

FAX/DATA MODEM USER'S MANUAL

Notice:

Bitcom is a registered trademark of BIT Software Inc.

BitFAX is a registered trademark of BIT Software Inc.

Crosstalk is a registered trademark of Microstuf Corporation.

Hayes is a trademark of Microcomputer Products Inc.

PCTALK is a registered trademark of Headlands Press Inc.

Smartcom is a trademark of Hayes Microcomputer Products.

Macintosh is a trademark of Apple Computer Corp.

Publication Number : ASK9706

Table of Content

i - FCC/DOC REQUIREMENTS

- i.1 FCC General Information
- i.2 FCC Notice
- i.3 DOC Notice

1 - INTRODUCTION

2 - COMMAND REFERENCE

- 2.1 General Command Information
- 2.2 AT Commands
 - 2.2.a Commands Preceded by &
 - 2.2.b Commands Preceded by #
- 2.3 Dial Modifiers
- 2.4 Commands Not Preceded By AT
- 2.5 Result Codes

3 - S REGISTER REFERENCE

- 3.1 Register Summary

4 - TESTING

- 4.1 Local Analog Loopback
- 4.2 Local Analog Loopback with Self-Test
- 4.3 Remote Digital Loopback
- 4.4 Remote Digital Loopback with Self-Test
- 4.5 Local Digital Loopback
- 4.6 Grant or Deny RDL Request from Remote Modem

5 - TROUBLESHOOTING GUIDE

6 - APPLICATION EXAMPLES

- 6.1 Dialing a Remote Modem
- 6.2 Dial a Stored Number
- 6.3 Manual Answer an Incoming Call
- 6.4 Auto Answer an Incoming Call
- 6.5 Voice to Data Switching

A - TECHNICAL SPECIFICATIONS

B - QUICK REFERENCE

C - GLOSSARY

D - ASCII CODE TABLE

i - FCC/DOC REQUIREMENTS

i.1 FCC General Information

The Federal Communications Commission (FCC) of the United States restricts specific uses of modems, and places registration responsibilities on both the manufacturer and the individual user:

1. The modem may not be connected to a party line or to a coin operated telephone.
2. The modem manufacturer must make any repairs to the modem to maintain valid FCC registration.
3. Notification to the telephone company is no longer required prior to connecting registered equipment, but upon request from the telephone company, the user shall tell the telephone company which line the equipment is connected to as well as the registration number and ringer equivalence number of the registered protective circuitry. FCC information is printed on a label on the bottom of the modem.

i.2 FCC Notice

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Subpart B of Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and uses radio frequency energy and if not installed and used the instructions, may cause interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

Shielded interconnect cables and a shielded power cord must be employed with this equipment to insure compliance with the pertinent RF emission limits governing this device. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

NOTE : The manufacturer is not responsible for any radio or T.V. interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

i.3 DOC Notice

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 telecommunications company cause to request the user to disconnect the equipment.

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

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

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

1 - INTRODUCTION

Congratulations on your purchase of this outstanding Fax/Data Modem. This manual describes how to operate your new Fax/Data Modem.

Instructions for installing your Fax/Data Modem will be found in the Installation Manual, while the information in this manual, deals exclusively with the operation of the modem after it is installed, such as the command set, the internal configuration registers, troubleshooting and testing.

Features:

These Fax/Data Modems combine the features of a 56000(receive only)/33600/28800/14400/9600 bps Data modem and a 14400/9600 bps FAX modem. Your new Fax/Data Modem gives your personal computer the ability to send and receive FAX messages over the telephone line like a standard FAX machine. Your Fax/Data Modem also allows your PC to communicate with other personal computers, terminals or BBS's (Bulletin Board Systems) through the data modem functions.

When used as a data modem your Fax/Data Modem uses the standard AT command set and is fully compatible with ITU-T V.90, V.42, V.42bis, V.34, V.32bis, V.32, V.22bis, V.23, V.22, V.21, MNP 2-5, Bell 103, 212A, and x2 (upgradable to ITU-T 56Kbps when available). When used as a Fax/Data Modem it communicates with all ITU-T Group 3 FAX machines and is compatible with ITU-T V.27ter and V.29, V.17, T.4 and T.30. Switching between DATA mode operation and FAX mode operation of your Fax/Data Modem is done through its firmware, no hardware settings are required.

If you are already familiar with the use of a modem and the Hayes AT command set, this modem will be extremely easy for you to use. Just read the installation procedures in the installation manual and you are ready to begin operation. If you are new to modem communications, we recommend that you read through this manual first. If you come across terms that you don't understand, consult the glossary. Words in boldface type are command names, commands, or default settings. Carriage returns (Enter) are noted with <CR> or [ENTER]; this does not mean to enter these characters literally; but instead to press the Enter key.

