

**GRID<sup>®</sup>**

# Internal Modem

User's Guide



# **Internal Modem User's Guide**

**March 1993**



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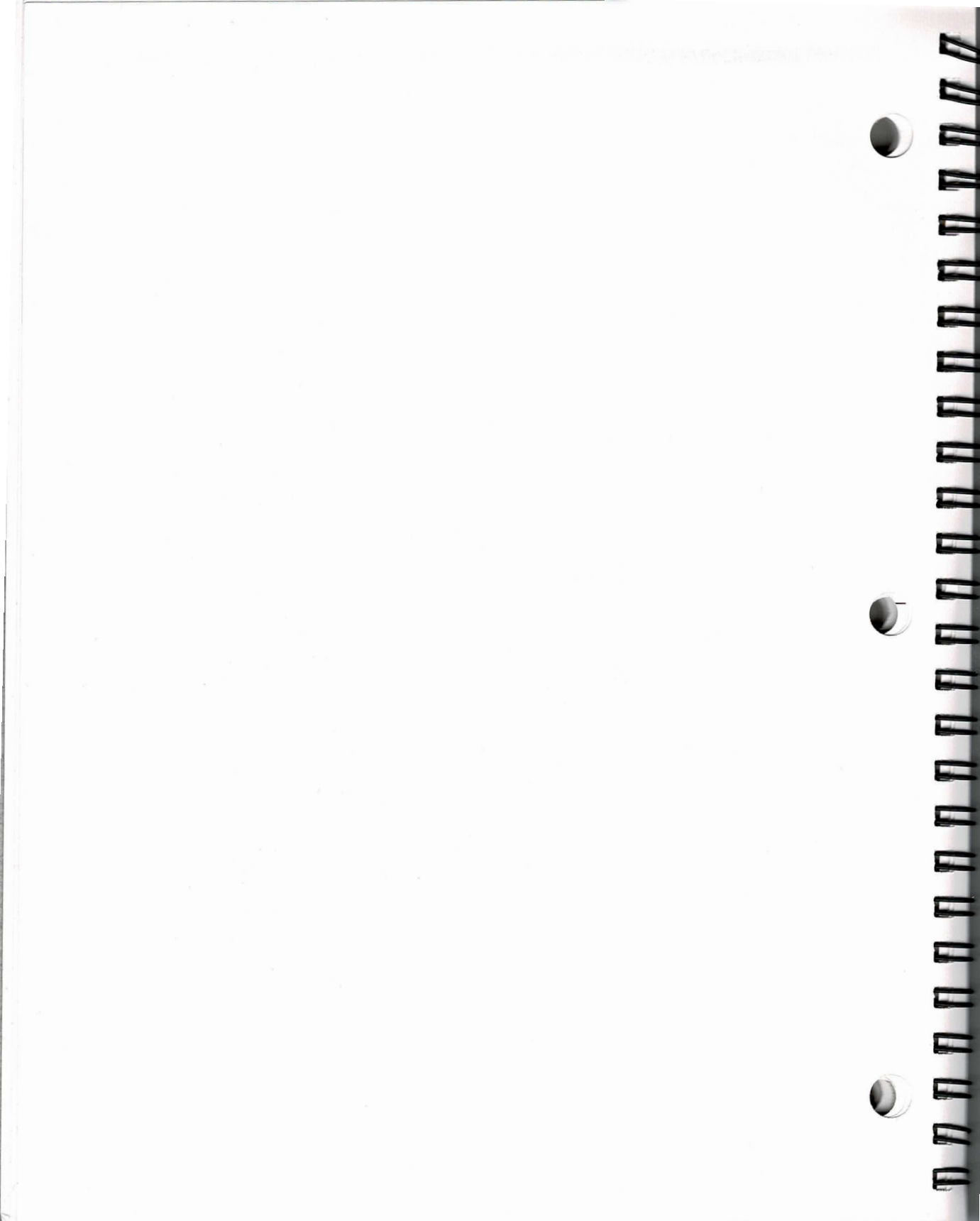
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## ABOUT THIS BOOK

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This manual describes how to operate the V.42/FAX modem, the V.42bis/FAX modem, the V.32bis 14400 bps/FAX modem, the MNP modem, and the MNP/FAX modem for GRiD<sup>®</sup> Systems computers. These modems are all internal modems.

This manual provides regulatory information on each modem and shows you how to use the command sets for each modem.

To begin using your internal modem, first consult the user's guide that comes with your computer to set up and connect the modem (see the manuals listed in the section Related Publications). Then read Chapter 1 of this manual.

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## Manual Organization

This manual is organized into four chapters. Chapter 1 gives a general introduction about using the AT command set. Chapters 2 and 3 are set up as stand-alone chapters, meaning that both of these chapters can be used as a separate manual coupled with Chapter 1. For example, if your computer is equipped with an V.32bis/FAX modem, you will need to reference only Chapters 1 and 3.

**Chapter 1, INTRODUCTION**, discusses the AT command set and factory settings. Read this chapter first.

**Chapter 2, MNP AND MNP/FAX MODEMS**, describes the warranty, FCC information, and command set for the MNP and MNP/FAX modems.

**Chapter 3, V.42/FAX, V.42bis/FAX, AND V.32bis 14400 BPS/FAX MODEMS**, describes the warranty, FCC information, and command set for the V.42FAX, the V.42bis/FAX, and the V.32bis 14,400 bps/FAX modem.

A postage paid Customer Response Card is provided at the end of this section. Owners and users in the United States are encouraged to use the card to comment on the usefulness and readability of the manual.

---

## Related Publications

For further information on using one of the internal modems, you may want to refer to the user's guide supplied with your computer and to the *MS-DOS User's Guide* and the *MS-DOS Reference Manual*. Following is a partial list of these publications.

*GRiDCASE 1535 EXP User's Guide* (Order Number: 001535-40), for information on connecting and setting up the internal modem on a GRiDCASE 1535 EXP computer.

*GRiDCASE 1550sx User's Guide* (Order Number: 001550-42), for information on connecting and setting up the internal modem on a GRiDCASE 1550sx computer.

*GRiDPAD Computer User's Guide* (Order Number: 001910-40), for information on connecting and setting up the internal modem on a GRiDPAD computer.

*PalmPAD Computer User's Guide* (Order Number: GMN-2354), for information on connecting and setting up the internal modem on a PalmPAD computer.

*MS-DOS Version User's Guide* (Order Number: 029570-40), and *MS-DOS Version 5.0 Reference Manual* (Order Number: 029570-41) for reference information on using MS-DOS **mode** command options.



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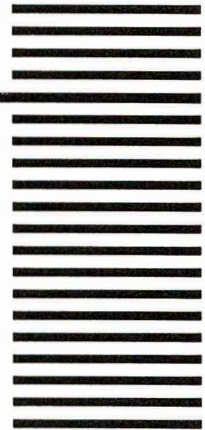
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## CHAPTER 1: INTRODUCTION

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This chapter provides general information about using the internal modem installed on your computer. Five internal modem options are available. These options are the V.42/FAX modem, V.42bis/FAX modem, the V.32bis 14400 bps/FAX modem, the MNP mode, and the MNP/FAX modem. Each modem transmits and receives data through the telephone system and resides inside the computer, providing greater convenience when you are traveling or moving your equipment.

The de facto Hayes<sup>®</sup> standard AT command set is used to configure the modem's operating parameters and to initiate and terminate communication. These commands can be issued directly from the keyboard or may be sent to the modem through communications software. The modem may return result codes indicating the responses to the instructions it receives.

For information on setting up and connecting your internal modem, see the respective user's guide for the computer you are using.

---

### AT Command Set

The AT commands described in this manual are available to you whenever the computer is in the terminal mode and the modem is in the command state, regardless of what communications software you are running.

You will require a communications software package, such as CrossTalk<sup>®</sup>, to put your computer in terminal mode. Most commercially available communications packages not only put the computer in terminal mode, but also take direct control of the modem. Therefore, in most cases, you will not need to learn the modem command set. Instead, you learn to use your own communications software and let the software command the modem. The AT command set is nevertheless documented here for special cases when you may need to control the modem directly.



## Putting the Modem in the Command State

When the computer is in terminal mode, and your communications software is running, the software intercepts your keyboard entries. To issue commands directly to the modem, you must be in the command state. To put the modem in the command state from the on-line state, enter the escape command. The escape command consists of three plus signs (+++). The first + must be separated from any previous keystroke by at least one second, and the last + must be separated from any following keystroke by at least one second.

## Issuing Modem Commands

Instructions to the modem are issued according to a simple command syntax. Once the computer is in the command state, you issue a command to the modem by typing the appropriate command characters on a single line and then pressing **Return**. All commands are prefixed by the letters, *AT* or *at*, which *get the modem's attention*. The escape sequence (+++) and the repeat previous command (*A*) are the only exceptions. They are sent without the *AT* prefix and **Return** key, and must appear on a line by themselves. Modem command characters can be entered as all uppercase letters or all lowercase letters. Spaces between characters are ignored. If you make a mistake while typing, press the **BkSp** (Backspace) key and enter the correct character.

**NOTE:** When a value is missing from the command, it is understood to be 0. For example, *ATM* is equivalent to *ATM0*.

## Command Line

A command line can contain up to 40 characters and may be used to send one or more commands to the modem. The *AT* prefix and the carriage return at the end of the command line are not counted as part of the 40 characters.

## On-Line State

The modem goes on-line after making a connection with a remote system. When the modem is on-line, data can be transmitted and received.

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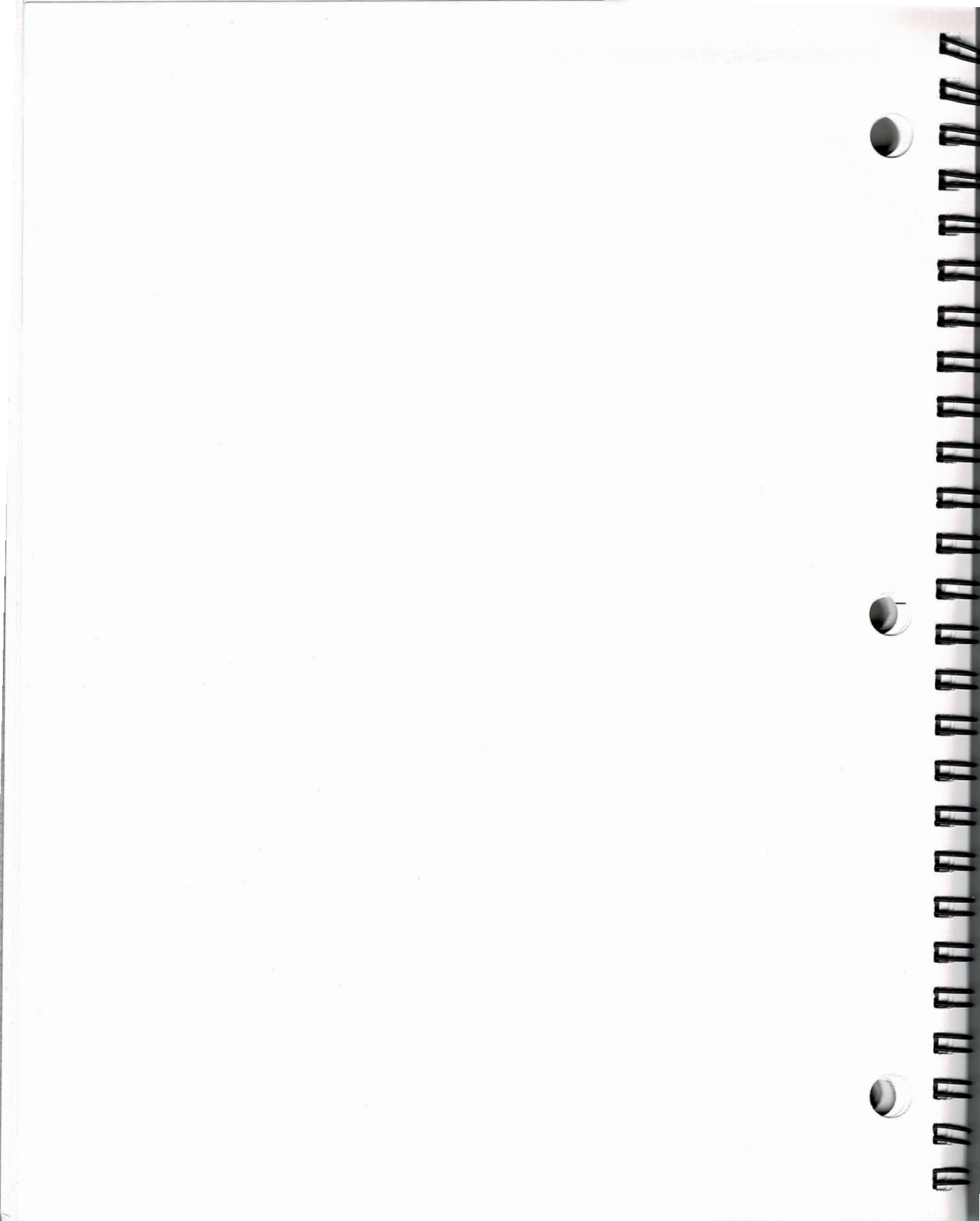
## Factory Configuration

Modem configuration is maintained as a collection of parameter values that are defined with AT commands and S-registers. These parameters are accessed from three areas: factory configuration, active configuration, and user profiles. The factory configuration reflects the settings appropriate for most communication needs. These factory settings (sometimes called default settings) can be reconfigured for specific operating conditions. The majority of parameters can be saved to nonvolatile memory. Some, however, are nonstorable and must be reconfigured individually following each reset.

The command settings and S-register values installed at the factory are stored in the modem's firmware memory (ROM). Any of these values can be modified using the AT commands, but the factory-set configuration remains fixed in ROM. The first time power is applied to the modem, the modem is configured using this collection of parameter values, which are referred to in this guide as the *factory settings*. Whenever power is applied to the modem after the first time, the configuration is dependent on the setting of the AT&Y command.

