &S2 and &H1 in the command string as suggested above. But keep in mind that if the modems fail to connect or reconnect, the reason could be a keypress abort.

- 3** Set DIP switch 10 OFF. This tells the modem to load NVRAM settings at power-on. It does not matter whether the modem is in Dumb or Smart mode (DIP switch 8).
- 4** Decide which modem is to be the calling modem and which the answering modem. Set the answering modem to Auto Answer, DIP switch 5 OFF, and the calling modem to Auto Answer suppressed, DIP switch 5 ON.
- 5** Power off and power on the modems. This initiates the new DIP switch settings and loads the power-on defaults, including &L1. The modems go off hook and establish the connection.

NOTE: If the modems cannot restore the connection and you could not set the modem to &S2, the reason could be a keypress abort. If the problem persists, however, you may need to call your telephone company to have them check your line.

Dial Using V.25bis Software

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

Configuring the Courier

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

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

&M6 Dial using a character -oriented protocol that is similar to BISYNC.

The modem and the remote device must use the same eight -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 modem and the computer to which it is directly attached) when the 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 modem and the remote communications device) when the modem is on line.

If &Nn is set for 2 –10, the 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 Kbps
&N5	7200 bps	&N13	26.4 Kbps
&N6	9600 bps	&N14	28.8 Kbps
&N7	12 Kbps	&N15	31.2 Kbps
		&N16	33.6 Kbps

NOTE: We recommend that you fix the rate between the computer or terminal and modem (% Nn) and that you set the connection rate (& Nn) to match. This avoids dramatic changes in 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 Select a source of the synchronous timing signals.

- &X0** The modem sends transmit clock timing signals to the DTE over the serial interface. DTE rate follows the connection rate.
- &X1** The DTE sends transmit clock timing signals to the modem over the serial interface. Typical use: multiplexed leased lines.
- &X2** The modem sends receiver clock timing signals, which are looped to the transmit clock and sent to the DTE over the serial interface. Typical use: systems that require synchronization of data flowing in both directions.

Example: **AT&X0&W <Enter>** selects the modem as the source of the synchronous transmit clock timing signals.

5 Choose whether the modem should display normal or extended synchronous result codes.

Depending on the setting of the **Xn** command, the 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 modem is set to **X1** for extended result codes. To change to normal result codes, set the modem to **X0**.

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

6 If the modem is to answer calls, enable automatic answering by setting DIP switch 5 OFF.

7 Set DIP switch 10 OFF and then power the modem off then on again. Setting DIP switch 10 OFF causes the modem to read from NVRAM the settings you just made, enabling synchronous operation.

Dialing Using V.25bis

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

Hanging Up

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

The only way for the modem to disconnect is to drop its Data Terminal Ready (DTR) signal. Either power off the 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 10 ON and then OFF. The 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.25 *bis* communications software. You are not expected to send them to the modem the way you do with AT commands.

Commands

CIC	Connect incoming call	Instructs the modem to answer an incoming call.
CRN	Call request using number provided	Instructs the modem to dial the number following this command. <i>Example:</i> CRN18005551234
CRS	Call Request with memory location	Instructs the modem to dial a number stored in memory. <i>Example:</i> CRS3
DIC	Disregard incoming call	Instructs the modem to disregard an incoming call — overrides auto answer for this call.
PRN <i>n</i>	Program number	Stores a number in NVRAM. <i>Example:</i> PRN3; 18005551234
RFN	Request list of forbidden numbers	Instructs the modem to list the numbers with which the modem is unable to connect.
RLN	Request list of stored numbers	Instructs the modem to list those numbers previously stored in NVRAM.

Dial Options

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

Result Codes

These are the normal (X0) result codes.

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

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

CFAB	Call aborted
CFCB	Local 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.

Auto-Dialing

Because the 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.

Then you can set it to dial the remote device at power-on, when it receives the DTR signal from your computer, or when you press the Voice/Data switch.

Once the remote device answers, the modem switches to synchronous mode and starts sending synchronous timing signals to your computer.

Configuring the 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&W** <Enter>.

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

3 Select a source of the synchronous timing signals. For example, send **AT&X0&W** <Enter> to select the modem as the source of the synchronous transmit clock timing signals.

&X0 The modem sends transmit clock timing signals to the DTE over the serial interface. DTE rate follows the connection rate. Default.

&X1 The DTE sends transmit clock timing signals to the modem over the serial interface. Typical use: multiplexed leased lines.

&X2 The modem sends receiver clock timing signals, which are looped to the transmit clock and sent to the DTE over the serial interface. Typical use: systems that require synchronization of data flowing in both directions.

- 4** Set the connection rate to be used (between the modem and the remote communications device) when the modem is on line.

Try a variable connection rate first, &N0. If that doesn't work, try a fixed connection rate of &N10 (19.2 Kbps), &N6 (9600 bps), or &N3 (2400 bps).

&N0	Variable (default)	&N8	14.4 Kbps
&N1	Reserved	&N9	16.8 Kbps
&N2	1200 bps	&N10	19.2 Kbps
&N3	2400 bps	&N11	21.6 Kbps
&N4	4800 bps	&N12	24 Kbps
&N5	7200 bps	&N13	26.4 Kbps
&N6	9600 bps	&N14	28.8 Kbps
&N7	12 Kbps	&N15	31.2 Kbps
		&N16	33.6 Kbps

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

NOTES:

- ◆ If the modem is set to a fixed rate, and the remote device is not set to the same rate, the modem hangs up.
- ◆ V. Everything cannot connect at 21.6 Kbps or higher in synchronous mode.
- ◆ HST and V.FC modulations do not support synchronous communications.

- 5** If the modem is to answer calls, enable automatic answering by setting DIP switch 5 OFF.
- 6** Send **AT&M1&W <Enter>**, to have the modem enter synchronous mode.
- 7** 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>

- 8** Select a method to use to autodial the stored number. You can have the modem dial the stored number when it receives the Data Terminal Ready (DTR) signal from your computer, at power-on/reset, or when you press the Voice/Data switch.

Follow step **a**, **b**, or **c**, depending on the dialing method you chose.

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

ATS13.3=1&W <Enter>

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

ATS13.4=1&W <Enter>

- c** To have the modem dial when you press the Voice/Data switch, type:

ATS32=4&W <Enter>

- 9** Make sure that DIP switch 10 is set to OFF, to load settings from NVRAM.

Hanging Up

The 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 modem. Once one of these events occurs, the Courier returns to asynchronous Command mode.

Chapter 13

Querying

The V.Everything can display information such as the current settings, product code, and call duration.

The most commonly used inquiry commands are:

AT14	Current settings
AT15	NVRAM settings
AT16	Link diagnostics summary

In Display the results of a query.

- I0 Display a 4 -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.
- I1 Perform a checksum of the modem's read -only memory (ROM) and display the results. This function is used only in factory testing. The modem should always display the same number, except after you upgrade the modem's operating software (see Chapter 17).
- I2 Perform a test of the 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 modem appears to be malfunctioning.
- I3 Display the modem's banner, or product title.

I4 Display the modem's current configuration.

```

ati4
USRobotics V.Everything Settings...

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

&A3 &B1 &C1 &D0 &G0 &H1 &I0 &K1 &L0 &M4 &N0
&P0 &R2 &S0 &T5 &X0 &Y1 %N6 #CID=0

S00=000 S01=000 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
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=000 S47=000
S48=000 S49=000 S50=000 S51=000 S52=000 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=000 S68=000 S69=000 S70=000

LAST DIALED #:
OK

```

Figure 13-1. Current Configuration (I4).

I5 Display the configuration saved in non-volatile random access memory (NVRAM). If the modem connects to a device that has USR Dial Security and local access enabled, you cannot view the stored phone numbers.

```

ati5
USRobotics V.Everything NVRAM Settings...

DIAL=PULSE B0 F1 M1 X7
BAUD=57600 PARITY=N WORDLEN=8

&A3 &B1 &G0 &H1 &I0 &K1 &L0 &M4 &N0
&P0 &R2 &S0 &T5 &X0 &Y1 %N6 #CID=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 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=001 S42=126 S43=200 S44=015 S51=000 S53=000
S54=064 S55=000 S56=000 S57=000 S69=000 S70=000

STORED PHONE NUMBERS
0: 1:
2: 3:
4: 5:
6: 7:
8: 9:

STORED COMMAND =

```

OK

Figure 13-2. Saved (NVRAM) Configuration (I5).