**CHAPTER 2:  
MNP AND MNP/FAX MODEMS**





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GRiD shall not be liable for loss of data contained in any returned equipment.

This warranty is not valid if the Product has been abused, misused, altered, neglected, accidentally damaged, or if repairs are attempted by unauthorized personnel. **Except as provided above, GRiD makes no warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.** Any implied warranty is limited in duration to the duration of this express written warranty set forth herein.

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Some states do not allow limitations on how long an implied warranty lasts, or the limitation or exclusion of incidental or consequential damages, so the above limitations may not apply to you. The warranties contained herein give you specific legal rights and you may have other rights which vary from state to state.

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## CHAPTER 2: MNP AND MNP/FAX MODEMS

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This chapter describes the command set for the MNP and MNP/FAX modem. It also provides FCC information that may be required from your local telephone company, as described in the following section.

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### FCC Regulations

The local telephone company may ask that you contact them before using telephone lines to transmit data and may request the following information:

- FCC registration number:  
Refer to the label on the computer
- Ringer equivalence: 0.4B

The Ringer Equivalence Number (REN) is used to determine the quantity of devices you can connect to your telephone line and still have all of those devices ring when your number is called. In most areas, the sum of the RENs of all devices connected to one telephone line cannot exceed five. Check with your telephone company to determine the maximum REN for your calling area.

The internal modem complies with Part 68 of the FCC rules. In compliance with these rules, the FCC requires that you be aware of the following restrictions on the use of the internal modem:

- The internal modem may not be connected to a coin telephone or party line.
- If the modem malfunctions, it may harm the telephone network. You should disconnect the internal modem from the telephone line until the problem is repaired. If you don't disconnect the modem, the telephone company may temporarily discontinue your service, though they must notify you as soon as possible.
- The telephone company must notify you in advance if it makes changes that could affect the operation of the internal modem.

If the modem malfunctions, do not attempt to repair it yourself. Contact the GRiD Resource Center at 1-800-654-GRID (4743).

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## **Canadian Department of Communications (DOC) Notice**

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telephone company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

#### **Caution**

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

### **Load Number**

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop which is used by the device to prevent overloading. The termination on a loop may consist of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100B.

The MNP/FAX modem has been assigned a load number of 29.

---

## Command Set

This section describes the AT command set for the MNP and MNP/FAX modems. These modems provide the de facto Hayes standard AT command set for auto dialing, Microcom Networking Protocol (MNP) AT command subset for error control and data compression, and Class 1 (EIA-578) command set.

### **AT (attention command)**

Unless otherwise noted, all modem commands must begin with the characters AT. (The AT prefix must be either all uppercase or all lowercase.) These characters stand for *attention*, and they tell the modem that subsequent characters constitute a command to the modem rather than data to be transmitted. The AT command set allows you to combine commands on a line. After you press **Return**, the modem executes the commands in the order they appear.

Example: AT *command characters*

**NOTE:** In order to enable the MNP Class 5 data compression for your modem, you must enter the command, AT%*C1*. This command is described in the Error Detection, Correction, and Data Compression Commands section of this chapter.

## Automatic Dialing Commands

### **D (dial command)**

Instructs the modem to dial the number specified by subsequent digits. Spaces, hyphens, and parentheses can be omitted; if present, they are ignored. Valid dial string characters are 0-9, #, \*, A, B, C, and D. The following options can be used with the Dial command and are explained in the following paragraphs: P T , ; " ! W @ R S=n

Example: ATD4085551212



**P (pulse dialing command)**

Instructs the modem to use pulse dialing. Can be used alone or with a dial command. Pulse dialing is the factory default.

Example: ATP

Example: ATDP4085551212

**T (Touch-Tone dialing command)**

Instructs the modem to use Touch-Tone dialing. Can be used alone or with a dial command.

Example: ATT

Example: ATDT4085551212

**, (pause command)**

Each comma inserted in a dial command causes a two-second delay (or the value of register S8) at that point in the dialing sequence. Delays are necessary when you need to dial part of a number, wait for dial tone or signal of some sort, and then resume dialing. In the example, a four-second delay is inserted after dialing 9 to get an outside line.

Example: ATD9,,4085551212

**; (return to command state after dialing)**

Causes the modem to dial the specified number and then return to the command state (the OK prompt) without hanging up. Ordinarily, the modem goes on-line as soon as it makes a connection. When the modem is on-line, you cannot issue any modem commands except the escape command. When you end a dial command with a semicolon (;), the modem dials the number, but does not go on-line when the connection is made.

Example: ATD4085551212;



**! (flash switch hook command)**

Causes the modem to “depress” the switch hook<sup>1</sup> for half a second, then “release” the switch hook for half a second before continuing to dial. On some telephone systems, you can use this command to transfer an incoming call to another line. The following example transfers a call and then hangs up (the H command is discussed in the following section).

Example: `ATD!1507;H`

**W (wait for second dial tone command)**

Causes the modem to wait for a second dial tone at this point in the dial command before proceeding to dial any remaining digits. Use this command when you access a telecommunications service that requires you to dial an access number, wait for a dial tone, and then dial another number or enter a code. You can use the W command only when the result code command currently in effect is X3 or higher. The W command can be used more than once in a single dial command.

Example:

`ATD9501022W04085551212W86455478853064`

<sup>1</sup> The term “switch hook” refers to whatever mechanism your telephone uses to distinguish between a raised and a lowered receiver. On the most common types of telephone, the two buttons on which the handset rests constitute the switch hook. On a wall-mounted phone, the switch hook is the bracket from which the receiver hangs when the phone is not in use.

**@ (wait for answer command)**

Causes the modem to wait for five seconds of silence at the other end of a completed call before proceeding to dial. This is useful if you need to wait for a recorded message to complete before entering digits in response to that message. To use the @ command, set the result code command X3 or higher. The @ command can be used more than once in a single dial command. In the example below, assume that the @ command corresponds to a recorded message asking you to enter your access code. The dialing operation stops while the message is played. Five seconds after the message completes, the digits of the access code are dialed.

Example: ATD4085553825@32863

**R (reverse frequency command)**

Reverses the modem's originate and answer frequencies. This is necessary when you want to call an originate-only modem. The R command can immediately precede or follow the number to be dialed.

Example: ATDR4085551212

Example: ATD4085551212R

**DS=*n* (dial stored number)**

Dials the stored number, where *n* is location 0-3. See &Zn=*x* command for information on storing a number.

Example: ATDS=2

**A/ (repeat last command)**

Causes the modem to repeat whatever command was last entered. This command is **not** preceded by the AT (attention command), and it is not terminated with the **Return** key. Just type A/ and the modem performs **one** repetition of the last command entered. In the example, A/ is used to redial a busy phone number.

```
Example: ATD4085551212
         NO CARRIER
         A/
```

**Any key**

While the modem is dialing, pressing any character key causes the modem to cancel the call.

## Modem Operation Commands

**+++ (escape command)**

Use this command to take the modem to the command state. The escape command is **not** preceded by the AT (attention) command, and it is not terminated with the **Return** key. The first + must be separated from any previous keystroke by at least one second, and the last + must be separated from any following keystroke by at least one second. Otherwise, the modem interprets the three + signs as part of the data stream instead of the escape command. The + signs must be entered with less than one second between each one. Use the ATO command to go back to the on-line state.

Example: *data keystrokes* [1 sec. pause]+++  
[1 sec. pause] *command keystrokes*

**A (answer manually)**

Forces the modem to go off hook in answer mode. Use this command to answer a call manually. This command must be the last one on a command line.

**Bn (CCITT/Bell mode)**

Selects either CCITT or Bell standard for 1200 bps operation. At 0-300 bps, Bell 103 is automatically selected. At 2400 bps, CCITT V.22bis is selected. At 1200 bps, either standard can be chosen to match the standard used by the remote system.

ATB0        Selects CCITT V.22 standard.

ATB1        Selects Bell 212A standard (factory setting).

|   |   |
|---|---|
| <b>C1 (normal transmit carrier switching)</b> | The C command is used in some modems to control the transmit carrier. The C0 option is not valid.   |
| <b>En (command-state echo command)</b>        | Turns local echo off or on for modem commands.  |
|   | ATE0      Turns local echo off. In this state, commands you type at the keyboard are not echoed to your screen.   |
|   | ATE1      Turns local echo on (factory setting).  |
| <b>F1 (on-line state echo command)</b>        | The F command is used in some modems to disable character echo in the on-line state. The F0 option is not valid.  |
| <b>Hz (on/off hook command)</b>               | Causes modem to go on hook or off hook.   |
|   | ATH0      Causes the modem to hang up or go on hook (factory setting).  |
|   | ATH1      Causes the modem to go off hook (same as picking up the receiver of a telephone).   |
| <b>In (identification command)</b>            | <i>In</i> is used to identify the modem code and status of the ROM.   |
|   | ATI0      Displays the product ID code.   |
|   | ATI1      Performs checksum on ROM and displays result.   |
|   | ATI2      Performs checksum on ROM and displays status, either OK or ERROR.   |
| <b>Ln (speaker volume)</b>                    | Sets the speaker volume. If your computer is equipped with a voice-quality speaker, you can set three different speaker volumes. Otherwise, the speaker volume is medium. |

***L*n (speaker volume)**

Sets the speaker volume. If your computer is equipped with a voice-quality speaker, you can set three different speaker volumes. Otherwise, the speaker volume is medium.

ATL0, ATL1 Low speaker volume.  
ATL2 Medium speaker volume (factory setting).  
ATL3 High speaker volume.

***M*n (speaker control command)**

The number you enter to replace *n* determines when the modem's built-in speaker is on and when it is off. The four possible values are shown below.

ATM0 Speaker OFF.  
ATM1 ON through dialing and carrier detect; OFF at connection (factory setting).  
ATM2 ON continuously, even during data transmission.  
ATM3 ON after last digit dialed, until carrier detect; OFF at connection.

***O*n (on-line command)**

Switches modem from command state to on-line state.

ATO0 Takes the modem from the command state back to the on-line state when a connection is still open.  
ATO1 Also returns modem to on-line state and initiates equalizer retrain sequence (at speeds of 2400 bps).



**Qn (quiet command)**

This command determines whether or not result codes are displayed on the screen.

ATQ0 Causes the codes to be displayed (factory setting).

ATQ1 Causes the codes to be suppressed.

**Sr=n (register command)**

Sets register *r* to value *n*. You can use this command if you need to change the values stored in any of the modem's registers. (It is unlikely that you will need to do this—do not change register values unless you are sure of what you are doing.) The general form of the register command is shown below. In an actual command, you would replace *r* with the register number and *n* with the value to be set (from 0-255). The registers and their values are listed in Table 2-1.

ATSr = n

*Table 2-1. Modem Registers and Values*

| <b>Register Number</b> | <b>Function</b>  | <b>Default Value</b> |
|------------------------|--|----------------------|
| 0                      | Sets number of rings before automatic answering.   | 0                    |
| 1                      | Counts and stores number of times the phone rings. Reverts to 0 if no ring occurs for 8 seconds.   | 0                    |
| 2                      | Sets ASCII value of escape code sequence character. A value greater than 127 disables escape sequence.   | 43 (+)               |
| 3                      | Sets ASCII value of carriage return <CR> character.  | 13                   |
| 4                      | Sets ASCII value of line feed character.   | 10                   |
| 5                      | Sets ASCII value of backspace character.   | 8                    |
| 6                      | Sets number of seconds modem waits for dial tone. Used when X0, X1, or X3 commands are in effect.  | 2                    |
| 7                      | Sets number of seconds modem waits for carrier tone.   | 30                   |
| 8                      | Sets duration of delay generated by comma (,) dial modifier.   | 2                    |
| 9                      | Sets length of time, in tenths of a second, carrier signal must be present for modem to recognize signal and turn on DCD (data carrier detect). Prevents ring or busy signal from being mistaken as carrier. | 6                    |
| 10                     | Sets duration, in tenths of a second, that modem waits after loss of carrier before hanging up.  | 14                   |

---

| Register Number | Function  | Default Value |
|-----------------|---|---------------|
| 11              | Sets duration, in milliseconds, of spacing between touch-tones during dialing.  | 95            |
| 12              | <i>Reserved</i>   |               |
| 13              | <i>Reserved</i>   |               |
| 14              | <i>Reserved</i>   |               |
| 15              | <i>Reserved</i>   |               |
| 16              | <i>Reserved</i>   |               |
| 17              | <i>Reserved</i>   |               |
| 18              | Sets duration, in seconds, of modem diagnostic tests. When a test is active for this length of time, modem automatically terminates the test. 0 disables the timer. The range is 0-255. | 0             |
| 19              | <i>Reserved</i>   |               |
| 20              | <i>Reserved</i>   |               |
| 21              | <i>Reserved</i>   |               |
| 22              | <i>Reserved</i>   |               |

---

| Register Number | Function  | Default Value |
|-----------------|---|---------------|
| 23              | <i>Reserved</i>   |               |
| 24              | <i>Reserved</i>   |               |
| 25              | Delay to DTR (in 100ths of a second). A change in state (ON or OFF) of DTR that persists for less than this value is ignored by the modem while it is online. The range is 0-255. | 5             |
| 26              | <i>Reserved</i>   |               |
| 27              | <i>Reserved</i>   |               |

**Sr?** To display the value stored in register *r*, use the command `ATSr?`, where *r* is the register number that you want to query.

Example: `ATS8?`

**Vn (verbose command)** Determines whether result codes are displayed as numbers or text.

`ATV0` Causes codes to display as numbers.

`ATV1` Causes codes to display as text. See Table 2-2 for codes and messages (factory setting).

**Xn (result code command)**

Every operation the modem performs has one of several possible results. The modem reports the actual result of each operation in the form of a result code from 0 to 23. Each result code has an associated text message. Whether or not a particular result code appears on the screen depends on the result code command (see Table 2-3). Your choice of a result code set also determines whether or not certain modem functions are enabled, as explained later in this section. The factory setting is X4.

The result codes and their associated messages are shown in Table 2-2.

*Table 2-2. Result Codes*

| Code | Message          | Connection Indicated   |
|------|------------------|--|
| 0    | OK               | Command executed   |
| 1    | CONNECT          | Connection at 300/1200/2400 bps if X0 selected; otherwise connected at 300 bps   |
| 2    | RING             | Ring signal detected   |
| 3    | NO CARRIER       | Carrier signal not detected, or lost   |
| 4    | ERROR            | Invalid command, checksum, error in command line, or command line exceeds 40 characters  |
| 5    | CONNECT 1200     | Connection at 1200 bps   |
| 6    | NO DIAL TONE     | No dial tone detected  |
| 7    | BUSY             | Busy signal detected   |
| 8    | NO ANSWER        | No silence detected when dialing a system not providing a dial tone<br>(Replaces NO CARRIER if an @ is present in the dial string) |
| 10   | CONNECT 2400     | Connection at 2400 bps   |
| 20   | CONNECT/REL      | Reliable connection at 300 bps   |
| 22   | CONNECT 1200/REL | Reliable connection at 1200 bps  |
| 23   | CONNECT 2400/REL | Reliable connection at 2400 bps  |



Table 2-3 lists the result code commands and indicates which result codes are reported according to which command is in effect.

*Table 2-3. Result Code Commands*

| Command | Codes Reported |   |   |   |   |   |   |   |   |    | Enabled by<br>\ <b>V1</b> |    |    |
|---------|----------------|---|---|---|---|---|---|---|---|----|---------------------------|----|----|
|         | 0              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 20                        | 22 | 23 |
| X0      | .              | . | . | . | . |   |   |   |   |    | .                         |    |    |
| X1      | .              | . | . | . | . | . |   |   |   | .  |                           | .  | .  |
| X2      | .              | . | . | . | . | . | . |   |   | .  |                           | .  | .  |
| X3      | .              | . | . | . | . | . |   | . |   | .  |                           | .  | .  |
| X4      | .              | . | . | . | . | . | . | . | . | .  |                           | .  | .  |

If you do not enter a result code command, X0 is assumed by default.

Whether reported codes appear on the screen as numbers or as messages depends on what V command is in effect, as explained earlier in this section.

Example: ATX3

**Y (long-space disconnect)**

Controls long-space disconnect.

ATY0      Disables long-space disconnect (factory setting).

ATY1      Enables long-space disconnect.

**Zn (reset command)**

Resets the modem and recalls a user profile.

ATZ0      Recalls user profile 0.

ATZ1      Recalls user profile 1.

**&Cn (data carrier detect)**

Controls the Data Carrier Detect (DCD) signal on the serial port. The modem can be programmed to keep the DCD interchange circuit on at all times, ignoring data carrier presence or absence, or it can be programmed to turn on the DCD when a data carrier is detected. Use this command if your computer or terminal requires DCD to be OFF at certain times.

**AT&C0** DCD always ON; assumes data carrier always present (factory setting).

**AT&C1** DCD tracks presence of data carrier from the remote modem; DCD is on when data carrier is detected.

**&Dn (DTR control)**

Controls DTR transition. Positive transitions of DTR (OFF-to-ON) that occur within five seconds after disconnect are ignored. When AT&D2 or AT&D3 is set, DTR must be ON to autoanswer.

**AT&D0** Ignores DTR signal; DTR is not needed for autoanswer (factory setting).

**AT&D1** Enters command state when an ON-to-OFF transition of DTR is detected.

**AT&D2** Hangs up and enters command state when an ON-to-OFF transition of DTR is detected.

**AT&D3** Hangs up and resets when an ON-to-OFF transition of DTR is detected.

**&F (restore factory settings)**

Restores the factory settings as the active configuration. The factory settings are as follows:

B1, E1, H0, I0, L2, M1, Q0, V1, X4, &C0, &D0, &G0, &J0, &P0, &T4, &Y0, %A0, %B2400, %C1, \C0, \G0, \H0, \J1, \N0, \Q0, \T0, \V0

**&Gn (guard tone)**

Sets the guard tone. Calls within the United States do not require guard tones.

AT&G0      Disables guard tone (factory setting).

AT&G1      Sets guard tone on the answering modem to 550 Hz.

AT&G2      Sets guard tone to 1800 Hz.

**&Jn (phone jack type)**

Designates the type of jack with which the modem is connected to the telephone line.

AT&J0      RJ11, RJ41S, or RJ45S type phone jack (factory setting).

AT&J1      RJ12 or RJ13 type phone jack.

**&L0 (Dial-up line operation)**

The &L command is used in some modems to set the dial-up line operation mode. Any value other than &L0 or &L1 is not valid.

**&M0 (asynchronous mode)**

The &M command is used in some modems to set the communication mode. Any value other than &M0 is not valid.

|                                    |  |
|------------------------------------|--|
| <b>&amp;Pn (pulse dial ratio)</b>  | Controls the ratio of the off-hook (make) to on-hook (break) interval that the modem uses for pulse dialing.   |
| AT&P0                              | Pulse dial make/break ratio = 39/61 for use in the United States (factory setting).  |
| AT&P1                              | Pulse dial make/break ratio = 33/67 for use in the United Kingdom.   |
| <b>&amp;Q0 (asynchronous mode)</b> | The <b>&amp;Q</b> command is used in some modems to set the communication mode. Any value other than <b>&amp;Q0</b> is not valid.  |
| <b>&amp;Sn (assume DSR signal)</b> | The <b>&amp;S</b> command is used in some modems to indicate when the modem is connected to a communication channel and ready. Any value other than <b>&amp;S0</b> is not valid. |

|                                  |  |
|----------------------------------|--|
| <b>&amp;Tn (diagnostic test)</b> | This is the modem's diagnostic and test facility.  |
| AT&T0                            | Ends a test in progress and returns the local and remote modems to normal operation.   |
| AT&T1                            | Initiates local analog loopback. The modem should display the characters on your screen exactly as you type them.  |
| AT&T3                            | Allows a remote modem that does not support the CCITT V.54 standard to perform a local digital loopback test with the modem.   |
| AT&T4                            | Allows the modem to respond to a remote caller's request to enter remote digital loopback mode (factory setting).  |
| AT&T5                            | Prevents the modem from responding to a remote digital loopback request.   |
| AT&T6                            | Instructs the remote modem to initiate remote digital loopback.  |
| AT&T7                            | Instructs the remote modem to initiate a remote digital loopback with self-test.   |
| AT&T8                            | Initiates remote analog loopback with self-test. The modem sends itself the CCITT V.54 test pattern and verifies these characters to make sure they are received correctly. It reports errors upon completion of the test. |



|   |  |
|---|--|
| <b>&amp;V (view configuration and profiles)</b>         | Displays the active configuration, user profiles, and stored telephone numbers. This command should not be issued in conjunction with other commands. It should be issued on a line by itself.   |
| <b>&amp;W<sub>n</sub> (store current configuration)</b> | Saves the storable parameters of the active configuration in memory as one of two user-defined profiles. (The &V command displays the storable parameters.)  |
|   | AT&W0      Saves storable parameters of active configuration as user profile 0.  |
|   | AT&W1      Saves storable parameters of active configuration as user profile 1.  |
| <b>&amp;Y<sub>n</sub> (recall user profile)</b>         | Specifies which profile is recalled on power-up. Either user profile can be designated as the default to recall when the modem is powered up.  |
|   | AT&Y0      Recalls user profile 0 at power-up (factory setting).   |
|   | AT&Y1      Recalls user profile 1 at power-up.   |
| <b>&amp;Z<sub>n</sub>=<i>x</i> (store phone number)</b> | Stores dial string (phone number) <i>x</i> in location <i>n</i> , where <i>n</i> is a decimal integer (0 to 3) and <i>x</i> is a string of up to 32 characters. Valid dial string characters are 0-9, dial modifiers, and (for tone dialing) A, B, C, D, #, *. The modem ignores invalid characters. |

## Error Detection, Correction, And Data Compression Commands

### **%An (autoreliable fallback character)**

Sets the ASCII character recognized as the autoreliable fallback character on the answering modem, where *n* is a decimal integer between 0 and 127. (The factory setting is 0, meaning the autoreliable fallback character is disabled.)

In autoreliable mode, when the MNP/FAX modem encounters an incoming reliable fallback character from the remote system, it automatically switches to normal mode and passes the character to the serial port. Autoreliable fallback character recognition stops if the modem receives a SYN character (ASCII 22). The modem ignores the autoreliable fallback character parity bit. Note that with this command, both AT\N3 and AT\C2 must also be set.

### **%Bn (modem port bps rate)**

When issued locally, sets the maximum modem port bps rate, where *n* = 300, 1200, or 2400. An AT <RETURN> command issued locally causes the modem port speed to match the serial port speed, regardless of any previous AT%B setting. The factory setting is 2400.

### **\Cn (autoreliable buffer)**

Determines if the answering modem buffers the data that it receives from the remote modem during the 3-second interval in which it attempts to establish a reliable connection. Use this command when the answering modem is in autoreliable mode.

When AT\C1 or AT\C2 is set, reliable and normal connections may result independent of bps rate adjust. When AT\C0 is set, however, bps rate adjust affects the type of connection as follows: reliable and direct connections may result when bps rate adjust is on (AT\J1); reliable and normal connections may result when bps rate adjust is off (AT\J0).

- AT\C0 Does not buffer data during link negotiation. Switches to normal or direct mode if SYN not detected in 3 seconds (factory setting).
- AT\C1 Buffers all data on the answering modem until either 200 non-SYN characters are received or a SYN character is detected within 3 seconds. If 200 non-SYN characters are received, the modem switches to normal mode and passes the data through to the serial port. If a SYN character is detected within 3 seconds, the modem attempts to establish a reliable connection. Otherwise, the modem switches to normal mode. If the buffer fills, the modem switches to normal mode.
- AT\C2 Does not buffer data on the answering modem. Switches to normal mode upon receipt of a character defined by the AT%A command and passes that character to the serial port.
- When the modem is set to autoanswer and receives calls from modems that both support and do not support MNP, use autoreliable mode and set AT\C2. This allows the modem to switch to normal mode as soon as it detects a logon character (defined by the AT%A command) from a non-MNP caller, thereby eliminating the 3-second wait.

**%Cn (compression control)**

Determines whether the modem attempts to use data compression during reliable connections. Both modems must have this command set to AT%C1 at the time the reliable connection is established. For the most efficient results, also set the bps rate adjust off (AT\J0).

AT%C0      Disables data compression (factory setting).

AT%C1      Enables MNP Class 5 data compression only.

**\Gn (modem port flow control)**

Sets the flow control method used to pace data sent from the remote modem to this modem during a normal mode connection.

**NOTE:** The reliable link has its own method of flow control and ignores the AT\G setting. However, the serial port flow control settings (AT\Qn) remain active during a reliable link.

AT\G0      Disables modem port flow control (factory setting).

AT\G1      Sets modem port flow control to XON\XOFF (the modem sends an XOFF character to stop received data and sends an XON character to resume receiving data).

**\Hn (HP ENQ/ACK support)**

Allows the modem to emulate the Hewlett-Packard ENQ/ACK protocol when an MNP reliable link is established. Flow control may be used in addition to the ENQ/ACK protocol. Data blocks should not exceed 250 characters each.

|       |  |
|-------|--|
| AT\H0 | Disables HP ENQ/ACK protocol (factory setting).                                |
| AT\H1 | Enables HP ENQ/ACK protocol during MNP reliable link. Modem emulates terminal. |
| AT\H2 | Enables HP ENQ/ACK protocol during MNP reliable link. Modem emulates host.     |

Use the HP ENQ/ACK protocol as follows:

1. Set the modem at the host to AT\H1.
2. Set the modem at the terminal to AT\H2.
3. Enable either XON/XOFF (AT\Q1) or hardware (AT\Q3) flow control on the serial port on both modems to prevent data loss.
4. Establish an MNP reliable link.



**\Jn (bps rate adjust)**

Controls the bps rate adjust feature. To retain the highest throughput, disable the bps rate adjust when data compression is used.

**AT\J0** Disables the bps rate adjust feature. The serial port is independent of the rate of the connection.

**AT\J1** Enables the bps rate adjust feature. After a connection is made, the modem adjusts the speed of the serial port to match the speed of the connection. The serial port remains at the adjusted bps rate after the connection terminates. If your computer or terminal does not automatically change to the adjusted bps rate, you must manually change the bps rate to the new setting (factory setting).

**\Nn (operating mode)**

Selects the operating mode the modem uses while in the connect state. The operating mode determines how the modem communicates with the remote system.

**AT\N0** Sets normal mode; no error correction. In normal mode, when bps rate adjust is OFF, the serial and modem ports can operate at different speeds during a connection. Flow control should be used to avoid data loss (factory setting).

**AT\N1** Sets direct mode; responds with OK; same effect as \N0. The modem does not buffer data, and flow control is ignored. Upon connection, the serial port always adjusts to the speed of the connection, regardless of the setting of bps rate adjust command. The escape code sequence is disabled in direct mode if AT\J0 is set.

**AT\N2**

Sets reliable mode. Uses the MNP reliable link to provide error detection and automatic retransmission of data if an error occurs. This ensures that communications between your system and the remote system are error-free. The remote system must also be equipped to handle an MNP reliable link. The modem attempts to establish a reliable link immediately after making a connection. If the attempt fails, the modem disconnects.

During an MNP reliable link, you should use flow control on the modem's serial port. When the modem detects a transmission error, it holds data from the serial port in a buffer while correcting the transmission error. The remote system should also support flow control.