I6 Display a diagnostic summary. During a connection, the 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 V.Everything Link Diagnostics...
Chars sent           0      Chars Received           0
Chars lost           0
Octets sent          0      Octets Received           0
Blocks sent          0      Blocks Received           0
Blocks resent        0
Retrains Requested   0      Retrains Granted          0
Line Reversals       0      Blers                      0
Link Timeouts        0      Link Naks                   0
Data Compression     NONE
Equalization         Long
Fallback             Disabled
Last Call            00:00:00
Disconnect Reason is Keypress Abort
OK
```

Figure 13-3. Link Diagnostics Screen (I6).

Table 13-1. Terms in I6.

Term Used in I6	Meaning
Chars lost	The number of characters lost because the modem's transmit buffer overflowed. Should always be 0 (zero). If not zero, there is a problem with transmit data flow control.

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 received error control protocol and data blocks. Blers are caused by noise or other line impairment. This is a count of 50 ms time units during which one or more errors occurred.
Blocks Resent	Number of transmitted error control protocol blocks that were resent at the request of the remote modem.
Link Timeouts	Number of times the error control protocol did not receive a response from the remote modem within the expected time frame.
Link NAKs	Number of times the remote modem requested that one or more data blocks be resent. NAK means negative acknowledgment.
Error! Not a valid bookmark self-reference. Data Compression	Indicates the type of data compression negotiated for the call (V42BIS, 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 modems performed a speed shift during the connection sequence. Enabled means that there was a speed shift, disabled means that there wasn't.
Protocol	Indicates the error control protocol negotiated (LAPM, HST, MNP, NONE) or SYNC for a synchronous call.

Speed	The rate at which the receiver/transmitter were operating last before disconnecting, in bits per second (bps). For connections that use Adaptive Speed Leveling (ASL) or V.34, two speeds are indicated: receiver and transmitter, respectively.
Disconnect Reason:	Possible reasons the modem hung up. See <i>Table 12–2, Disconnect Reasons</i>
Dial Security Disconnect Reason	Possible reasons the answering device may have hung up during a Dial Security session. See <i>Table 12–3, Dial Security Disconnect Reasons</i>

Disconnect Reasons

This section explains the disconnect reasons that are displayed in the ATI6 response.

Table 13-2. Disconnect Reasons.

Disconnect Reason	Explanation
A Rootless Tree	The modem received an invalid V.42 bis (compression) frame.
Break Timeout	Incompatible processing of a Break signal occurred.
DISC	The remote device sent a V.42 Disconnect frame. "Normal" hangup.
DTR dropped	The computer dropped the Data Terminal Ready signal, terminating the call.
Escape code	The user sent the modem the +++ escape code.
Extra Stepup	The modem received an invalid V.42 bis (compression) frame.
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.
Illegal command code	The modem received an invalid V.42 bis (compression) frame.

Inactivity timeout	The modem detected no activity on the line for the duration specified in Register S19 (default is 0, timer disabled).
Invalid codeword	The modem received an invalid V.42 bis (compression) frame.
Invalid speed	The 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 before the connection was established.
LD received	The remote device sent an MNP error control Link Disconnect request. "Normal hangup."
Loss of carrier	The modem detected a loss of the remote device's carrier and waited the duration specified in Register S10 (default is 0.7 seconds).
MNP incompatibility	Either the modem is set to &M5 and the remote device does not have MNP capability, or there was an error in the MNP negotiation procedure.
Retransmit limit	The devices reached the maximum of twelve 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.
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.
XID timeout	The devices failed to negotiate the V.42 Detection (XID Exchange) phase.

Disconnect Reasons for Dial Security

Table 13-3. Dial Security Disconnect Reasons.

Disconnect Reason	Explanation
Mode Incompatible	The 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 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.
Non-ARQ Mode	The 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 modem hung up because the originating device did not send an autopass password, and prompting wasn't enabled.
Security Abort	The modem hung up because it received an invalid password three times.

- I7 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
USRobotics V.Everything

                                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          ACCT/E DIAL/B NEW_#  PHONE #
#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 13-4. Dial Security Account Status Screen (ATI10).

- I11 Displays a connection report that U.S. Robotics Technical Support representatives use to help you solve problems.

I15 Displays the caller ID information from the current call (if in progress) or the last call (if between calls).

The caller ID information remains until either the modem is reset or until it receives another valid caller ID signal.

The ATI15 screen presents both unformatted and formatted caller ID data.

```
ati15
USRobotics V.Everything CID Status

80 1E 01 08 31 30 31 35 32 30 33 38 02 0A 37 30
38 35 35 35 30 30 30 31 07 0C 55 2E 53 2E 52 4F
42 4F 54 49 43 53 22

DATE = 1015
TIME = 2038
NUMBER = 7085550001
NAME = U.S.ROBOTICS

OK
```

Figure 13-5. Caller ID Information Screen (ATI15).

Chapter 14 Displaying Help Screens

Everything provides six help, or command summary, screens: the basic AT command set, the ampersand (&) command set, the percent (%) command set, the Dial command options (D), the S-Registers (S), and the Octothorpe (#) command set.

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 modem displays a screen that shows a partial summary of the basic command set.

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

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

En	n=0 No Command Echo	T	Tone Dial
	n=1 Echo Command Chars	Vn	n=0 Numeric Responses
Fn	n=0 Online Echo		n=1 Verbal Responses
	n=1 No Online Echo	Xn	n=0 Basic Result Codes
Hn	n=0 On Hook (Hang Up)		n=1 Extended Result Codes
	n=1 Off Hook		n=2-7 Advanced Result Codes
In	n=0 Product Code	Z	Software Reset
	n=1 Checksum	+++	Escape Code
	n=2 RAM Test	\$	HELP, Command Summary
	n=3 Banner/Clock set		
	n=4 Current Settings		
	n=5 NVRAM Settings		
	n=6 Link Diagnostics		
	n=7 Product Configuration		
	n=10 Dial Security Status		
	n=11 Extended Link Screen		
	n=15 CID Status		
OK			

Figure 14-1. Basic Commands Help Screen (AT\$).

Ampersand Command Set (&\$)

When you send AT&\$, the 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.

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 On-Line Command Mode		n=5 Modem Controls DSR, CTS=CD
	n=2 DTE Controls DTR	& Tn	n=0 End Test
&Fn	n=0 Load Factory Configuration		n=1 Analog Loopback (ALB)
	n=1 Hardware Flow Control Cnfg.		n=3 Digital Loopback (DLB)
	n=2 Software Flow Control Cnfg.		n=4 Grant Remote DLB
&Gn	n=0 No Guard Tone		n=5 Deny Remote DLB
	n=1 550 Hz Guard Tone		n=6 Remote Digital Loopback
	n=2 1800 Hz Guard Tone		n=7 Remote DLB With Self Test
&Hn	n=0 Disable TX Flow Control		n=8 ALB With Self Test
	n=1 CTS	&W	Store Configuration
	n=2 Xon/Xoff	& Xn	n=0 DCE Synchronous Clock
	n=3 CTS and Xon/Xoff		n=1 DTE Synchronous Clock
&In	n=0 Disable RX Flow Control		n=2 RX Clock is Source

```

n=1 Xon/Xoff & Yn n=0 Destructive
n=2 Xon/Xoff Chars Filtered n=1 Destructive/Expedited
n=3 HP Enq/Ack Host Mode n=2 Nondest./Expedited
n=4 HP Enq/Ack Terminal Mode n=3 Nondest./Unexpedited
n=5 Xon/Xoff for non-ARQ Mode & Zn=s Store Phone Number
&Kn n=0 Disable Data Compression & Zn=L Store Last Phone Number
n=1 Auto Data Compression & Zn? Query Phone Number
n=2 Enable Data Compression & ZC=s Store Command
n=3 Selective Data Compression
&Ln n=0 Disable Leased Line
n=1 Enable Leased Line
&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 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 14-2. Ampersand Commands Help Screen (AT&\$).