**NOTE:** Certain other protocols may not be timed to work with MNP and can interfere with its effectiveness.

**AT\N3**

Sets autoreliable mode. This mode is designed to allow a modem to communicate with remote systems that both support and do not support the MNP reliable link. The answering modem looks for incoming MNP protocol characters from the remote modem. If it detects them within approximately three seconds, it tries to establish a reliable link connection.

When the modem is set to autoanswer, you can shorten this period by using the AT%A command with the AT\C2 command. You must set AT\C2 so

that the modem recognizes an incoming autoreliable fallback character. When the modem encounters this character from a remote modem, it stops waiting for an MNP protocol character and falls back to a normal connection.

**NOTE:** If both modems are set to autoreliable mode, a normal connection or no connection could result due to noise on the telephone line.

If the modem does not detect incoming MNP characters, and bps rate adjust is ON (ATVJ1) and autoreliable buffer is OFF (AT\C0), the modem establishes a direct connection instead. If bps rate adjust is OFF (ATVJ0), the modem falls back to a normal connection and uses flow control if it is enabled.

**\Qn (serial port flow control)**

Sets the type of flow control used on the serial port. If the serial port speed is faster than the modem port speed, data from your computer or terminal enters the modem faster than it is sent out. The modem holds characters in a buffer and sends them out at the slower modem port bps rate. When the buffer is full, flow control instructs your computer or terminal to stop transmitting data to the modem; the modem continues to send out the characters and empty the buffer. When there is room in the buffer, flow control instructs your computer or terminal to resume transmitting data to the modem.

For reliable connections, retransmission can reduce the effective modem port speed. If this occurs, flow control prevents buffer overflow.

Flow control is not used during direct mode connections, and the modem ignores the setting of this command.

- AT\Q0 Disables flow control (factory setting).
- AT\Q1 Enables bidirectional XON/XOFF flow control. Transmission is stopped by sending an XOFF character and is restarted by sending an XON character. The modem generates XON and XOFF characters at the same parity as used on the serial port. The serial port also responds to XON and XOFF characters sent to it from the local computer or terminal in the same way.
- AT\Q2 Enables unidirectional hardware flow control. The modem turns CTS OFF to stop the local computer or terminal from transmitting data, and turns CTS ON to allow the local computer or terminal to resume transmitting data.
- AT\Q3 Enables bidirectional hardware flow control using the CTS and RTS signals. The modem uses the CTS signal to start and stop data transmission from the local computer or terminal. When RTS is OFF, the modem stops transmitting data to the local computer or terminal. When RTS is ON, the modem resumes sending data.
- AT\Q4 Enables unidirectional XON/XOFF flow control. The modem serial port generates, but does not respond to, XON/XOFF flow control characters. This setting allows for computers to transmit data that has XON/XOFF data characters. The computer can still be set to respond to XON/XOFF flow control characters sent to it from the modem during serial port flow control.



|  |       |   |
|--|-------|---|
|  | AT\Q5 | Enables unidirectional hardware flow control, but also keeps CTS OFF until a connection is established.   |
|  | AT\Q6 | Enables bidirectional hardware flow control, but also keeps CTS OFF until a connection is established.  |
| <b>\Tn (inactivity timer)</b>              |       | Specifies the number of minutes the modem waits before automatically hanging up when data is not sent or received. The range for <i>n</i> is 0-90 with a factory setting of 0. AT\T0 disables the inactivity timer. The inactivity timer is only available during normal and reliable link connections. It is ignored when the modem is in direct mode. |
| <b>\Vn (MNP result code form)</b>          |       | Determines whether result codes indicate that a reliable link connection is in effect.  |
|  | AT\V0 | Disables modified MNP result codes. The modem uses the results codes listed with the ATV command. Use AT\V0 when the communications software you are using does not expect to see a reliable link result code, even if a reliable connection is made (factory setting).   |
|  | AT\V1 | Enables modified MNP result codes. Use this setting when your software supports MNP result codes.   |
| <b>%V (display modem firmware version)</b> |       | Displays the modem firmware version.  |
| <b>\Z (switch to normal mode)</b>          |       | Causes the local and remote modems to switch to normal mode during a reliable link. Switching to normal mode erases all data that may be in the buffer. <b>This command is for advanced use only.</b>   |
|  |       | If AT\J1 and AT\C0 are set, this command forces the modem to direct mode rather than to normal mode.  |



## Class 1 (EIA-578) Command Set

**NOTE:** This section applies only to MNP/FAX modems.

|  |   |
|--|---|
| <b>+FCLASS? (Service Class Indication)</b>             | Displays the current Class setting. The setting will be:<br>0 indicates a data modem<br>1 indicates a Class 1 fax modem   |
| <b>+FCLASS=? (Service Class Capabilities)</b>          | Displays the Classes available. The response is a list of values separated by commas. The values are those given in FCLASS?. For example, a modem that supported data communication and facsimile Class 1 would respond: "0,1". |
| <b>+FCLASS=value (Service Class Selection)</b>         | Sets the Class to the values given in FCLASS?. To configure a modem for Class 1, use the command: "AT+FCLASS=1".  |
| <b>+FTS=&lt;Time&gt; (Stop transmission and pause)</b> | Causes the modem to stop any transmission. The modem waits for the specified amount of time and sends the OK result code. Time is in 10 ms intervals in the range 0-255.  |
| <b>+FRS=&lt;Time&gt; (Wait for silence)</b>            | Causes the modem to listen and to report back an OK result code when silence has been present on the line for the amount of time specified. Time is in 10 ms intervals in the range 0-255.                                      |
| <b>+FTM=&lt;MOD&gt; (Facsimile Transmit)</b>           | Causes the modem to transmit data using the modulation selected in <MOD>, which may have the values shown in Table 2-4).  |
| <b>+FRM=&lt;MOD&gt; (Facsimile Receive)</b>            | Causes the modem to enter receive mode using the modulation specified in <MOD>, which may have the values shown in Table 2-4.   |
| <b>+FTH=&lt;MOD&gt; (HDLC Transmit)</b>                | Causes the modem to transmit data framed in the HDLC protocol using the modulation mode selected by <MOD>, which may have the values shown in Table 2-4.  |

**+FRH=<MOD>**  
**(HDLC Receive)**

Causes the modem to receive HDLC framed data using the modulation mode selected in and deliver the next received frame to the DTE. <MOD> may have the values shown in Table 2-4.

*Table 2-4. <MOD> Parameter Values*

| Value | Modulation | Speed |
|-------|------------|-------|
| 3     | V.21 ch.2  | 300   |
| 24    | V.27ter    | 2400  |
| 48    | V.27ter    | 4800  |
| 72    | V.29       | 7200  |
| 96    | V.29       | 9600  |

**NOTE:** To obtain a copy of the EIA-578 specification, contact the Electronic Industry Association, P.O. Box 57258, Washington, DC 20037-0258; telephone (202) 457-8734.

With the exception of +FCLASS, all Class 1 commands return an ERROR result code if issued when the modem is on-hook.

All Class 1 commands using the <MOD> parameter can be queried for the range of values supported. When the +FCLASS setting is a Class 1 FAX modem (+FCLASS = 1), the query syntax is: +(command) = ?

---

## MNP Modem Specifications

### Communication Modes

Asynchronous, MNP Classes 2-5

### Communication Rates and Communication Standards Supported

300 bps Bell 103

1200 bps Bell 212A

1200 bps CCITT V.22

2400 bps CCITT V.22bis

### Error Control

Microcom Networking Protocol (MNP) Class 4

### Data Compression

Microcom Networking Protocol (MNP) Class 5

### Command Set

Hayes "AT" command set

Microcom "AT" command subset

### Operating Modes

Full duplex at 2400 bps and below

### Flow Control

None, RTS/CTS, XON/XOFF (Stop/Start), Transparent XON/XOFF

### Call Progress Monitoring

Dial tone, busy tone, ring detect, answer tone

### Dialing Capability

Command-selectable tone or pulse dialing

### Command Buffer

40 characters

### Receive Levels

-9 to -43 dBm

Transmit Levels

-11 dBm to -9 dBm

Carrier Detection Level

On > -34 dBm and OFF < -40 dBm

Line Requirements

Two-wire switched network (standard telephone line)

Ringer Equivalence: 0.4B

Regulatory Approvals

FCC Part 68

CSA/DOC

UL

Registration and Approvals

FCC # Refer to the label on the computer

DOC Certified

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## MNP/FAX Modem Specifications

### Communication Modes

Asynchronous, MNP Classes 1-5, CCITT Group III Facsimile

### Communication Rates and Communicaton Standards Supported

300 bps Bell 103  
1200 bps Bell 212A  
1200 bps CCITT V.22  
2400 bps CCITT V.22bis  
2400 bps CCITT V.27  
4800 bps CCITT V.29  
7200 bps CCITT V.29  
9600 bps CCITT V.29

### FAX Compatibility

Group III

### Error Control

Microcom Networking Protocol (MNP) Class 4

### Data Compression

Microcom Networking Protocol (MNP) Class 5

### Command Set

Hayes "AT" command set  
Microcom "AT" command subset  
EIA 578 Class 1 FAX command set

### Operating Modes

Full duplex at 2400 bps and below  
Half duplex for Group III Facsimile

### Flow Control

None, RTS/CTS, XON/XOFF (Stop/Start), Transparent XON/XOFF

### Call Progress Monitoring

Dial tone, busy tone, ring detect, answer tone



Dialing Capability

Command-selectable tone or pulse dialing

Command Buffer

40 characters

Receive Levels

-9 to -43 dBm

Transmit Levels

-10 dBm to -9 dBm

Carrier Detection Level

On > -43 dBm and off < -48 dBm

Line Requirements:

Two-wire switched network (standard telephone line)

Ringer Equivalence: 0.4B

Regulatory Approvals:

FCC Part 68

CSA/DOC

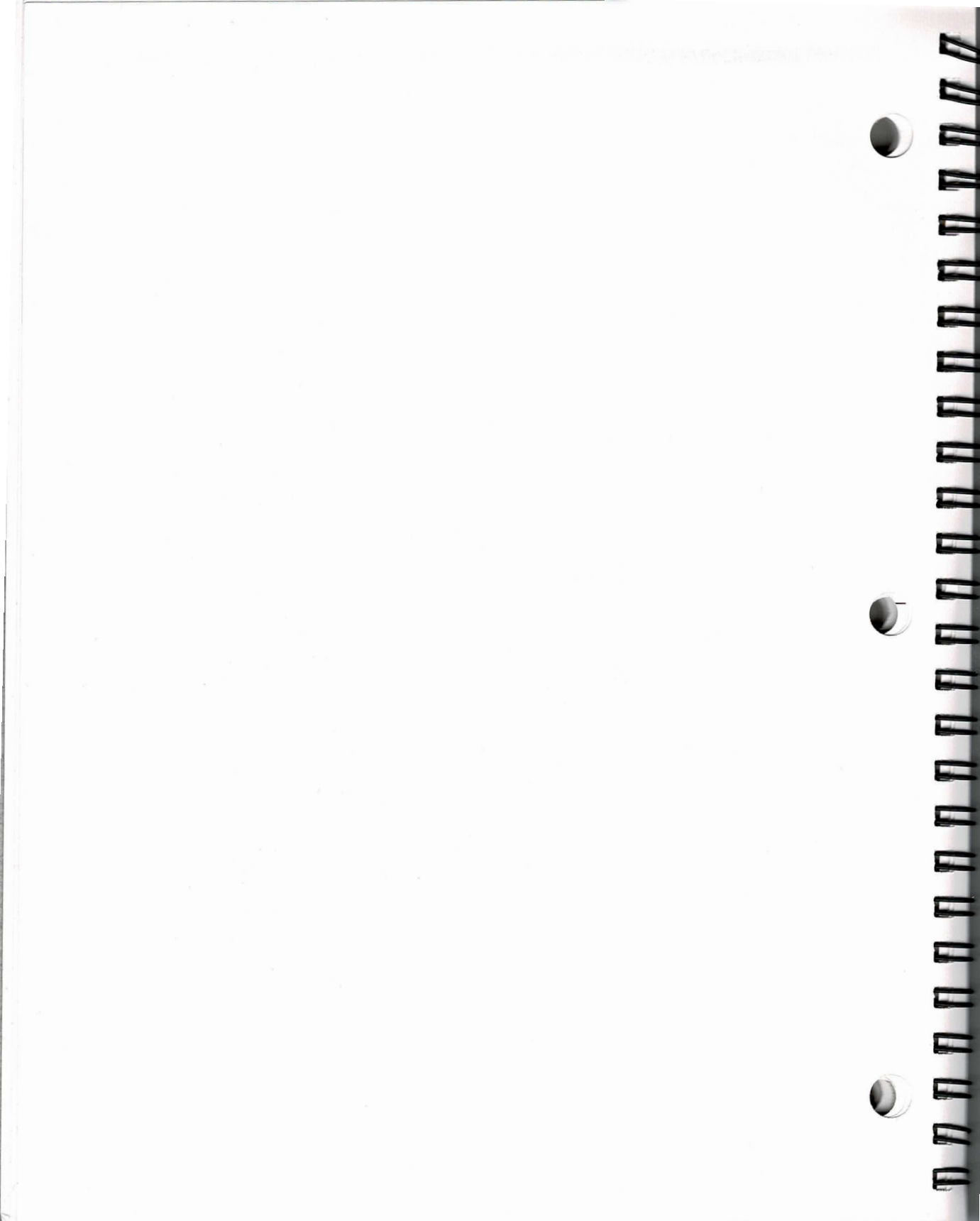
UL

Registration and Approvals:

FCC # Refer to the label on the computer

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**CHAPTER 3:  
V.42/FAX, V.42bis/FAX, AND  
V.32bis 14400 BPS/FAX MODEMS**



## Limited Warranty and Limitation of Liability

You should carefully read the following terms and conditions. You will be deemed to have accepted these terms and conditions if you have not returned the Product with your proof of purchase to your GRiD representative, within five days of the date of payment.