S-Registers (S\$)

When you send ATSS, the 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.

```

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

S0 Ring to Answer On S36 Reserved
S1 Counts # of Rings S37 Reserved
S2 Escape Code Char S38 Disconnect Wait Time (sec)
S3 Carriage Return Char S39 Reserved
S4 Line Feed Char S40 Reserved
S5 Backspace Char S41 # of Allowed Login Attempts

```

S6 Wait Time/Dial Tone (sec)	S42 Remote Escape Code Char
S7 Wait Time/Carrier (sec)	S43 Remote Escape Code Time (1/50sec)
S8 Comma Time (sec)	S44 Leased Line Delay Timer (sec)
S9 Carrier Detect Time (1/10sec)	S51 Bit Mapped
S10 Carrier Loss Time (1/10sec)	1 = MNP/V.42 Disabled in V.22
S11 Dial Tone Spacing (msec)	2 = MNP/V.42 Disabled in V.22bis
S12 Escape Code Time (1/50sec)	4 = MNP/V.42 Disabled in V.32
S13 Bit Mapped	8 = Reserved
1 = Reset On DTR Loss	16 = Reserved
2 = Do Originate in Auto Answer	32 = Reserved
4 = No Pause Before Result Codes	64 = Disable Selective Reject
8 = Do DS0 On DTR	128 = Enable phone exclusion delay
16 = Do DS0 On Reset	S53 Bit Mapped
32 = Disable HST	1 = Enable Dial Security
64 = Disable MNP Level 3	2 = Enable Autopass Fallback
128 = Hardware Reset	4 = Enable Local Access Psw
S14 Bit Mapped	8 = Reserved
1 = Escape Code Hang Up	16 = Reserved
S15 Bit Mapped	32 = Reserved
1 = Disable High- Freq EQ	64 = Reserved
2 = Disable Online Fallback	128 = Reserved
4 = Disable 450 bps Back Channel	S54 Bit Mapped
8 = Reduced Non-ARQ TX Buffer	1 = Disable 2400 symbol rate
16 = Disable MNP Level 4	2 = Disable 2743 symbol rate
32 = Set DEL=Backspace	4 = Disable 2800 symbol rate
64 = Unusual MNP-Incompatibility	8 = Disable 3000 symbol rate
128 = Custom Applications	16 = Disable 3200 symbol rate
S16 Test Modes	32 = Disable 3429 symbol rate
1 = Analog Loopback	64 = Disable V.8 Call Indicate
2 = Dial Test	128 = Disable V.8 Mode
4 = Test Pattern	S55 Bit Mapped
8 = Remote Digital Loopback	1 = Disable 8S-2D trellis code
16 = Reserved	2 = Disable 16S-4D trellis code
32 = Reserved	4 = Disable 32S-2D trellis code
64 = Reserved	8 = Disable 64S-4D trellis code
128 = Reserved	16 = Reserved
S17 Reserved	32 = Reserved
S18 &Tn Test Timeout (sec)	64 = Reserved
S19 Inactivity Timeout (min)	128 = Enable phase roll detection
S20 Reserved	S56 Bit Mapped
S21 Break Length (1/100sec)	1 = Disable nonlinear coding
S22 Xon Char	2 = Disable TX level deviation
S23 Xoff Char	4 = Disable preemphasis
S24 DSR Pulse Time (1/50sec)	8 = Disable precoding
S25 DTR Recognition Time (1/100sec)	16 = Disable shaping
S26 RTS/CTS Delay Time (1/100sec)	32 = Disable V34+
S27 Bit Mapped	64 = Disable V34
1 = V21 Mode	128 = Disable VFC
2 = Disable TCM	S57 Reserved
4 = Disable V32	S69 Bit Mapped
8 = Disable 2100hz	1 = Disable Extrn. PnP
16 = Disable MNP Handshake	2 = Enable Auto Redial
32 = Disable V.42	4 = Reserved
48 = Disable V.42 Detect Phase	8 = Reserved
64 = Reserved	16 = Reserved
128 = Unusual SW-Incompatibility	32 = Reserved
S28 V32 Handshake Time (1/10sec)	64 = Reserved
S29 Reserved	128 = Reserved
S30 Reserved	S70 Bit Mapped
S31 Reserved	1 = Enable ring type A
S32 Talk/Data Switch	2 = Enable ring type B
0 = Disabled	4 = Enable ring type C

```

1 = Originate Mode
2 = Answer Mode
3 = Redial Last Number
4 = Dial Stored Number 0
5 = Auto Answer Toggle
6 = Reset Modem
7 = Initiate RDL
8 = Busy Toggle
9 = Execute Stored Cmd
8 = Enable ring type D
16 = Reserved
32 = Reserved
64 = Reserved
128 = Reserved
S33 Reserved
S34 Bit Mapped
1 = Disable V32bis
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 Terbo
S35 Reserved
OK

```

Figure 14-3. S-Registers Help Screen (ATSS).

Percent Command Set (%\$)

When you send AT%\$, the 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.

```

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 Psw
      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 14-4. Percent Commands Help Screen (AT%\$).

Octothorpe Command Set (#\$)

When you send AT#\$, the modem displays a screen that shows a summary of the octothorpe command set.

```

at#$
HELP, Octothorpe Commands (CTRL-S to Stop, CTRL-C to Cancel)
#CID=n Caller ID control
n=0 Disable detection
n=1 Formatted results
n=2 Unformatted results
n=3 Formatted without name
n=4 Disable results to DTE
#CID? Show current setting
#CID=? Show supported settings
OK

```

Figure 14-5. Octothorpe Commands Help Screen (AT#\$).

Chapter 15 Testing

The V. Everything can perform Analog, 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 modem is in test mode, the it will return an ERROR message.

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

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

Testing the Modem (Using &T)

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

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

Analog Loopback Testing (&T1, &T8)

This test checks the operation of the modem's transmitter and receiver. Data flow is shown in Figure 15-1.

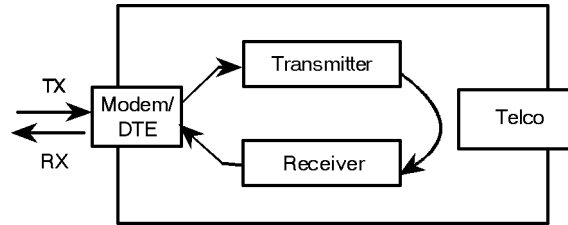


Figure 15-1. Data Flow During Analog Loopback.

There are two analog loop back options. The first, &T1, involves your typing data that you can verify at your screen.

The second option, &T8, is an internal self-test that does not involve the keyboard or screen. It isolates the modem from the computer interface to give you a more specific result.

Analog Loopback Testing Using &T1

- 1** Send the command **AT&M0&N3S14.0=0** to prepare the modem for testing.
This command disables error control, fixes the connection rate at 2400 bps, and makes the modem return to command mode when you type +++.
 - 2** Send **AT&T1** <Enter> to begin the test.
The modem enters analog loopback (AL) mode, and sends a CONNECT message.
 - 3** Type recognizable data so that you can verify it when it is looped back to your screen.
 - 4** Send the escape code, +++, and then **AT&T0** to end the test.
Alternatively, you can end the test by sending ATH or ATZ. Be careful, because ATZ resets the modem in addition to ending the test.
In any case, the modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.
 - 5** Send **AT&M4** unless you used ATZ.

NOTE: If the modem is in online mode, that is, still connected to a remote modem, and you send it an &T1 or &T8 command, it drops the call, enters AL mode, sends a CONNECT result and waits for loopback characters.

Stopping a Test (&T0, S18)

To stop a test, send **AT&T0 <Enter>**, or set Register S18 to a specified number of seconds, for example, S18=10. When the 10 seconds are up, the modem will stop the test automatically and return to Command mode. Send **ATH <Enter>** to hang up, or **ATZ <Enter>** to hang up 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 nonvolatile memory; its power-on and reset default is always zero.

Analog Loopback Testing Using &T8

This AL option causes the modem to send an internal test pattern to its transmitter and loop it back to the receiver. 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.

Since you don't type anything during this test, and the modem does not send anything to the screen, this option only verifies the modem. If there are no errors but your problem continues, it may be at the computer interface.

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

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

2 Send **AT&T8** to begin the test.

The modem enters analog loopback (AL) mode, and sends a CONNECT message. The modem then sends its internal test pattern to the transmitter, and loops the pattern back to the receiver. You will not see any data on your screen.

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

Alternatively, you can end the test by sending ATH or ATZ. Be careful, because ATZ resets the modem in addition to ending the test.

In any case, the modem hangs up and 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. An ERROR message indicates that you issued an invalid command.

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

Digital Loopback Testing (&T3)

This test can help you locate a problem with a remote device or with the tele phone line. Figure 15-2 shows the data flow during Digital Loopback (DL) testing.

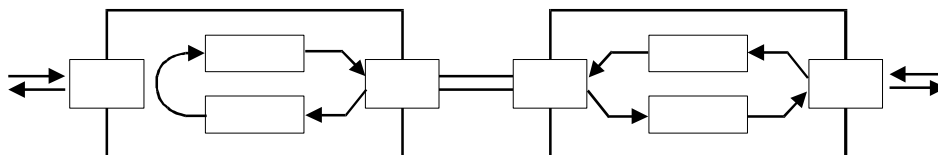


Figure 15-2. Data Flow During Digital Loopback.

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

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

- 2 Establish a connection with the remote device.
- 3 Send the modem the +++ escape code to bring it back to Command mode.
- 4 Send the modem the AT&T3 command. The modem enters Digital Loopback mode.
- 5 Have the remote user type a short message. It will be looped back by your 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 or ATZ. Be careful, because ATZ resets the modem in addition to ending the test.

In any case, the modem responds OK. If it sends an ERROR message, you have issued an invalid command.
- 7 Send AT&M4, unless you used 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 modem will stop the test automatically and return to Command mode. Send an ATH command to hang up the modem, or an ATZ command to hang it up and reset 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 nonvolatile memory; 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 15-3.

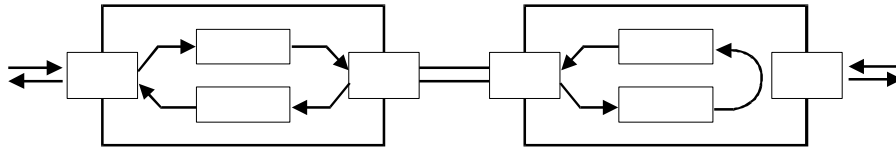


Figure 15-3. Data Flow During Remote Digital Loopback.

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 modem and verify it when it is returned over the phone lines and to your screen. If you select &T7, the 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 modem to grant a remote device's request for a Remote Digital Loopback test.

Canceling All Digital Loopback Test Requests (&T5)

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

RDL Testing Using Keyboard Data (&T6)

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

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

- 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 high speed modems need to be set to **S16=8**.

- 4** Send the modem the **AT&T6** command. The modem enters Remote Digital Loopback mode.

- 5** Type a short message. It will be looped back to your 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** or **ATZ**. Be careful, because **ATZ** resets the modem in addition to ending the test.

If you issue an invalid command, the modem sends an **ERROR** message. If you set Register **S18**, the 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 **ATZ**.

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

This test option causes the 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 modem sends only its final error count to your screen.

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

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

- 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 high speed modems need to be set to S16=8.

- 4** Send the modem the **AT&T7** command. The modem enters Remote Digital Loopback mode.

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

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

Alternatively, you can end the test by sending **ATH** or **ATZ**. Be careful, because **ATZ** resets the modem in addition to ending the test.

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

When the test ends, the 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 ATZ.

Testing the Modem Using S16

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

Table 15-1. S-Register 16.

Bit	Value	Function
0	1	Analog Loopback (AL)
2	4	RDL with built-in test pattern
3	8	RDL using keyboard data

NOTE: Earlier U.S. Robotics modems require bit 3 to be enabled in order to grant RDL to a remote device. The modem requires its default &T4 setting instead. To perform RDL with a U.S. Robotics modem that does not use the &T test repertoire, that modem should be set to S16=8 before it can grant RDL testing.

Analog Loopback (AL)—S16=1D

To use the modem's Test Pattern (S16, bit 2) instead of typing your own data, see *RDL Testing Using a Built-in Test Pattern (S16=4)*.

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

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

- 2** Send **ATS16=1D**. The modem enters AL mode and sends a CONNECT result code.
- 3** Type data to the modem for it to transmit, loop it to its receiver, and output to the screen.

An alternative is to use the *Test Pattern*, described later.
- 4** Send the escape code, **+++**, and then **ATH** to end the test.
- 5** Send **AT&M4**, unless you used a reset command (ATZ or ATZ!).

Remote Digital Loopback Testing

RDL Testing Using Keyboard Data (S16=8)

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

This command disables error control, fixes the connection rate at 2400 bps, and makes the modem return to command mode when you type **+++**.
- 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 high-speed modems should be set to &T4. Older U.S. modems should be set to S16=8.
- 5** Send the modem **ATS16=8O**.

The modem enters RDL mode and then goes back online (O command). Then it transmits the RDL signals, causing the remote device to enter RDL mode.
- 6** Type a short message. It will be looped back to your modem by the remote device and to your screen for verification. (The remote user will not see your data.)

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

If you issue an invalid command, the modem sends an ERROR message. If you set Register S18, the 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 modem is back on hook and in Command mode.

8 Send **AT&M4** unless you used ATZ.

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

Starting Testing That Uses the Test Pattern

The test pattern can be used instead of your typed data Remote Digital Loop back (RDL) testing, using either &T commands or S16.

The test pattern is available at all speeds. At 300 bps, the 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 modem for a fixed serial port rate (&B1).

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

AT&M0S16=12

To use the test pattern with the &T RDL 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 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 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 16

Troubleshooting

This chapter has three sections:

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

Problems That Occur Before Connecting

No response to AT

- ◆ For Windows users, make sure that you set the correct COM port and IRQ in your communications software and, if applicable, in Windows' Control Panel - Ports.
- ◆ For Macintosh users, make sure that you set the correct serial port (modem port or printer port) and that AppleTalk is disabled.
- ◆ Make sure that your communications software is in Terminal mode. See Chapter 1, *Using the AT Command Set*.
- ◆ Be sure that 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 8 is ON, for "act on AT commands." If the switch is OFF, power off the modem, set the switch ON, and power on the modem again. Then try typing **AT** <Enter> again.

- ◆ Make sure that verbal result codes (status messages) are enabled. Send these commands to the 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 whether your computer is reversing the send/receive functions at the EIA-232 interface. Refer to your computer's documentation.

The 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 modem. If so, see Chapter 6, *Controlling EIA-232 Signaling*.
- ◆ Make sure that the phone line from your wall jack connects to PHONE port of the modem.
- ◆ Make sure the modem is connected to a standard analog phone line and not to a digital system (typically found in offices and hotels).
- ◆ If the modem responds NO DIAL TONE when you attempt to dial, try adding X5 to the dial string, for example: ATDTX5 5551212. The modem will ignore dial tone detection.

Double characters are appearing on your monitor

This is a signal that both the 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).

After you dial, the Modem reports NO CARRIER and then hangs up

- ◆ 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 modem (send ATZ) after you finish the call.

Hear ringing but the Modem won't answer

- ◆ Check your communications software's manual to find out what Data Terminal Ready (DTR) operations your software requires.
- ◆ Send ATI4 to the modem and check that S0 is set to a value higher than 0. Also, check that DIP switch 5 is OFF.
- ◆ Set &F and S0=1, then try again.

The 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 Modem behaves as if <Enter> were pressed when you don't press any keys

Your software may be misreading signals from the modem when the it sends a Carriage Return and a Line Feed before and after the RING and CONNECT messages. Sending the Quiet mode command, ATQ1 <Enter>, should solve the problem.

Problems that Occur After Connecting

Your screen displays random or “garbage” characters

Make sure that the 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 modem is set to a fixed serial port rate (&B1) and your software is fixed at 19.2K, 38.4K, 57.6K, or 115.2K bps, the reason may be one of the following:

- ◆ Your computer may not support the higher serial port rate. If this is the case, fix your software rate at 9600 bps and disable high-speed V.32 *terbo* modulation: AT&S34=3 or AT&S34 .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 modem are set for the same kind of flow control, either hardware or software. Some communications programs also require that you disable the kind you are not using. Send AT&F1.

Many CRC errors

- ◆ Send AT&F1 to enable hardware flow control and other optimized settings.
- ◆ Try a different file transfer protocol (use ZMODEM if it's available to you)

- ◆ If you use memory -resident programs (TSRs—Terminate and Stay Resident programs) or disk -caching programs, they may be interfering. Try disabling them before you run your communications software.

Mainframe computer keeps dropping your connection

You must turn off the 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 communications software.

Both devices exchange carrier signals, but fail to establish a communications link

- ◆ Make sure the 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 12, *Dedicated/Leased Line and Synchronous Applications*. If you've configured the modem correctly, the problem may be with the synchronous adapter or with the system you're trying to call.
- ◆ Send ATi4 and check to see that your modem is at the correct B n setting to connect with either an HST modem (B1 setting) or V.32 *terbo* modem (B0 setting).

- ◆ Make sure that your 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 modem hangs up. The default setting of &N0, variable link operations, allows the two modems to negotiate the highest possible connection rate.
- ◆ If your modem is attempting to answer a V.32 call, you may need to lengthen the extra V.32 answer tones. See Appendix A, *Alphabetic Command Summary*, under S28.
- ◆ If you are attempting to make a connection using HST modulation, make sure that 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 SDL program, or performing the XMODEM file transfer, at a slower serial port rate.

You can also try running the program on a different PC. An idiosyncrasy of an off-brand PC or an uncommon version of DOS may lock up the SDL program.

If You Still Have Problems

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

- 1** Review the manual carefully to see if you've missed something.
- 2** Call or visit your dealer. Chances are that your dealer will be able to give you the assistance you need. This is much more efficient (and time -saving) than returning the product to U.S. Robotics.
- 3** If your dealer ca n't help you, refer to the Customer Service Access Card provided in this package. This card lists several important U. S. Robotics numbers. See also Appendix D, *Warranty and Notices*. Your Courier is warranted for 5 years from the date of purchase.
- 4** If you must return your modem to 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 do return the modem to us, please follow these procedures:
 - a** Ship the unit, postage pre -paid, in its original container. If the original container is not available, pack the unit carefully in a strong box of corrugated cardboard 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 your SRO number on the shipping label as well.

C Ship the package to the following address:

Cor/Sys Technical Support
U.S. Robotics
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 modem and return it to you via United Parcel Service.

Chapter 17

Upgrading the Courier's Software

We periodically release updates and enhancements to the modem's operating software. We make the software publicly available from our BBS and ftp site.

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

Checking Your Modem's Software Version

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