The term "Product", as used herein, means hardware, hardware parts, and documentation sold by GRiD.

### 1. Warranty

GRiD warrants that the Product sold hereunder shall be free from defects in materials and workmanship for a period of one year after date of shipment. Any defective Product will be repaired or replaced, at GRiD's option, by GRiD during the warranty period. You shall notify GRiD of any defective Product within the one year period, obtain a Product Repair Order, and return the Product to GRiD along with a copy of your receipt or other proof of purchase. If this Product is returned by mail, you agree to insure the Product or assume the risk of loss or damage in transit, prepay shipping charges to the warranty service location, and use the original shipping container or equivalent. In the U.S., contact an authorized GRiD Systems representative or write to: GRiD Systems Corporation, GRiD Resource Center, P.O. Box 612706, DFW Airport, TX 75261, for further information. Outside of the U.S., contact your local GRiD Systems representative or distributor.

GRiD shall not be liable for loss of data contained in any returned equipment.

This warranty is not valid if the Product has been abused, misused, altered, neglected, accidentally damaged, or if repairs are attempted by unauthorized personnel. **Except as provided above, GRiD makes no warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose.** Any implied warranty is limited in duration to the duration of this express written warranty set forth herein.

## **2. Limitation of Liability**

In no event will GRiD be liable for any special, incidental or consequential damages, however caused. GRiD's sole liability for breach of this warranty is limited to refund of the purchase price.

## **3. General**

You shall not assign this agreement nor any rights hereunder without the prior written consent of GRiD. GRiD reserves the right to withhold such consent for any reason whatsoever. Subject to the foregoing, this Agreement shall bind and inure to the benefit of the respective parties hereto and their heirs, personal representatives, successors, and assigns.

The Terms and Conditions of this Limited Warranty and Limitation of Liability represent the entire Agreement between GRiD and you relating to Product purchases and may only be modified in writing, signed by you and an authorized officer of GRiD.

Some states do not allow limitations on how long an implied warranty lasts, or the limitation or exclusion of incidental or consequential damages, so the above limitations may not apply to you. The warranties contained herein give you specific legal rights and you may have other rights which vary from state to state.



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## **CHAPTER 3: V.42/FAX, V.42bis/FAX and V.32bis 14400 BPS/FAX MODEMS**

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This chapter describes the command set for the V.42/FAX, V.42bis/FAX and V.32bis 14400 bps/FAX modems. A few of the commands apply only to the V.32bis modem or do not apply to the V.42 modem; these exceptions are indicated when the command is described. This chapter also provides FCC information that may be required from your local telephone company, as described in the following section.

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### **FCC Regulations**

The local telephone company may ask that you contact them before using telephone lines to transmit data and may request the following information:

- FCC registration number:  
Refer to the label on the computer
- Ringer equivalence: 0.4B

The Ringer Equivalence Number (REN) is used to determine the quantity of devices you can connect to your telephone line and still have all of those devices ring when your number is called. In most areas, the sum of the RENs of all devices connected to one telephone line cannot exceed five. Check with your telephone company to determine the maximum REN for your calling area.

The internal modem complies with Part 68 of the FCC rules. In compliance with these rules, the FCC requires that you be aware of the following restrictions on the use of the internal modem:

- The internal modem may not be connected to a coin telephone or party line.
- If the modem malfunctions, it may harm the telephone network. You should disconnect the internal modem from the telephone line until the problem is repaired. If you don't disconnect the modem, the telephone company may temporarily discontinue your service, though they must notify you as soon as possible.
- The telephone company must notify you in advance if it makes changes that could affect the operation of the internal modem.

If the modem malfunctions, do not attempt to repair it yourself. Contact the GRiD Resource Center at 1-800-654-GRID (4743).

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## Canadian Department of Communications (DOC) Notice

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telephone company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

**Caution**

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



## Command Matrix

The following matrix shows the command string to set up for error control features.

Hardware flow control uses the modem serial interface to control the flow of data. The signals used are RTS (Request To Send) and CTS (Clear to Send). Software flow control uses flow control characters (XON and XOFF) in the data stream. Both the modem and the communications software need to be set to use the same kind of flow control.

| Desired Settings                        | Setup String                        |
|---|-------------------------------------|
| V.42bis, hardware flow control          | AT \N7 \Q3 \J0 %C1                  |
| V.42bis, software flow control          | AT \N7 \Q1 \J0 %C1                  |
| V.42, hardware flow control             | AT \N7 \Q3 \J0 %C0 <sup>1</sup>     |
| V.42, software flow control             | AT \N7 \Q1 \J0 %C0 <sup>1</sup>     |
| MNP 5, hardware flow control            | AT \N3 \Q3 \J0 %C1                  |
| MNP 5, software flow control            | AT \N3 \Q1 \J0 %C1                  |
| MNP 4, hardware flow control            | AT \N3 \Q3 \J0 %C0                  |
| MNP 4, software flow control            | AT \N3 \Q1 \J0 %C0                  |
| No error control, hardware flow control | AT \N0 \Q3 \J0                      |
| No error control, software flow control | AT \N0 \Q1 \J0                      |
| No error control, no flow control       | AT \N0 \Q0 \J1 <sup>2</sup>         |
| Emulate Hayes Smartmodem 2400           | AT &F &C1 &D2 %B2400 <sup>2 3</sup> |

<sup>1</sup>Use \N5 instead of \N7 on V.42 modems.

<sup>2</sup>DTE speed must match the connection speed.

<sup>3</sup>%B2400 limits the maximum connection rate to 2400 bps.

**NOTE:** Some applications may lose characters between the V.32bis modem and the computer when operating at a terminal speed (DTE rate) of 38,400 bps. If this occurs, reduce the terminal speed to 19,200 bps.



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## Command Set

This section describes the AT command set for the V.42/FAX, V.42bis/FAX and V.32bis 14400 bps/FAX modem. These modems provide the de facto Hayes standard AT command set for auto dialing, Microcom Networking Protocol (MNP) AT command subset for error control and data compression, and Class 1 (EIA-578) command set for facsimile operation.

### AT (attention command)

Unless otherwise noted, all modem commands must begin with the characters AT. The AT prefix must be either all uppercase or all lowercase. These characters stand for *attention*, and they tell the modem that subsequent characters constitute a command to the modem rather than data to be transmitted. The AT command set allows you to combine commands on a line. After you press **Enter**, the modem executes the commands in the order they appear.

Example: *AT command characters*

**NOTE:** In order to enable V.42bis and MNP Class 5 data compression for your V.42bis or V.32 bis modem or to enable MNP Class 5 data compression for your V.42 modem, you must enter the command, AT%**C1**. This command is described in the Error Detection, Correction, and Data Compression Commands section of this chapter.

## Automatic Dialing Commands

### D (dial command)

Instructs the modem to dial the number specified by subsequent digits. Spaces, hyphens, and parentheses can be omitted; if present, they are ignored. Valid dial string characters are 0-9, #, \*, A, B, C, and D. The following options can be used with the Dial command and are explained in the following paragraphs: P T , ; " ! W @ R S=n

Example: ATD4085551212

**P (pulse dialing command)**

Instructs the modem to use pulse dialing. Can be used alone or with a dial command. Pulse dialing is the factory default.

Example: ATP

Example: ATDP4085551212

**T (Touch-Tone dialing command)**

Instructs the modem to use Touch-Tone dialing. Can be used alone or with a dial command.

Example: ATT

Example: ATDT4085551212

**, (pause command)**

Each comma inserted in a dial command causes a two-second delay (or the value of register S8) at that point in the dialing sequence. Delays are necessary when you need to dial part of a number, wait for dial tone or signal of some sort, and then resume dialing. In the example, a four-second delay is inserted after dialing 9 to get an outside line.

Example: ATD9,,4085551212

**; (return to command state after dialing)**

Causes the modem to dial the specified number and then return to the command state (the OK prompt) without hanging up. Ordinarily, the modem goes on-line as soon as it makes a connection. When the modem is on-line, you cannot issue any modem commands except the escape command. When you end a dial command with a semicolon (;), the modem dials the number, but does not go on-line when the connection is made.

Example: ATD4085551212;

**! (flash switch hook command)**

Causes the modem to “depress” the switch hook<sup>1</sup> for half a second, then “release” the switch hook for half a second before continuing to dial. On some telephone systems, you can use this command to transfer an incoming call to another line. The example below transfers a call and then hangs up (the H command is discussed in the following section).

Example: ATD!1507;H

**W (wait for second dial tone command)**

Causes the modem to wait for a second dial tone at this point in the dial command before proceeding to dial any remaining digits. Use this command when you access a telecommunications service that requires you to dial an access number, wait for a dial tone, and then dial another number or enter a code. You can use the W command only when the result code command currently in effect is X3 or higher. The W command can be used more than once in a single dial command.

Example:

ATD9501022W04085551212W86455478853064

1 The term “switch hook” refers to whatever mechanism your telephone uses to distinguish between a raised and a lowered receiver. On the most common types of telephone, the two buttons on which the handset rests constitute the switch hook. On a wall-mounted phone, the switch hook is the bracket from which the receiver hangs when the phone is not in use.

**@ (wait for answer command)**

Causes the modem to wait for five seconds of silence at the other end of a completed call before proceeding to dial. This is useful if you need to wait for a recorded message to complete before entering digits in response to that message. To use the @ command, set the result code command X3 or higher. The @ command can be used more than once in a single dial command. In the example below, assume that the @ command corresponds to a recorded message asking you to enter your access code. The dialing operation stops while the message is played. Five seconds after the message completes, the digits of the access code are dialed.

Example: ATD4085553825@32863

**R (reverse frequency command)**

Reverses the modem's originate and answer frequencies. This is necessary when you want to call an originate-only modem. The R command can immediately precede or follow the number to be dialed.

Example: ATDR4085551212

Example: ATD4085551212R

**DS=*n* (dial stored number)**

Dials the stored number, where *n* is location 0-3. See &Z*n*=*x* command for information on storing a number.

Example: ATDS=2

**A/ (repeat last command)**

Causes the modem to repeat whatever command was last entered. This command is **not** preceded by the AT (attention command), and it is not terminated with the **Enter** key. Just type A/ and the modem performs one repetition of the last command entered. In the example, A/ is used to redial a busy phone number.



Example: ATD4085551212  
 NO CARRIER  
 A/

**Any key**

While the modem is dialing, pressing any character key causes the modem to cancel the call.

**Modem Operation Commands****+++ (escape command)**

Use this command to take the modem to the command state. (The connection remains established.) The escape command is **not** preceded by the AT (attention) command, and it is not terminated with the **Enter** key. The first + must be separated from any previous keystroke by at least one second, and the last + must be separated from any following keystroke by at least one second. Otherwise, the modem interprets the three + signs as part of the data stream instead of the escape command. The + signs must be entered with less than one second between each one.

Example: *data keystrokes* [1 sec. pause]+++  
 [1 sec. pause] *command keystrokes*

**A (answer manually)**

Forces the modem to go off hook in answer mode. Use this command to answer a call manually. This command must be the last one on a command line.

**B*n* (CCITT/Bell mode)**

Selects either CCITT or Bell standard for 300 and 1200 bps operation. At 2400 bps, CCITT V.22bis is selected. At 300 and 1200 bps, either standard can be chosen to match the standard used by the remote system. For the V.32bis modem operating at 4800 bps and above, CCITT V.32bis is selected.

ATB0        Selects CCITT V.21/V.22 standard.

ATB1        Selects Bell 103/212A standard  
 (factory setting).



**C1 (normal transmit carrier switching)**

The **C** command is used in some modems to control the transmit carrier. The **C0** option is not valid for these modems.

**En (command-state echo command)**

Turns local echo off or on for modem commands.

**ATE0** Turns local echo off. In this state, commands you type at the keyboard are not echoed to your screen.

**ATE1** Turns local echo on (factory setting).

**F1 (on-line state echo command)**

The **F** command is used in some modems to disable character echo in the on-line state. The **F0** option is not valid for these modems.

**Hz (on/off hook command)**

Causes modem to go on hook or off hook.

**ATH0** Causes the modem to hang up or go on hook.

**ATH1** Causes the modem to go off hook (same as picking up the receiver of a telephone).

**In (identification command)**

**In** is used to identify the modem code and status of the ROM.

**ATI0** Displays the product ID code.

**ATI1** Performs checksum on ROM and displays result.

**ATI2** Performs checksum on ROM and displays status, either OK or ERROR.

**$L_n$  (speaker volume)**

Sets the speaker volume. If your computer is equipped with a voice-quality speaker, you can set three different speaker volumes. Otherwise, the speaker volume is medium.

ATL0, ATL1 Low speaker volume.  
ATL2 Medium speaker volume (factory setting).  
ATL3 High speaker volume.

 **$M_n$  (speaker control command)**

The number you enter to replace  $n$  determines when the modem's built-in speaker is on and when it is off. The four possible values are shown below.

ATM0 Speaker OFF.  
ATM1 ON through dialing and carrier detect, OFF at connection (factory setting).  
ATM2 ON continuously, even during data transmission.  
ATM3 ON after last digit dialed until carrier detect; OFF at connection.

 **$O_n$  (on-line command)**

Switches modem from command state to on-line state.

ATO0 Takes the modem from the command state back to the on-line state when a connection is still open.  
ATO1 Also returns modem to on-line state and initiates equalizer retrain sequence (at speeds of 2400 bps or greater).

**Q $n$  (quiet command)**

This command determines whether or not result codes are returned.

ATQ0 Causes the codes to be returned (factory setting).

ATQ1 Causes the codes to be suppressed.

ATQ2 Causes the codes to be returned in originate mode only.

**S $r$ = $n$  (register command)**

Sets register  $r$  to value  $n$ . You can use this command if you need to change the values stored in any of the modem's registers. (It is unlikely that you will need to do this—do not change register values unless you are sure of what you are doing.) The general form of the register command is shown below. In an actual command, you would replace  $r$  with the register number and  $n$  with the value to be set (from 0-255). The registers and their values are listed in Table 1.