```
ati7
USRobotics V.Everything Configuration Profile...
Product type      US/Canada Internal
Options          HST,V32bis, Terbo,VFC,V34+
Fax Options      Class 1/Class 2.0
Clock Freq       20.16Mhz
Eprom            256k
Ram              32k

Supervisor date   01/23/96
DSP date          01/17/96

Supervisor rev    6.4.5
DSP rev           1.3.0

OK
```

Check the Supervisor and Digital Signal Processor (DSP) dates. The best way to find out the current version of the Courier's software is to call U.S. Robotics Technical Support at the number listed on the Customer Support Services card that's included with the modem.

Getting New Operating Software

There are two ways to get the newest version of the 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 file with the extension XMD.
- ◆ Over the Internet, ftp to **ftp.usr.com**. Login as *anonymous* and then enter your Internet email address as your password. From the **sys/pcb/dl05** directory, get the newest file with the extension XMD.

Sending New Software to the Modem

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

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

- 2** Type **AT~X! <Enter>**. The 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 modem using the XMODEM-Checksum or XMODEM-CRC protocol. Since this is a test, the 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 Modem Doesn't Respond

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

- 1** Power the modem off.
- 2** Set DIP switches 1, 5, and 10 on and 8 off. The settings of the other DIP switches are ignored.
- 3** Power the modem on.
- 4** Start your communications software package and send the operating software using the XMODEM protocol.

- 5** Power the modem off.
- 6** Set the DIP switches to their previous settings.
- 7** Power the modem on.

Appendix A

Alphabetic Command Summary

This appendix contains an alphabetic listing of the AT commands to which the modem will respond. Default settings are **bold**.

Basic Command Set

- \$ Display help screens for the Basic command set.
- +++ Escape code. Do not type AT or press Enter.
When you type +++, the modem will either hang up or stay on line depending on how you set S14 or DIP Switch 9.
- > Repeat command. If you include the repeat command in the Dial string, the modem will dial the number and wait 60 seconds for a carrier.
- AT>DT1234567 <Enter> or**
ATDT1234567> <Enter>
- If the line is busy, the Modem will pause for two seconds and then redial. The Modem makes a maximum of 10 attempts.
- A Force the Modem to answer when it is not receiving an incoming call.
- A/ Re-execute 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 Modem that a command is coming. AT must precede all commands except A/, A> and +++.
- 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 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 maximum number of characters allowed is 36, including the AT prefix, punctuation, and spaces.

NOTE: With the exception of the Dial options, Modems ignore any commands issued after D in the same command string.

Optional parameters:

- P** Dial using pulses.
- T** Dial using tones.
- ,** (Comma) Pause for 2 seconds.
- ;** (Semicolon) Return to 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

- Modem to dial out at the answer frequency.
- !** Flash the switchhook (off hook 0.5 sec, on hook 0.5 sec, then off hook). Use **!** when other modems share the line.
- 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.

NOTE: If double characters appear on the screen, both the Modem's local echo and your software's local echo are on.

Fn Online local echo. If ON, the 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. Default. Sometimes called full duplex.

Hn Go on or off hook.

H0 Go on hook (hang up).

H1 Go off hook (pick up).

In Query the Modem.

I0 Display the 4 -digit product code.

I1 Display results of ROM checksum test (factory test).

- I2 Display results of RAM test.
- I3 Displays the banner (product name).

NOTE: Prior versions of the modem displayed either call duration or the current time when **ATI3 <Enter>** was sent. Check ATI6 for the time information. See also ATK.

- 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 a high speed connection report (contains symbol rates).
- I15 Display Caller ID information.
- Kn** Control the modem clock. I6 displays the time.
 - K0 If on line, display current call duration. If off line, display last call's duration. Default.
 - K1 Display the actual time. Set the clock using **ATI3=HH:MM:SS K1**.
- Ln** (Internal modem only) Control the speaker's volume.
 - L0 Quietest.
 - L1 Low.
 - L2** Medium.
 - L3 Loudest.

- Mn** Control when the speaker sounds.
- M0** The speaker is always off.
 - M1** The speaker is on until the call is negotiated.
 - M2** The speaker is always on.
 - M3** The speaker turns on after the last digit is dialed and stays on until the call is negotiated.
- On** Return on line. Use with the escape code (+++) to toggle between command and online modes.
- O0** Return online (normal).
 - O1** Return online and retrain. Use O1 if there were errors in a non -ARQ data transfer.
- Qn** Enable or disable the display of result codes.
- Q0** Display result codes.
 - Q1** Suppress result codes (quiet).
 - Q2** Suppress result codes when answering.
- 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 page A-17 for a listing of all the S -Registers.

- 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 12, *Dedicated/Leased Line and 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 (Incoming)	•	•	•	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•	•	•	•
4/ERROR	•	•	•	•	•	•	•	•
5/CONNECT 1200		•	•	•	•	•	•	•
6/NO DIAL TONE			•		•		•	•
7/BUSY				•	•	•	•	•
8/NO ANSWER				•	•	•	•	•
10/CONNECT 2400		•	•	•	•	•	•	•
11/RINGING (Outgoing)						•	•	•
12/VOICE						•	•	
13/CONNECT 9600		•	•	•	•	•	•	•
18/CONNECT 4800		•	•	•	•	•	•	•
20/CONNECT 7200		•	•	•	•	•	•	•
21/CONNECT 12000		•	•	•	•	•	•	•
25/CONNECT 14400		•	•	•	•	•	•	•
43/CONNECT 16800		•	•	•	•	•	•	•
85/CONNECT 19200		•	•	•	•	•	•	•
91/CONNECT 21600		•	•	•	•	•	•	•
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•
151/CONNECT 31200		•	•	•	•	•	•	•
155/CONNECT 33600		•	•	•	•	•	•	•
170/RING A		•	•	•	•	•	•	•
171/RING B		•	•	•	•	•	•	•
172/RING C		•	•	•	•	•	•	•
173/RING D		•	•	•	•	•	•	•
Functions								
Wait for 2nd Dial Tone (W)				•	•	•	•	•
Wait for Answer (@)				•	•	•	•	•

Z Reset the modem.

For all modems except the PC Card version, if DIP Switch 10 is OFF (factory setting), revert to the settings in NVRAM. If DIP switch 10 is ON, reset to the &F0 configuration template (no flow control).

Ampersand (&) Command Set

&\$ Display help for the ampersand (&) command set.

&A*n* Enable or disable the display of additional result code subsets. Also, see the *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, or V.34 modulation indicator.

&A3 In addition to ARQ and modulation indicators, display an error control indicator (LAPM, HST, MNP, SYNC, or NONE) and a data compression type (V42 *bis* or MNP5).

&B*n* Set the serial port rate variable or fixed.

NOTE: The serial port rate *must be equal to or higher than* the &N*n* rate.

&B0 Variable: the serial port rate adapts to match the speed of the connection.

&B1 Fixed rate. The modem always communicates with your computer at the rate at which you have set, regardless of the connection rate.

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

- &Cn** Control how the modem sends a carrier detect (CD) signal to your computer.
- &C0** CD always ON, even if the modem is not on line.
 - &C1** Normal operations. The modem sends a CD signal when it connects with another modem and drops the CD when it disconnects.
- &Dn** Control how the modem responds to Data Terminal Ready (DTR) signals from the attached computer.
- &D0** Ignore DTR.
 - &D1** If issued *before connecting with another device*, the modem can enter online command mode during a call by dropping DTR. &D1 functions similarly to the escape code (+++). Return online with the O n command, or hang up with the 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&F n.
 To write a template to nonvolatile memory, enter AT&F n&W.
- If DIP switch 1 is OFF, &F0 is always loaded into memory at power-on or reset.
- &F0** Load No Flow Control template settings
 - &F1** Load Hardware Flow Control template settings
 - &F2** Load Software Flow Control template settings

- &Gn Set guard tones for international calls.
 - &G0** No guard tone. Use this in the U.S. and in 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 modem's buffer for data transmitted to the modem by its attached computer from overflowing.
 - &H0 Disable transmit data flow control.
 - &H1** Use hardware flow control. Requires that your computer and software support Clear to Send (CTS) at the EIA -232 interface.
 - &H2 Use software flow control. Requires that your software support XON/XOFF 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 control.
 - &I0** Disables XON/XOFF flow control of received data.
 - &I1 The modem acts on your typed XON/XOFF commands, Ctrl -S or Ctrl -Q, and passes them to the remote device.
 - &I2 The 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 (External modems only) Hewlett Packard—Host mode. Applies only to modems attached

to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only.

&I4 (External modems only) Hewlett Packard—Terminal mode. Applies only to 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 for you, the remote device must have &I5 capability.

&Kn Enable or disable data compression.

&K0 Disable data compression.

&K1 Use auto -enable/disable. The 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. Compression may even degrade throughput.

&K2 Always enable data compression. Use this setting to keep the modem from disabling compression.

&K3 Selective data compression. The 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.