ATS $r$  =  $n$

*Table 1. Modem Registers and Values*

| Register Number | Function   | Default Value |
|-----------------|--|---------------|
| 0               | Sets number of rings before automatic answering.   | 0             |
| 1               | Counts and stores number of times the phone rings. Reverts to 0 if no ring occurs for 8 seconds.   | 0             |
| 2               | Sets ASCII value of escape code sequence. A value greater than 127 disables the escape sequence.   | 43 (+)        |
| 3               | Sets ASCII value of carriage return <CR> character.  | 13            |
| 4               | Sets ASCII value of line feed character.   | 10            |
| 5               | Sets ASCII value of backspace character.   | 8             |
| 6               | Sets number of seconds modem waits for dial tone. This value is used when X0, X1, or X3 commands are in effect.  | 2             |
| 7               | Sets number of seconds modem waits for carrier tone.   | 30*           |
| 8               | Sets duration of delay generated by comma (,) dial modifier.   | 2             |
| 9               | Sets length of time, in tenths of a second, carrier signal must be present for modem to recognize signal and turn on DCD (data carrier detect). Prevents a ring or a busy signal from being mistaken as a carrier. | 6             |
| 10              | Sets duration, in tenths of a second, that modem waits after loss of carrier before hanging up.  | 14            |

\* Default value for the V.32bis modem is 50.

| Register Number | Function   | Default Value |
|-----------------|--|---------------|
| 11              | Sets duration, in milliseconds, of spacing between touch-tones during dialing.   | 95            |
| 12              | <i>Reserved</i>  |               |
| 13              | <i>Reserved</i>  |               |
| 14              | <i>Reserved</i>  |               |
| 15              | <i>Reserved</i>  |               |
| 16              | <i>Reserved</i>  |               |
| 17              | <i>Reserved</i>  |               |
| 18              | Sets duration, in seconds, of modem diagnostic tests. When a test is active for a length of time equal to this value, modem automatically terminates the test. 0 disables the timer. The range is 0-255. | 0             |
| 19              | Autosync only. Bit-mapped protocol register:<br>Bit      Use<br>1      0 = Bisync, 1 = SDLC<br>2      1 = SDLC Address Detect On<br>4      0 = SDLC idle on MARK,<br>1 = SDLC idle on FLAG               | 26            |
| 20              | Autosync only. In bisync mode, it contains the SYNC character. In SDLC mode, it contains the ADDRESS character if Address Detect is on.  | 32            |
| 21              | <i>Reserved</i>  |               |
| 22              | <i>Reserved</i>  |               |



| Register Number | Function  | Default Value |
|-----------------|---|---------------|
| 23              | <i>Reserved</i>   |               |
| 24              | <i>Reserved</i>   |               |
| 25              | Delay to DTR (in 100ths of a second for async mode and in seconds for autosync mode). A change in state (ON or OFF) of DTR that persists for less than this value is ignored by the modem while it is online. The range is 0-255.   | 5             |
| 26              | <i>Reserved</i>   |               |
| 27              | <i>Reserved</i>   |               |
| 214             | Set maximum V.42bis string length. Determines the largest string that can be represented by a given V.42bis code. Range is 6-250. Set a lower value if an incompatibility problem with a different V.42bis modem is encountered; the suggested alternate setting is 64. (This function is not available on the V.42 modem.) | 250           |

**Sr?** To display the value stored in register *r*, use the command `ATSr?`, where *r* is the register number that you want to query.

Example: `ATS8?`

**Vn (verbose command)** Determines whether result codes are returned as numbers or text.

`ATV0` Causes codes to be returned as numbers.

ATV1 Causes codes to be returned as text (factory setting). See Table 3-2 for codes and messages.

**Wn (negotiation progress code command)**

Enables an additional set of result codes. These result codes report the progress of the negotiation phase in the error-correction and compression mode. These codes report the carrier speed and the error-correction protocol. For example, both 77 and PROTOCOL: LAP-M indicate that the error-correction protocol is V.42 LAP-M. See Table 3-2 for codes and messages.

ATW0 Does not report negotiation progress. The modem reports the serial port connect rate on connection.

ATW1 Reports negotiation progress. When a reliable link is established, the modem can report a different carrier rate and connect rate.

ATW2 Does not report negotiation progress. The modem reports the modem (carrier) connect rate on connection (factory settings).

**Xn (result code command)**

Every operation the modem performs has one of several possible results. The modem reports the actual result of each operation in the form of a result code from 0 to 80. Each result code has an associated text message. Whether or not a particular result code appears on the screen depends on the result code command (see Tables 3-3 and 3-4). Your choice of a result code set also determines whether or not certain modem functions are enabled, as explained later in this section. The factory setting is X4.

The result codes and their associated messages are shown in Table 3-2.

Table 3-2. Result Codes

| Code | Message           | Connection Indicated   |
|------|-------------------|--|
| 0    | OK                | Command executed   |
| 1    | CONNECT           | Connection at<br>300/1200/2400/4800/7200/9600/12000/<br>14400 bps if X0 selected; otherwise<br>connection at 300 bps                     |
| 2    | RING              | Ring signal detected   |
| 3    | NO CARRIER        | Carrier signal not detected, or lost   |
| 4    | ERROR             | Invalid command, checksum, error in<br>command line, or command line exceeds<br>40 characters  |
| 5    | CONNECT 1200      | Connection at 1200 bps   |
| 6    | NO DIALTONE       | No dial tone detected  |
| 7    | BUSY              | Busy signal detected   |
| 8    | NO ANSWER         | No silence detected when dialing a<br>system not providing a dial tone<br>(Replaces NO CARRIER if an<br>@ is present in the dial string) |
| 10   | CONNECT 2400      | Connection at 2400 bps   |
| 11   | CONNECT 4800      | Connection at 4800 bps   |
| 12   | CONNECT 9600      | Connection at 9600 bps   |
| 14   | CONNECT 19200     | Connection at 19200 bps (serial port<br>speed)   |
| 15*  | CONNECT 38400     | Connection at 38400 bps (serial port<br>speed)   |
| 20   | CONNECT/REL       | Reliable connection at 300 bps   |
| 22   | CONNECT 1200/REL  | Reliable connection at 1200 bps  |
| 23   | CONNECT 2400/REL  | Reliable connection at 2400 bps  |
| 24   | CONNECT 4800/REL  | Reliable connection at 4800 bps  |
| 26   | CONNECT 9600/REL  | Reliable connection at 9600 bps  |
| 27   | CONNECT 19200/REL | Reliable connection at 19200 bps (serial<br>port speed)  |
| 28*  | CONNECT 38400/REL | Reliable connection at 38400 bps (serial<br>port speed)  |
| 34*  | CONNECT 7200      | Connection at 7200 bps   |
| 35*  | CONNECT 12000     | Connection at 12000 bps  |
| 36*  | CONNECT 14400     | Connection at 14400 bps  |

\* These codes apply only to V.32bis modems.

Table 3-2. Result Codes (continued)

| Code | Message              | Connection Indicated  |
|------|----------------------|---|
| 37*  | CONNECT 7200/REL     | MNP or V.42 connection at 7200 bps                            |
| 38*  | CONNECT 12000/REL    | Reliable connection at 12000 bps                              |
| 39*  | CONNECT 14400/REL    | Reliable connection at 14400 bps                              |
| 40   | CARRIER 300          | Carrier detected at 300 bps                                   |
| 46   | CARRIER 1200         | Carrier detected at 1200 bps                                  |
| 47   | CARRIER 2400         | Carrier detected at 2400 bps                                  |
| 48*  | CARRIER 4800         | Carrier detected at 4800 bps                                  |
| 49*  | CARRIER 7200         | Carrier detected at 7200 bps                                  |
| 50*  | CARRIER 9600         | Carrier detected at 9600 bps                                  |
| 51*  | CARRIER 12000        | Carrier detected at 12000 bps                                 |
| 52*  | CARRIER 14400        | Carrier detected at 14400 bps                                 |
| 66   | COMPRESSION: CLASS 5 | MNP compression negotiated                                    |
| 67   | COMPRESSION: V.42BIS | V.42bis compression negotiated (not available on V.42 modems) |
| 69   | COMPRESSION: NONE    | No compression negotiated                                     |
| 70   | PROTOCOL: NONE       | Asynchronous mode   |
| 77   | PROTOCOL: LAP-M      | V.42 LAP-M error correction negotiated                        |
| 80   | PROTOCOL: ALT        | MNP error correction negotiated                               |

\* These codes apply only to V.32bis modems.

Tables 3-3 and 3-4 list the result code commands and indicates which result codes are reported according to which command is in effect. Table 3-3 shows result code commands for the V.42 and V.42bis modems; Table 3-4 shows the V.32bis modem.



Table 3-3. Result Code Commands for the V.42 and V.42bis Modems

| Command | Codes Reported |   |   |   |   |   |   |   |   |    |
|---------|----------------|---|---|---|---|---|---|---|---|----|
|         | 0              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 |
| X0      | .              | . | . | . | . |   |   |   |   |    |
| X1      | .              | . | . | . | . | . |   |   |   | .  |
| X2      | .              | . | . | . | . | . | . |   | . | .  |
| X3      | .              | . | . | . | . | . |   | . |   | .  |
| X4      | .              | . | . | . | . | . | . | . | . | .  |

| Command | Enabled by W0 |    |    | Enabled by \V1 |    |    | Enabled by W0 and \V1 |    |    |
|---------|---------------|----|----|----------------|----|----|-----------------------|----|----|
|         | 11            | 12 | 14 | 20             | 22 | 23 | 24                    | 26 | 27 |
| X0      |               |    |    | .              |    |    |                       |    |    |
| X1      | .             | .  | .  | .              | .  | .  | .                     | .  | .  |
| X2      | .             | .  | .  | .              | .  | .  | .                     | .  | .  |
| X3      | .             | .  | .  | .              | .  | .  | .                     | .  | .  |
| X4      | .             | .  | .  | .              | .  | .  | .                     | .  | .  |

| Command | Enabled by W1 |    |    |                 |     |    |    |    |    |
|---------|---------------|----|----|-----------------|-----|----|----|----|----|
|         |               |    |    | Disabled by %C0 |     |    |    |    |    |
|         | 40            | 46 | 47 | 66              | 67* | 69 | 70 | 77 | 80 |
| X0      |               |    |    | .               | .   | .  | .  | .  | .  |
| X1      | .             | .  | .  | .               | .   | .  | .  | .  | .  |
| X2      | .             | .  | .  | .               | .   | .  | .  | .  | .  |
| X3      | .             | .  | .  | .               | .   | .  | .  | .  | .  |
| X4      | .             | .  | .  | .               | .   | .  | .  | .  | .  |

If you do not enter a result code command, the modem assumes X4, W2, %C0 by default.

\* Only the V.42bis/FAX modem supports result code 67.



Table 3-4. Result Code Commands for V.32bis Modems

| Command | Codes Reported |   |   |   |   |   |   |   |   |    |    |    |
|---------|----------------|---|---|---|---|---|---|---|---|----|----|----|
|         | 0              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 12 |
| X0      | .              | . | . | . | . |   |   |   |   |    |    |    |
| X1      | .              | . | . | . | . | . |   |   |   | .  | .  | .  |
| X2      | .              | . | . | . | . | . | . |   | . | .  | .  | .  |
| X3      | .              | . | . | . | . | . |   | . |   | .  | .  | .  |
| X4      | .              | . | . | . | . | . | . | . | . | .  | .  | .  |

| Command | Enabled by W0 |    |    |    |    | Enabled by \V1 |    |    |    |    |    |    |    | Enabled by W0 and \V1 |    |
|---------|---------------|----|----|----|----|----------------|----|----|----|----|----|----|----|-----------------------|----|
|         | 14            | 15 | 34 | 35 | 36 | 20             | 22 | 23 | 24 | 26 | 37 | 38 | 39 | 27                    | 28 |
| X0      |               |    |    |    |    | .              |    |    |    |    |    |    |    |                       |    |
| X1      | .             | .  | .  | .  | .  | .              | .  | .  | .  | .  | .  | .  | .  | .                     | .  |
| X2      | .             | .  | .  | .  | .  | .              | .  | .  | .  | .  | .  | .  | .  | .                     | .  |
| X3      | .             | .  | .  | .  | .  | .              | .  | .  | .  | .  | .  | .  | .  | .                     | .  |
| X4      | .             | .  | .  | .  | .  | .              | .  | .  | .  | .  | .  | .  | .  | .                     | .  |

| Command | Enabled by W1 |    |    |    |    |    |    |                 |   |    |    |    |    |  |
|---------|---------------|----|----|----|----|----|----|-----------------|---|----|----|----|----|--|
|         | 40            | 46 | 47 | 48 | 50 | 51 | 52 | Disabled by %C0 |   | 69 | 70 | 77 | 80 |  |
| X0      |               |    |    |    |    |    |    | .               | . | .  | .  | .  | .  |  |
| X1      | .             | .  | .  | .  | .  | .  | .  | .               | . | .  | .  | .  | .  |  |
| X2      | .             | .  | .  | .  | .  | .  | .  | .               | . | .  | .  | .  | .  |  |
| X3      | .             | .  | .  | .  | .  | .  | .  | .               | . | .  | .  | .  | .  |  |
| X4      | .             | .  | .  | .  | .  | .  | .  | .               | . | .  | .  | .  | .  |  |

If you do not enter a result code command, the modem assumes X4, W2, %C0 by default.

Whether reported codes are returned as numbers or as messages depends on what V command is in effect, as explained earlier in this section.

***Yn* (long space disconnect)**

Allows modem to recognize and respond to a long space disconnect.

**ATY0** Modem does not recognize or respond to a long space disconnect (factory setting).

**ATY1** Modem recognizes and responds to a long space disconnect.

***Zn* (reset command)**

Resets the modem and recalls a user profile.

**ATZ0** Recalls user profile 0.

**ATZ1** Recalls user profile 1.

***&Cn* (data carrier detect)**

Controls the Data Carrier Detect (DCD) signal on the serial port. The modem can be programmed to keep the DCD interchange circuit on at all times, ignoring data carrier presence or absence, or it can be programmed to turn on the DCD when a data carrier is detected. Use this command if your computer or terminal requires DCD to be OFF at certain times.

**AT&C0** DCD always ON; assumes data carrier always present (factory setting).

**AT&C1** DCD tracks presence of data carrier from the remote modem; DCD is on when data carrier is detected. Most autodial software requires this option to be set.

**&Dn (DTR control)**

The ON-to-OFF transition of DTR must last as long as the value specified in register S25 (default = 0.05 second). Positive transitions of DTR (OFF-to-ON) that occur within five seconds after disconnect are ignored. When AT&D2, AT&D3, or AT&D4 is set, DTR must be ON to autoanswer.

**AT&D0** Ignores DTR signal; DTR is not needed for autoanswer (factory setting).

**AT&D1** Enters command state when an ON-to-OFF transition of DTR is detected.

**AT&D2** Hangs up and enters command state when an ON-to-OFF transition of DTR is detected.

**AT&D3** Hangs up and resets when an ON-to-OFF transition of DTR is detected.

**AT&D4** (V.32bis modems) Delivers all buffered data, hangs up, and enters command state when an ON-to-OFF transition of DTR is detected.

**&F (restore factory settings)**

Restores the factory settings as the active configuration. The factory settings are as follows:

**V.32bis modems:** B1, E1, H0, I0, L2, M1, Q0, V1, X4, W2, Y0, &C0, &D0, &G0, &J0, &P0, &Q0, &T4, &Y0, %A0, %B14400, %C0, %E1, %M300, \A3, \C0, \G0, \H0, \J1, \K5, \N0, \Q0, \T0, \V0, \X0

**V.42 and V.42bis modems:** B1, E1, H0, I0, L2, M1, Q0, V1, X4, W2, Y0, &C0, &D0, &G0, &J0, &P0, &Q0, &T4, &Y0, %A0, %B2400, %C0, \A3, \C0, \G0, \H0, \J1, \K5, \N0, \Q0, \T0, \V0, \X0

**AT&F1 (restore second factory settings) (V.32bis modems only)**

Restores the second factory settings as active. This setting enables the error control and data compression features of the modem. The second factory settings are as follows:

`\N7, \V1, \Q1, \G1, \J0, \C2, %C1`

**&Gn (guard tone)**

Sets the guard tone. Calls within the United States do not require guard tones.

**AT&G0** Disables guard tone (factory setting).

**AT&G1** Sets guard tone on the answering modem to 550 Hz.

**AT&G2** Sets guard tone to 1800 Hz.

**&Jn (phone jack type)**

Designates the type of jack with which the modem is connected to the telephone line.

**AT&J0** RJ11, RJ41S, or RJ45S type phone jack (factory setting).

**AT&J1** RJ12 or RJ13 type phone jack.

**&Ln (dial-up line operation)**

Sets the dial-up line operation mode.

**AT&L0** Sets the line type to a dial-up line (factory setting).

**AT&L1** Sets the line type to a leased line.

**&M0 (asynchronous mode)**

Used in some modems to set the communication mode. Any value other than &M0 is not valid.

|  |  |
|--|--|
| <b>&amp;Pn (pulse dial ratio)</b>              | Controls the ratio of the off-hook (make) to on-hook (break) interval that the modem uses for pulse dialing.   |
| AT&P0  | Pulse dial make/break ratio = 39/61 for use in the United States (factory setting).  |
| AT&P1  | Pulse dial make/break ratio = 33/67 for use in the United Kingdom.   |
| <b>&amp;Qn (asynchronous/synchronous mode)</b> | Selects between the asynchronous and synchronous modes.  |
| AT&Q0  | Selects the asynchronous mode. This mode is compatible with most computer services, bulletin boards, and remote connections (factory setting).   |
| AT&Q4  | Selects Synchronous Mode 4 (Hayes autosync). In this mode, the modem I/O interface operates asynchronously and the modem translates to BISYNC or SDLC protocol on the telephone line. This is compatible with systems that emulate IBM 3780 Bisync and IBM 3270, 3770, and 5250 SNA terminals. Registers 19 and 20 affect synchronous operation. |
| <b>&amp;Rn (CTS control)</b>                   | Selects CTS control. This command only applies when the modem is set to autosync mode (&Q4).   |
| AT&R0  | CTS follows RTS when online. CTS always true in command state (factory setting).   |
| AT&R1  | CTS always true.   |



**&Sn (assume DSR  
signal)**

Controls the Data Set Ready (DSR) signal on the serial port. This setting should be left at the default (&S0) unless you know your application requires a different setting.

AT&S0      DSR always ON (factory setting).

AT&S1      In originate mode, DSR is turned on  
(V.32bis      when the answer tone is received from  
modems)      the remote modem. In answer mode,  
DSR is turned on after the modem  
sends the answer tone.

|                                  |  |
|----------------------------------|--|
| <b>&amp;Tn (diagnostic test)</b> | This is the modem's diagnostic and test facility.  |
| AT&T0                            | Ends a test in progress without terminating a connection and returns the local and remote modems to normal operation.  |
| AT&T1                            | Initiates local analog loopback. The modem should display the characters on your screen exactly as you type them.  |
| AT&T2                            | Initiates local analog loopback in answer frequency.   |
| AT&T3                            | Allows a remote modem that does not support the CCITT V.54 standard to perform a local digital loopback test with the modem.   |
| AT&T4                            | Allows the modem to respond to a remote caller's request to enter remote digital loopback mode (factory setting).  |
| AT&T5                            | Prevents the modem from responding to a remote digital loopback request.   |
| AT&T6                            | Instructs the remote modem to initiate remote digital loopback.  |
| AT&T7                            | Instructs the remote modem to initiate a remote digital loopback with self-test.   |
| AT&T8                            | Initiates remote analog loopback with self-test. The modem sends itself the CCITT V.54 test pattern and verifies these characters to make sure they are received correctly. It reports errors upon completion of the test. |

|   |  |
|---|--|
| <b>&amp;V (view configuration and profiles)</b>           | Returns the active configuration, user profiles, and stored telephone numbers. This command should not be issued in conjunction with other commands. It should be issued on a line by itself.  |
| <b>&amp;W<math>n</math> (store current configuration)</b> | Saves the storable parameters of the active configuration in memory as one of two user-defined profiles. (The <b>&amp;V</b> command displays the storable parameters.)   |
|   | <b>AT&amp;W0</b> Saves storable parameters of active configuration as user profile 0.  |
|   | <b>AT&amp;W1</b> Saves storable parameters of active configuration as user profile 1.  |
| <b>&amp;Y<math>n</math> (recall user profile)</b>         | Recalls user profiles on power-up. Either user profile can be designated as the default to recall when the modem is powered up.  |
|   | <b>AT&amp;Y0</b> Recalls user profile 0 at power-up (factory setting).   |
|   | <b>AT&amp;Y1</b> Recalls user profile 1 at power-up.   |
| <b>&amp;Z<math>n=x</math> (store phone number)</b>        | Stores dial string (phone number) $x$ in location $n$ , where $n$ is a decimal integer (0 to 3) and $x$ is a string of up to 33 characters. Valid dial string characters are 0-9, dial modifiers, and (for tone dialing) A, B, C, D, #, *. The modem ignores invalid characters. |

## Error Detection, Correction, And Data Compression Commands

**\An (maximum MNP  
blocksize)**

Sets the maximum blocksize the modem uses during an MNP reliable link. For best throughput, select a large blocksize (256 bytes). If you connect through a poor telephone connection, reducing the blocksize might improve throughput by reducing the amount of data to be retransmitted when errors occur.

ATVA0      Maximum MNP blocksize = 64 bytes.

ATVA1      Maximum MNP blocksize = 128 bytes.

ATVA2      Maximum MNP blocksize = 192 bytes.

ATVA3      Maximum MNP blocksize = 256 bytes  
(factory setting).

**\Bn (send break)**

Sends an  $n*100$  millisecond break to the remote system (default = 300 ms).

**%An (autoreliable  
fallback character)**

Sets the ASCII character recognized as the autoreliable fallback character on the answering modem, where  $n$  is a decimal integer between 0 and 127. (The factory setting is 0, meaning the autoreliable fallback character is disabled.)

Autoreliable fallback character recognition stops if the modem receives a SYN character (ASCII 22). The modem ignores the autoreliable fallback character parity bit. Note that with this command, either AT\N3, AT\N5, AT\N7, and AT\C2 must also be set.

**%Bn (modem port  
bps rate)**

When issued locally, sets the maximum modem port bps rate, where  $n = 300, 1200, 2400, 4800, 7200, 9600, 12000$  or  $14400$ . (Values of 4800 and above are valid only on V.32bis modems.) The factory setting is 2400 for V.42 and V.42bis modems and 14400 for V.32bis modems.

**\Cn (autoreliable  
buffer)**

Determines if the answering modem buffers the data that it receives from the remote modem during the 3-second interval in which it attempts to establish a reliable connection. Use this command when the answering modem is in autoreliable mode.

When AT\C1 or AT\C2 is set, reliable and normal connections may result independent of bps rate adjust. When AT\C0 is set, however, bps rate adjust affects the type of connection as follows: reliable and direct connections may result when bps rate adjust is on (ATJ1); reliable and normal connections may result when bps rate adjust is off (ATJ0).

- AT\C0 Does not buffer data during link negotiation. Switches to normal or direct mode if SYN not detected in 3 seconds (factory setting).
- AT\C1 Buffers all data on the answering modem until either 200 non-SYN characters are received or a SYN character is detected within 3 seconds. If 200 non-SYN characters are received, the modem switches to normal mode and passes the data through to the serial port. If a SYN character is detected within 3 seconds, the modem attempts to establish a reliable connection. Otherwise, the modem switches to normal mode. If the buffer fills, the modem switches to normal mode.
- AT\C2 Does not buffer data on the answering modem. Switches to normal mode upon receipt of a character defined by the AT%A command and passes that character to the serial port.



When the modem is set to autoanswer and receives calls from modems that both support and do not support MNP, use autoreliable mode and set AT\C2. This allows the modem to switch to normal mode as soon as it detects a logon character (defined by the AT%A command) from a non-MNP caller, thereby eliminating the 3-second wait.

**%Cn (compression control)**

Determines whether the modem attempts to use data compression during reliable connections. Both modems must have this command set to AT%C1 at the time the reliable connection is established. For the most efficient results, also set the bps rate adjust off (AT\J0).

AT%C0      Disables data compression (factory setting).

AT%C1      Enables V.42bis and MNP Class 5 data compression. (V.42bis data compression is not available on the V.42 modem.)

**%En (auto retrain)  
(V.32bis modems)**

When auto-retrain is enabled and line quality is too poor to sustain communications, the modem tries up to three times to resynchronize the modems before hanging up. The modem only retrains when a connection is established at 2400 bps or higher.

AT%E0      Disables the automatic retrain sequence.

AT%E1      Enables the automatic retrain sequence at 2400 bps or higher (factory setting).

**\Gn (modem port flow control)**

Sets the flow control method used to pace data sent from the remote modem to this modem during a normal mode connection.

NOTE: The reliable link has its own method of flow control and ignores the AT\G setting. However, the serial port flow control settings (AT\Qn) remain active during a reliable link.

AT\G0 Disables modem port flow control (factory setting).

AT\G1 Sets modem port flow control to XON\XOFF (the modem sends an XOFF character to stop received data and sends an XON character to resume receiving data).

**\Hn (HP ENQ/ACK support)**

Allows the modem to emulate the Hewlett-Packard ENQ/ACK protocol when an MNP reliable link is established. Flow control may be used in addition to the ENQ\ACK protocol. Data blocks should not exceed 250 characters each.

AT\H0 Disables HP ENQ/ACK protocol (factory setting).

AT\H1 Enables HP ENQ/ACK protocol during MNP reliable link. Modem emulates terminal.

AT\H2 Enables HP ENQ/ACK protocol during MNP reliable link. Modem emulates host.

Use the HP ENQ/ACK protocol as follows:

1. Set the modem at the host to AT\H1.
2. Set the modem at the terminal to AT\H2.
3. Enable either XON/XOFF (AT\Q1) or hardware (AT\Q3) flow control on the serial port on both modems to prevent data loss.
4. Establish an MNP reliable link.

NOTE: HP ENQ/ACK is not supported during V.42 LAP-M reliable connections.

### **\n (bps rate adjust)**

Controls the bps rate adjust feature. To retain the highest throughput, disable the bps rate adjust when data compression is used.

AT\J0      Disables the bps rate adjust feature.  
The serial port is independent of the rate of the connection.

AT\J1      Enables the bps rate adjust feature.  
After a connection is made, the modem adjusts the speed of the serial port to match the speed of the connection. The serial port remains at the adjusted bps rate after the connection terminates. If your computer or terminal does not automatically change to the adjusted bps rate, you must manually change the bps rate to the new setting (factory setting).

**\Kn (break control)** Determines what the modem does when it receives a BREAK from the computer or remote modem. During MNP mode, the remote modem's BREAK control setting determines how this modem handles BREAK. \K5 is the factory setting.