&L1 Dedicated or leased line.

- &Mn** Enable ARQ (error control) or synchronous protocols. Both your 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.
- &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 modem hangs up if an ARQ connection cannot be made.
- &M6** (External modems only) V.25 *bis* synchronous mode, using a character-oriented link protocol similar to BISYNC.
- &Nn** Connection rate variable or fixed (analog connections only).
- &N0** Variable connection rate. The 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 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, and never higher than, the serial port rate.

&N1	300 bps	&N9	16.8 Kbps
&N2	1200 bps	&N10	19.2 Kbps
&N3	2400 bps	&N11	21.6 Kbps
&N4	4800 bps	&N12	24 Kbps
&N5	7200 bps	&N13	26.4 Kbps
&N6	9600 bps	&N14	28.8 Kbps
&N7	12 Kbps	&N15	31.2 Kbps
&N8	14.4 Kbps	&N16	33.6 Kbps

&Pn Pulse dialing type.

&P0 North American pulse dialing.

&P1 United Kingdom pulse dialing.

&Rn Received data (RTS) hardware flow control

&R0 Delay Clear to Send Response after Request to Send signal (RTS/CTS delay).

&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 modem sends data to the computer only on 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 a DSR signal at the same time as the Carrier Detect (CD).
- &S5 Send DSR normally, and follow CTS with CD.
- &Tn Test the modem
 - &T0 End testing
 - &T3 Start Local Digital Loopback (LDL) testing
 - &T4 Grant a Remote Digital Loopback (RDL) test of your modem
 - &T5** Deny an RDL test of your modem
 - &T6 Start RDL testing
 - &T7 Start RDL with self test and error detection
- &W Write the current settings to NVRAM.
 - &X0** The modem sends transmit clock timing signals to the DTE over the serial interface. DTE rate follows the connection rate.
 - &X1 The DTE sends transmit clock timing signals to the modem over the serial interface. Typical use: multiplexed leased lines.
 - &X2 The modem sends receiver clock timing signals, which are looped to the transmit clock and sent to the DTE over the serial interface. Typical use: systems that require synchronization of data flowing in both directions.

&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 modem sends Break in sequence with data received from 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.

&Zn=s Store up to ten numbers in NVRAM, where *n* is the position 0–9 in NVRAM, and *s* is the phone number string. The number *s*-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 **& Zn** string. If the call requires a special setting, insert it in the command string before the **DSn** command.

In the following example, **&M0** (no error control) is inserted before the Dial command:

AT&M0 DS2 <Enter>

NOTE: The **& Zn=s** command functions differently when Dial Security is enabled.

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

&ZC=*s* Store command string *s* in NVRAM. The command string can be up to 30 characters long; spaces do not count.

&ZC? Display the stored command string.

Percent (%) Command Set

%\$ Display the help panels for the percent (%) command set.

%A*n* Create and configure security accounts.

%B*n* Remotely configure a 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		

%C*n* Remote configuration control.

%C0 Defer configuration changes until the call is ended. Default. Changes take effect for ensuing connections.

%C1 Cancel configuration changes and restore the original configuration.

NOTE: %C1 will not reverse any changes that you wrote to NVRAM (with &W) or forced (with %C2).

%C2 Force configuration changes to take effect immediately.

NOTE: We recommend against forcing configuration changes unless it is absolutely necessary. An unreliable connection, or loss of connection, may result.

%E=*n* Erase security settings.

- %E=1 Erase local access password.
- %E=2 Erase autopass password.
- %E=3 Erase passwords in accounts 0-9.
- %E=4 Erase phone numbers in accounts 0 -9.
- %E=5 Disable Account, Dialback, and New Number fields in accounts 0 -9.
- %Fn Configure another device's data format remotely.
 - %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.

%N1	300 bps	%N6	9600 bps
%N2	1200 bps	%N7	12 Kbps
%N3	2400 bps	%N8	14.4 Kbps
%N4	4800 bps	%N9	16.8 Kbps
%N5	7200 bps	%N10	19.2 Kbps
- %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 modem responds OK.

`%V=PW n` Assign the password in account `n` in your modem's security account as your autopass password.

Octothorpe (#) Command Set

`#$` Display the help panels for the octothorpe (#) command set.

`#CID= n` Control the Caller ID settings.

#CID=0 Disable Caller ID detection and reporting

`#CID=1` Enable Caller ID with formatted output

`#CID=2` Enable Caller ID with unformatted output

`#CID=3` Enable Caller ID with formatted output and name suppressed

`#CID=4` Enable Caller ID but do not transmit the information to your computer—retain it in the modem's memory

`#CID?` Display the current caller ID setting.

`#CID=?` Display the Caller ID actions that are available

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 when in Auto Answer mode. S0=0 disables Auto Answer. S0=1 enables Auto Answer and the modem answers on the first ring.
S1	0	Counts and stores the number of rings from an incoming call.
S2	43	Stores the ASCII decimal code for the escape code character. Default character is "+". A value of 128-255 disables the escape code. *
S3	13	Stores the ASCII decimal code for the Carriage Return character. Valid range is 0 -127.*
S4	10	Stores the ASCII decimal code for the Line Feed character. Valid range is 0 -127.*
S5	8	Stores the ASCII decimal code for the Backspace character. A value of 128 -255 disables the Backspace key's delete function.*
S7	60	Sets the number of seconds the modem waits for a carrier. May be set for much longer duration if, for example, the modem is originating an international connection.
S8	2	Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command re -executions (> 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 modem.

* See Appendix B, *ASCII Chart*.

Register	Default	Function
S10	7	Sets the duration, in tenths of a second, that the modem waits after loss of carrier before hanging up. This guard time allows the 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 Chapter 1, <i>Using the AT Command Set</i> , for instructions about how to set bit-mapped registers. See also dip switch 9.

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 msec pause before result code display
3	8	On DTR signal, Auto Dial the number stored in NVRAM at position 0 (External modem only)
4	16	At power on/reset, Auto Dial number stored in NVRAM at position 0
5	32	Disable HST (used for testing V.32 <i>terbo</i> in Dual Standard modems)
6	64	Disable MNP Level 3 (used for testing Level 2)
7	128	Hardware reset (works like powering off and then on)

Register	Default	Function																								
S14	1	Bit-mapped register. See Chapter 1, <i>Using the AT Command Set</i> , for instructions about how to set bit-mapped registers.																								
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MNP connection with a remote MNP modem, it may be because of this incompatibility. Set S15 to 64 and try again to make the connection.

7 128 Custom applications only

* The default 1.5K byte non -ARQ buffer allows data transfer with X - and YMODEM -type file transfer protocols without using flow control.

The 128 -byte option allows remote users with slower modems to stop data you're transmitting from scrolling off their screens. When remote users send your computer an XOFF (<Ctrl -S>) and you stop transmitting, the data in transit from your modem's buffer doesn't exceed the size of their screen.

Register	Default	Function									
S16	0	Bit-mapped register. See Chapter 1 , <i>Using the AT Command Set</i> , for instructions about how to set bit-mapped registers. For information about testing, see Chapter 14, <i>Testing</i> .									
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Bit	Value	Result									
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S18	0	Test timer for software -initiated loopback testing (&Tn), disabled when S18 is set to 0. Used to set the duration of testing, in seconds, before the modem automatically times out and terminates the test.									
S19	0	Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the phone line and at the timeout the modem hangs up. S19=0 disables the timer.									
S21	10	Sets, in 10 -millisecond units, the length of Breaks sent from the modem to the computer or terminal. Applies to ARQ mode only.									

Register	Default	Function
S22	17	Stores the ASCII code for the XON character. *
S23	19	Stores the ASCII code for the XOFF character.*
S24	150	Sets the duration, in 20 -millisecond units, between pulsed DSR signals when the 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 the duration, in 10 millisecond units, of the delay between RTS and the modem's CTS response in synchronous mode.
S27	0	Bit-mapped register. See Chapter 1 , <i>Using the AT Command Set</i> , for instructions about how to set bit-mapped registers.

Bit	Value	Result
0	1	Enable ITU -T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the 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.
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

* See Appendix B, *ASCII Chart*.

certain result codes. This setting disables the codes and displays the 9600 code instead. The call's actual rate can be viewed on the ATI6 screen.

Error control handshaking options: select the total values of bits 4 and 5.

Bit 4	Bit 5	Result
0	0	Complete handshaking sequence: V.42 Detection, LAPM error control, MNP
16	0	Disable MNP
0	32	Disable V.42 Detection and LAPM
16	32	Disable Detection phase, if you know that the remote modem does LAPM, but not the Detection phase.

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 modem is set to use V.21 modulation (300 bps) or V.23 modulation (1200 bps).</p>
S29	20	<p>Sets the duration, in tenths of a second, of the V.21 answer tone.</p>

Register	Default	Function																						
S32	9	(External modems only) Assign Voice/Data switch function.																						
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Started manual.
 6 64 Disable the remote access busy message.
 7 128 Disable V.32 *terbo*.

Register	Default	Function
S38	0	<p>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.</p> <p>Default = 0: the modem immediately hangs up when DTR drops. If the modem receives the ATH command, it ignores S38 and immediately hangs up.</p>
S41	0	<p>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 modem returns online and any further login attempts during the remainder of that connection are refused.</p>
S42	126	<p>Stores the ASCII decimal code for the remote access escape character. The default character is a tilde (~).</p>
S43	200	<p>Sets the duration, in fiftieths of a second, of the guard time for the remote access (~~~~) sequence.</p>
S44	15	<p>Sets the duration, in seconds, of the interval between losing carrier and reestablishing a connection. See page 3-4.</p>

Register	Default	Function																		
S51	0	Bit-mapped register. See Chapter 1 , <i>Using the AT Command Set</i> , 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.22 <i>bis</i> (2400 bps)</td> </tr> <tr> <td>2</td> <td>4</td> <td>Disable MNP/V.42 for V.32/V.32 <i>bis</i>/V.32 <i>terbo</i> (9600/14,400/19,200/21,600 bps).</td> </tr> <tr> <td>6</td> <td>64</td> <td>Disable selective reject.</td> </tr> <tr> <td>7</td> <td>128</td> <td>Enable handset exclusion delay. For installations where a modem and telephone share a line. When the modem receives the DTR signal from your computer, it disconnects any voice call in progress and waits for the time indicated in S6. The phone is reenabled when the modem hangs up.</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.22 <i>bis</i> (2400 bps)	2	4	Disable MNP/V.42 for V.32/V.32 <i>bis</i> /V.32 <i>terbo</i> (9600/14,400/19,200/21,600 bps).	6	64	Disable selective reject.	7	128	Enable handset exclusion delay. For installations where a modem and telephone share a line. When the modem receives the DTR signal from your computer, it disconnects any voice call in progress and waits for the time indicated in S6. The phone is reenabled when the modem hangs up.
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<div style="border: 1px solid black; padding: 5px;"> <p>NOTE: Enabling local access password protection disables the & Z<i>n=s</i> command which stores up to ten phone numbers because stored phone numbers occupy the same space in NVRAM as the dialback numbers for Dial Security accounts.</p> </div>																				

Register	Default	Function																											
S54	64	Symbol rate bit -mapped register used primarily by U.S.Robotics Technical Support for debugging purposes. See Chapter 1 , <i>Using the AT Command Set</i> , for instructions about how to set bit -mapped registers.																											
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S55	0	Trellis code bit -mapped register used primarily by U.S.Robotics Technical Support for debugging purposes. See Chapter 1 , <i>Using the AT Command Set</i> , for instructions about how to set bit -mapped registers.																											
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2	4	Disable 32S -2D mapping																											
3	8	Disable 64S-4D mapping																											
7	128	Enable phase roll detection																											

Register	Default	Function																											
S56	0	Bit-mapped register primarily used by U.S.Robotics Technical Support for debugging purposes. See Chapter 1 , <i>Using the AT Command Set</i> , for instructions about how to set bit -mapped registers.																											
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3	8	Enable recognition of Ring D																											

Appendix B ASCII Chart

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

Appendix C

Fax Information for Programmers

Fax Service Class 1 Commands

+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, 10ms.
+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

FAX Service Class 2.0 Commands

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

+FNS=0,1	Pass-through non-Standard 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

Fax Mode Flow Control Setting

Many facsimile software products use software flow control when the modem is in Fax mode. Throughout our documentation, we recommend that you use hardware flow control for Data mode (factory setting). However, to allow compatibility with software products that use software flow control by default, U.S. Robotics fax modems automatically change to software flow control when entering Fax mode.

If the modem is already set for hardware flow control, when the software puts the modem in fax mode, the modem will use software *and* hardware flow control.

FCC Notice

FCC part 68, rules regarding fax operation, has been amended as follows:

Telephone facsimile machines—identification of the sender of the message: It shall be unlawful for any person within the United States to use a computer or other electronic device to send any message via a telephone facsimile machine unless such a message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business, other entity, or individual sending the message and the telephone number of the sending machine or of such business, other entity, or individual. Telephone facsimile machines manufactured on and after December 20, 1992 must clearly mark such identifying information on each transmitted page.

Notes

If you want to know more about the supported Class 1 fax commands, refer to the standard for the Service Class 1 fax protocol:

ANSI/EIA/TIA-578-1990 (EIA-578)
Asynchronous Facsimile DCE Control Standard
November, 1990 Approved: October 22, 1990

For more information on Class 2.0, refer to the standard for the Service Class 2.0 fax protocol:

ANSI/EIA/TIA-592-1993 (EIA-592)
Asynchronous Facsimile DCE Control Standard
May, 1993

You can obtain copies of these standards by contacting Global Engineering Documents, at 1-800-854-7179.

Glossary

Cross-references in the following definitions are printed in boldface.

16550 UART

The fastest type of **UART** that is currently available.

Adaptive Speed Leveling (ASL)

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 signals

Continuous, varying waveforms such as the voice tones carried over phone lines. Contrast with **digital signals**.

answer mode

A state in which the modem transmits at the predefined high frequency of the communications channel and receives at the low frequency. The transmit/receive frequencies are the reverse of the calling modem which is in **originate mode**.

application (application program)

A computer program designed to perform a specific function, such as a word processor or a spreadsheet.

ARQ

See **Automatic Repeat Request**

ASCII

American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as \$, !, and /. Supported by almost every computer and terminal manufacturer.

ASL

See **Adaptive Speed 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.

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 which feature error detection and automatic retransmission of defective blocks of data. See **HST**, **MNP**, and **V.42**.

baud rate

The number of discrete signal events per second occurring on a communications channel. Although not technically accurate, baud rate is commonly used to mean **bit rate**.

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. 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 8 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.

buffer

A memory area used as temporary storage during input and output operations. An example is the modem's command buffer. Another is the Transmit Data flow control buffer used for flow control and to store copies of transmitted **frames** until they are positively acknowledged by the receiving modem.

byte

A group of **binary digits** stored and operated upon as a unit. A byte may have a coded value equal to a character in the ASCII code (letters, numbers), or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte (K) is equal to 1,024 bytes or characters; 64K indicates 65,536 bytes or characters.

call 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 telegraphic 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, and modems 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, and modems 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 ten **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.

Class 1/EIA-578

An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 1 faxes.

Class 2.0/EIA-592

An American standard used between facsimile application programs and facsimile modems for sending and receiving Class 2.0 faxes.

CO

See **central office**.

COM port

See **serial port**, **EIA-232**.

cps

See **characters per second**.

CPU

Central processing unit.

CRC

See **cyclic redundancy check**.

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.

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**

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 **EIA-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.

DSR

See **data set ready**.

DTE

See **Data Terminal Equipment**

duplex

Indicates a communications channel capable of carrying signals in both directions. See **Half Duplex, Full Duplex**.

echo

See **local echo**.

EIA

Electronic Industries Association, which defines electronic standards in the U.S.

EIA-232

A technical specification published by the Electronic Industries Association that establishes mechanical and electrical interface requirements between computers, terminals, modems, and communication lines. EIA-232 was formerly known as **RS-232**.