When the modem receives a BREAK from the local computer during LAP-M or MNP operation:

|           |   |
|-----------|---|
| AT\K0,2,4 | Modem enters the command mode (waiting for AT) without sending a BREAK to the remote modem. |
| AT\K1     | Modem does not clear the buffers, but sends a BREAK to the remote modem.                    |
| AT\K5     | Modem sends a BREAK to the remote modem in sequence with any transmitted data.              |

When the modem receives a BREAK from the remote modem during normal mode:

|         |  |
|---------|--|
| AT\K0,1 | Modem clears the terminal and modem buffers and sends a BREAK to the computer. |
| AT\K2,3 | Modem does not clear the buffers, but sends a BREAK to the computer.           |
| AT\K4,5 | Modem sends a BREAK to the computer in sequence with any data being buffered.  |

When the modem receives a BREAK from the computer during direct mode:

|           |  |
|-----------|--|
| AT\K0,1,2 | Modem sends a BREAK to the remote modem and enters the command mode. |
| AT\K3,4,5 | Modem sends a BREAK to the remote modem.                             |

NOTE: In LAP-M mode, the modem tries to preserve the break duration when transmitting it to a remote modem. MNP cannot maintain the break duration; long and short breaks are the same duration.

**%Mn (minimum  
modem port bps rate)  
(V.32bis modems)**

Sets the minimum modem port bps rate, where n=300, 1200, 2400, 4800, 7200, 9600, 12000, or 14400. Connections will not be established at a lower bps rate than set here. The factory setting is 300.

**\Nn (operating mode)**

Selects the operating mode the modem uses while in the connect state. The operating mode determines how the modem communicates with the remote system.

**AT\N0** Sets normal mode; no error correction. In normal mode, when bps rate adjust is OFF, the serial and modem ports can operate at different speeds during a connection. Flow control should be used to avoid data loss (factory setting).

**AT\N1** Sets direct mode; responds with OK; same effect as \N0. The modem does not buffer data, and flow control is ignored. In connect state, the serial port always adjusts to the speed of the connection, regardless of the setting of bps rate adjust command. The escape code sequence is disabled in direct mode if AT\J0 is set.



AT\N2

Sets reliable mode. Uses the MNP reliable link to provide error detection and automatic retransmission of data if an error occurs. This ensures that communications between your system and the remote system are error-free. The remote system must also be equipped to handle an MNP reliable link. The modem attempts to establish a reliable link immediately after making a connection. If the attempt fails, the modem disconnects.

During an MNP reliable link, you should use flow control on the modem's serial port. When the modem detects a transmission error, it holds data from the serial port in a buffer while correcting the transmission error. The remote system should also support flow control.

**NOTE:** Certain other protocols may not be timed to work with MNP and can interfere with its effectiveness.

**AT\N3** Sets autoreliable mode. This mode is designed to allow a modem to communicate with remote systems that both support and do not support the MNP reliable link. The answering modem looks for incoming MNP protocol characters from the remote modem. If it detects them within approximately three seconds, it tries to establish a reliable link connection. When the modem is set to autoanswer, you can shorten this period by using the **AT%A** command with the **AT\C2** command. You must set **AT\C2** so that the modem recognizes an incoming autoreliable fallback character. When the modem encounters this character from a remote modem, it stops waiting for an MNP protocol character and falls back to a normal connection.

**NOTE:** If both modems are set to autoreliable mode, a normal connection or no connection could result due to noise on the telephone line.

If the modem does not detect incoming MNP characters, and bps rate adjust is ON (**AT\J1**) and autoreliable buffer is OFF (**AT\C0**), the modem establishes a direct connection instead. If bps rate adjust is OFF (**AT\J0**), the modem falls back to a normal connection and uses flow control if it is enabled.

**AT\N4** Sets reliable mode using V.42 LAP-M protocol. If the modem cannot establish a V.42 LAP-M link, the call is dropped.

AT\N5 Sets autoreliable mode using V.42 LAP-M protocol. If the modem cannot establish a V.42 LAP-M link, the modems establish a connection following the same parameters as documented under AT\N3.

AT\N6 Sets reliable mode using V.42 LAP-M protocol with fallback to MNP. If the modem cannot establish a V.42 LAP-M link, the modem tries to establish an MNP reliable connection. If the modems cannot establish an MNP connection, the call is dropped.

AT\N7 Sets autoreliable mode using V.42 LAP-M protocol. If the modem cannot establish a reliable link using V.42, the modem tries MNP. If the MNP attempt also fails, the modems establish a connection following the same parameters as documented under AT\N3.

**\Qn (serial port flow control)**

Sets the type of flow control used on the serial port. If the serial port speed is faster than the modem port speed, data from your computer or terminal enters the modem faster than it is sent out. The modem holds characters in a buffer and sends them out at the slower modem port bps rate. When the buffer is full, flow control instructs your computer or terminal to stop transmitting data to the modem; the modem continues to send out the characters and empty the buffer. When there is room in the buffer, flow control instructs your computer or terminal to resume transmitting data to the modem.

For reliable connections, retransmission can reduce the effective modem port speed. If this occurs, flow control prevents buffer overflow.

Flow control is not used during direct mode connections, and the modem ignores the setting of this command.

- ATQ0      Disables flow control (factory setting).
- ATQ1      Enables bidirectional XON/XOFF flow control. Transmission is stopped by sending an XOFF character and is restarted by sending an XON character. The modem generates XON and XOFF characters at the same parity as used on the serial port. The serial port also responds to XON and XOFF characters sent to it from the local computer or terminal in the same way.
- ATQ2      Enables unidirectional hardware flow control. The modem turns CTS OFF to stop the local computer or terminal from transmitting data, and turns CTS ON to allow the local computer or terminal to resume transmitting data.
- ATQ3      Enables bidirectional hardware flow control using the CTS and RTS signals. The modem uses the CTS signal to start and stop data transmission from the local computer or terminal. When RTS is OFF, the modem stops transmitting data to the local computer or terminal. When RTS is ON, the modem resumes sending data.

- AT\Q4** Enables unidirectional XON/XOFF flow control. The modem serial port generates, but does not respond to, XON/XOFF flow control characters. This setting allows for computers to transmit data that has XON/XOFF data characters. The computer can still be set to respond to XON/XOFF flow control characters sent to it from the modem during serial port flow control.
- AT\Q5** Enables unidirectional hardware flow control, but also keeps CTS OFF until a connection is established.
- AT\Q6** Enables bidirectional hardware flow control, but also keeps CTS OFF until a connection is established.
- \Tn (inactivity timer)** Specifies the number of minutes the modem waits before automatically hanging up when data is not sent or received. The range for *n* is 0-90 with a factory setting of 0. AT\T0 disables the inactivity timer. The activity timer is only available during normal and reliable link connections. It is ignored when the modem is in direct mode.
- \Vn (MNP result code form)** Determines whether result codes indicate that a reliable link connection is in effect.
- AT\V0** Disables modified MNP result codes. The modem uses the results codes listed with the ATV command. Use AT\V0 when the communications software you are using does not expect to see a reliable link result code, even if a reliable connection is made (factory setting).



|  |       |   |
|--|-------|---|
|  | AT\V1 | Enables modified MNP result codes. The modem uses result codes 20 through 28 when a reliable connection is made. Use this setting when your software supports MNP result codes.                       |
|  | AT\V2 | Enables reliable method result codes. The modem adds -MNP or -LAP-M to reliable connections.  |
| <b>%V (display modem firmware version)</b> |       | Displays the modem firmware version.  |
| <b>\Xn (XON/XOFF pass-through)</b>         |       | Determines whether the modem passes XON/XOFF (DC1/DC3) codes through to the computer or filters them out.   |
|  | AT\X0 | Filters out all XON/XOFF codes (factory setting).   |
|  | AT\X1 | Passes XON/XOFF codes through to the computer.  |
| <b>\Z (switch to normal mode)</b>          |       | Causes the local and remote modems to switch to normal mode during a reliable link. Switching to normal mode erases all data that may be in the buffer. <b>This command is for advanced use only.</b> |
|  |       | If AT\J1 and AT\C0 are set, this command forces the modem to direct mode rather than to normal mode.  |

## Class 1 (EIA-578) Command Set

|  |   |
|--|---|
| <b>+FCLASS? (Service Class Indication)</b>             | Displays the current Class setting. The setting will be:<br>0 indicates a data modem<br>1 indicates a Class 1 fax modem   |
| <b>+FCLASS=? (Service Class Capabilities)</b>          | Displays the Classes available. The response is a list of values separated by commas. The values are those given in FCLASS?. For example, a modem that supported data communication and facsimile Class 1 would respond: "0,1". |
| <b>+FCLASS=value (Service Class Selection)</b>         | Sets the Class to the values given in FCLASS?. To configure a modem for Class 1, use the command: "AT+FCLASS=1".  |
| <b>+FTS=&lt;Time&gt; (Stop transmission and pause)</b> | Causes the modem to stop any transmission. The modem waits for the specified amount of time and sends the OK result code. Time is in 10 ms intervals in the range 0-255.  |
| <b>+FRS=&lt;Time&gt; (Wait for silence)</b>            | Causes the modem to listen and to report back an OK result code when silence has been present on the line for the amount of time specified. Time is in 10 ms intervals in the range 0-255.                                      |
| <b>+FTM=&lt;MOD&gt; (Facsimile Transmit)</b>           | Causes the modem to transmit data using the modulation selected in <MOD>, which may have the values shown in Table 3-5.   |
| <b>+FRM=&lt;MOD&gt; (Facsimile Receive)</b>            | Causes the modem to enter receive mode using the modulation specified in <MOD>, which may have the values shown in Table 3-5.   |
| <b>+FTH=&lt;MOD&gt; (HDLC Transmit)</b>                | Causes the modem to transmit data framed in the HDLC protocol using the modulation mode selected by <MOD>, which may have the values shown in Table 3-5.  |

**+FRH=<MOD>**  
**(HDLC Receive)**

Causes the modem to receive HDLC framed data using the modulation mode selected in and deliver the next received frame to the DTE. <MOD> may have the values shown in Table 3-5.

*Table 3-5. <MOD> Parameter Values*

| Value | Modulation | Speed |
|-------|------------|-------|
| 3     | V.21 ch.2  | 300   |
| 24    | V.27ter    | 2400  |
| 48    | V.27ter    | 4800  |
| 72    | V.29       | 7200  |
| 96    | V.29       | 9600  |

**NOTE:** To obtain a copy of the EIA-578 specification, contact the Electronic Industry Association, P.O. Box 57258, Washington, DC 20037-0258; telephone (202) 457-8734.

With the exception of +FCLASS, all Class 1 commands return an ERROR result code if issued when the modem is on-hook.

All Class 1 commands using the <MOD> parameter can be queried for the range of values supported. When the +FCLASS setting is a Class 1 FAX modem (+FCLASS = 1), the query syntax is: +(command) = ?

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## V.42 and V.42bis Modem Specifications

### Communication Modes

Asynchronous, MNP Classes 2-5, CCITT Group III Facsimile, Autosync

### Communication Rates and Communication Standards Supported

#### Data

300 bps Bell 103  
300 bps CCITT V.21  
1200 bps Bell 212A  
1200 bps CCITT V.22  
2400 bps CCITT V.22bis

#### FAX

2400 bps CCITT V.27ter  
4800 bps CCITT V.27ter  
7200 bps CCITT V.29  
9600 bps CCITT V.29

### FAX Compatibility

Group III, Class 1

### Error Control

V.42 LAP-M

Microcom Networking Protocol (MNP) Classes 2-4

### Data Compression

V.42bis (V.42bis/FAX modem only)

Microcom Networking Protocol (MNP) Class 5

### Command Set

Hayes "AT" command set

Microcom "AT" command subset

EIA 578 Class 1 FAX command set

### Operating Modes

Full duplex at 2400 bps and below

Half duplex for Group III Facsimile

### Flow Control

None, RTS/CTS, XON/XOFF (Stop/Start), Transparent XON/XOFF,  
HP ENQ/ACK

### Call Progress Monitoring

Dial tone, busy tone, ring detect, answer tone

Dialing Capability

Command-selectable tone or pulse dialing

Command Buffer

40 characters

Receive Levels

-9 to -43 dBm

Transmit Levels

-10 dBm to -9 dBm

Carrier Detection Level

On > -43 dBm and off < -48 dBm

Line Requirements:

Two-wire switched network (standard telephone line)

Ringer Equivalence: 0.4B

Regulatory Approvals:

FCC Part 68

CSA/DOC

UL

Registration and Approvals:

FCC # Refer to the label on the computer

DOC Certified



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## V.32bis 14400 Bps Modem Specifications

### Communication Modes

Asynchronous, Autosync, Group III FAX

### Communication Rates and Communication Standards Supported

#### Data

300 bps Bell 103  
300 bps CCITT V.21  
1200 bps Bell 212A  
1200 bps CCITT V.22  
2400 bps CCITT V.22bis  
4800 bps CCITT V.32  
7200 bps CCITT V.32bis  
9600 bps CCITT V.32  
12000 bps CCITT V.32bis  
14400 bps CCITT V.32bis

#### FAX

2400 bps CCITT V.27ter  
4800 bps CCITT V.27ter  
7200 bps CCITT V.29  
9600 bps CCITT V.29

### FAX Compatibility

Group III, Class 1

### Error Control

Microcom Networking Protocol (MNP) Classes 2 through 4 and V.42 LAP-M

### Data Compression

Microcom Networking Protocol (MNP) Class 5 and V.42bis

### Command Set

Hayes "AT" command set  
Microcom "AT" command subset  
EIA-578 Class 1 FAX command set

### Operating Modes

Full duplex at 9600 bps and below  
Half duplex for Group III facsimile

### Flow Control

None, RTS/CTS, XON/XOFF (Stop/Start), Transparent XON/XOFF,  
HP ENQ/ACK

Call Progress Monitoring

Dial tone, busy tone, ring detect, answer tone

Dialing Capability

Command-selectable tone or pulse dialing

Command Buffer

40 characters

Receive Levels

-9 to -43 dBm

Transmit Levels

-10 dBm to -9 dBm

Carrier Detection Level

On > -43 dBm and OFF < -48 dBm

Line Requirements

Two-wire switched network (standard telephone line)

Ringer Equivalence: 0.4B

Regulatory Approvals

FCC Part 68

CSA/DOC

UL

Registration and Approvals

FCC # Refer to the label on the computer

DOC Certified



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