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.

facsimile (fax)

A method for transmitting the image on a printed page from one point to another.

fax mode

The mode in which the fax modem is capable of sending and receiving files in a facsimile format.

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.

file transfer protocol (FTP)

A TCP/IP application that allows users of an internet to send (put) and receive (get) files.

FTP

See **file transfer protocol**

full duplex

Signal flow in both directions at the same time. In microcomputer communications, may refer to the suppression of the online **Local Echo**.

half duplex

Signal flow in both directions, but only one way at a time. In microcomputer communications, may refer to activation of the online **Local Echo**, which causes the modem to send a copy of the transmitted data to the screen of the sending computer.

handshaking

A sequence that two modems undertake while connecting to agree on the parameters of the conversation that will ensue. During handshaking, the modems negotiate the speed of the connection, whether **error control** and **data compression** will be used and in what form, and so forth.

hardware flow control

A form of **flow control** that uses electronic signals to start and stop the flow of data.

HDLC

See **High Level Data Link Control**

High Level Data Link Control (HDLC)

A standard protocol developed by the International Standards 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 asymmetrical modulation for more efficient use of the phone channel at speeds of 4800 bps and above. HST also incorporates **MNP**-compatible error control procedures adapted to asymmetrical modulation.

Hz (Hertz)

A frequency measurement unit used internationally to indicate one cycle per second.

Industry Standard Architecture (ISA)

The most common type of computer expansion bus. Other types include Extended Industry Standard Architecture (EISA) and Microchannel Architecture (MCA).

interrupt request (IRQ)

A number that must be assigned to devices that plug in to your computer's expansion bus.

IP

Internet Protocol.

IPX

Novell's Internet Packet Exchange protocol.

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 telegraphic and telephone 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.22 *bis*.

jumper

A switch composed of pins and a **shunt**. The shunt's position on the pins determines the jumper setting.

Kbps

Kilobits per second, or thousand bits per second.

LAPM

See **Link Access Procedure for Modems**.

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 your typed commands. When the modem is online to another system, the local echo is invoked through the ATF0 command. This command causes the modem to display the data it transmits to the remote system.

MB

Megabyte. One million **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 **HST**.

MI/MIC

Mode Indicate/Mode Indicate Common. Also called fixed or manual originate. Used when equipment other than the modem does the dialing. In such installations, the modem does not respond to AT commands, but when taken off hook immediately goes into call originate mode.

MNP

See **Microcom Networking Protocol**

modem

A device that transmits/receives computer data through a communications channel such as radio or telephone lines. The modem 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.

Nonvolatile Random Access Memory (NVRAM)

User-programmable random access memory whose data is retained when modem power is turned off. Used in modems to store a user-defined default configuration loaded into random access memory (**RAM**) at power on.

NVRAM

See **Non-volatile Random Access Memory**

online fallback

A feature that allows high speed error-control modems to monitor line quality and fall back to the next lower speed if line quality degrades. The modems fall forward as line quality improves.

originate mode

A state in which the modem transmits at the predefined low frequency of the communications channel and receives at the high frequency. The transmit/receive frequencies are the reverse of the called modem which is in **Answer mode**.

parallel transmission

The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See **Serial Transmission**.

parity

An error-detection method that checks the validity of a transmitted character. Character checking has been surpassed by more reliable and efficient forms of block-checking, including **Xmodem**-type protocols and the **ARQ** protocol implemented in Courier modems.

The same type of parity must be used by two communicating computers, or both may omit parity. When parity is used, a parity bit is added to each transmitted character. The bit's value is 0 or 1, to make the total number of 1's in the character even or odd, depending on which type of parity is used.

Plug & 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 Protocol (PPP)

A **protocol** used to send data over serial lines. PPP provides error checking, link control, and authentication, and can be used to carry **IP**, **IPX**, and other protocols. PPP is superseding **SLIP** as the leading dial-in protocol.

protocol

A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

provisioning

Another way of saying "setting up telephone lines."

RAM

See **Random Access Memory**

Random Access Memory (RAM)

Random Access Memory. Memory that is available for use when the modem is turned on, but that clears of all information when the power is turned off. The modem's RAM holds the current operational settings, a flow control **buffer**, and a command buffer.

Read-Only Memory (ROM)

Permanent memory, not user-programmable. The modem'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 modem's configuration screens and change the modem'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, passing tip and ring signals, typically, from the public switched network.

ROM

See **Read-Only Memory**.

Serial Line Internet Protocol (SLIP)

A simple **protocol** that permits sending **IP** data over a serial line. SLIP is being superseded by the **Point-to-Point Protocol (PPP)**.

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 PC-compatible machines, 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 transfer of data characters one bit at a time, sequentially, using a single electrical path. See **Parallel Transmission**

software flow control

A form of **flow control** that uses **XON** and **XOFF** characters to start and stop the flow of data.

start bit

The 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**.

SDLC

See **Synchronous Data Link Control**

shunt

A small, plastic-and-metal piece used to cover sections of pins on a jumper. The shunt interconnects certain pins which, depending on the way the shunt is placed, determine functions.

S-register

An area of **NVRAM** that is used to store a setting.

switch

See **central office switch**

Synchronous Data Link Control (SDLC)

A protocol developed by IBM for software applications and communicating devices operating in IBM's Systems Network Architecture (SNA). The protocol defines operations at the link level of communications, for example, the format of data **frames** exchanged between modems over a phone line. See **BISYNC**, **Protocol**, **HDLC**.

synchronous transmission

A form of transmission in which blocks of data are sent at strictly timed intervals. Because the timing is uniform, no **Start** or **Stop bits** are required. Compare **Asynchronous Transmission**

Some mainframes only support synchronous communications unless their owners have installed a synchronous adapter and appropriate software.

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 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 **characters per second**

transmission rate

See **it rate**.

UART

See Universal Asynchronous Receiver/Transmitter.

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).

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—Modem

An **ITU-T** standard for modem communications at 300 bps. Modems made in the U.S. 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 U.S. and Canada.

V.22 bis

An **ITU-T** standard for modem communications at 2400 bps. The standard includes an automatic link negotiation fallback to 1200 bps and compatibility with Bell 212A/V.22 modems.

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.25 bis

An **ITU-T** standard for synchronous communications between the mainframe or host and the modem using the HDLC or character-oriented protocol. Modulation depends on the serial port rate and setting of the transmitting clock source, &X.

V.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.32 bis

An **ITU-T** standard that extends the V.32 connection range: 4800, 7200, 9600, 12K and 14.4 Kbps. V.32 *bis* modems fall back

to the next lower speed when line quality is impaired, and fall back further as necessary. They fall forward to the next higher speed when line quality improves.

V.32 *terbo*

Modulation scheme that extends the V.32 connection range: 4800, 7200, 9600, 12K, 14.4K, 16.8K, 19.2K, and 21.6 Kbps. 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 28.8 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.42 *bis*

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

V.Fast Class (V.FC)

Proprietary modulation scheme developed by Rockwell International for data communication speeds up to 28.8 Kbps.

word length

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

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 modem, understand <Ctrl>-Q as XON; others interpret the pressing of any key after <Ctrl>-S as XON.

YMODEM

An error-correcting file transfer **protocol** that is related to, but faster than, XMODEM.

ZMODEM

An error-correcting file transfer **protocol** that is related to, but faster than, XMODEM or YMODEM.

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