The communication software which should be used depends on the kind of machine that you are going to communicate with. If you are going to call a FAX machine then you must use the Fax software. If the machine that you are going to communicate with is a modem then you must use a data modem communications software.

This manual is written to be used for several models of Fax/Data Modems. Some of the information in this manual may not apply to your fax/data modem.

2 - COMMAND REFERENCE

This chapter provides an alphabetized reference with examples for all commands for the modem. The system of commands is depicted below in Figure 2-1.

To use these commands for dialing or configuring the modem, make sure the communications software package you will be using lets you operate the modem through its internal commands. If your software permits use of the modem's internal commands, read this chapter. If not, read your software user's manual and ignore the rest of this manual.

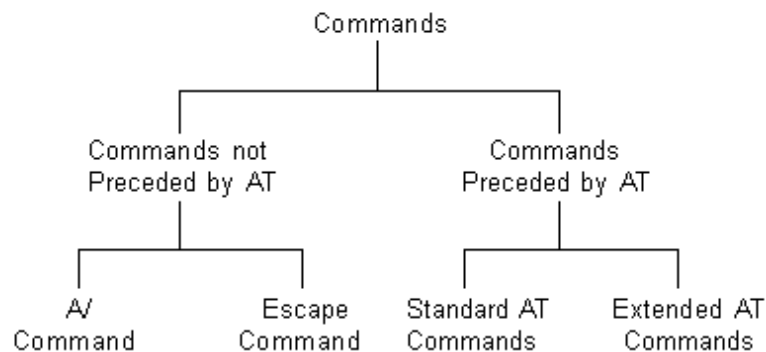


Fig.2-1 System of Commands

2.1 General Command Information

Except for the **A/** command and the **+++** escape command described in Section 2.4, all commands must be prefixed with the attention code **AT**. For instance, the **A** command (below) would be entered as: "**AT A<CR>**". Without the **AT** prefix, the command line cannot be executed. Once entered, **AT** cannot be deleted with the **Backspace** or **Delete** key.

More than one command can be placed on a single line, if desired, separated with spaces for readability. Once the carriage return (**Enter**) key is pressed, the command line is executed. A line with no carriage return is ignored.

The modem accepts either upper or lower case characters in the command line and ignores any spaces within or between commands. Typing errors can be corrected with the **Backspace** key. Exceptions are noted in the description of specific commands.

Variables (*r* and *x*) are listed in italics. Punctuation symbols (**,** **;** **!** **@**) use as dial modifiers are listed alphabetically according to their English names at the beginning of Section 2.3. Where two commands are separated by a slash, either command will have the same effect. For example, if the command is listed as **B0/B**, issuing either **B0** or **B** will have the same effect.

2.2 AT Commands

\$ Display a Basic Command List

Online Help.

A Go On-line in Answer Mode

This command instructs the modem to go off-hook immediately and then make a handshake with the remote modem. Handshaking is not available during leased line operation.

A is usually used to manual answer an incoming call or to switch from voice conversation to data communication, pressing any key aborts the operations.

Bn Select Protocol to 300 bps or 1200 bps

B0 or B Selects ITU-T V.25 answer sequence, once the command line prefix **AT** has been entered at the 300 bps or 1200 bps data rate. (default)

B1 Selects BELL 300 or BELL 212A protocol once the command line prefix **AT** has been entered at the 300 or 1200 bps data rate.

Dn Go On-Line in Originate Mode

Dials the Specified Phone Number. Includes the following:

P Pulse (rotary) dial.

T Tone dial. (default)

, (Comma) Two-second pause; linked to **S8** register.

; (Semicolon) Return to Command mode after dialing;

! (Exclamation point) Flashes the switch hook.

/ Delay for 125 msec. before proceeding with dial string.

W Wait for second dial tone (X3 or higher); linked to **S6** register.

@ Dials, waits for quiet answer, and continues (X3 or higher).

R Originates call using answer (reverse) frequencies.

#,* Extended touch tone pad tones.

L Dials the last-dialed number.

Sn Dials the phone number string stored in NVRAM at position n (n=0-3). Phone numbers are stored with the **&Zn=s** command.

\$ Displays a list of dial commands.

En Command Echo

E0/E Disables command echo.

E1 Enables command echo. (default)

Fn Sets Online Local Echo of Transmitted Data ON/OFF

F0 Local echo ON. Modem sends a copy of data it sends to the remote system to your screen.

F1 Local echo OFF. Receiving system may send a remote echo of data it receives. (default)

Hn Hang Up

- H0/H** Goes on-hook (hangs up).
- H1** Goes off-hook (ready to dial).

In Identification

Displays the following information.

- I0** Product code.
- I1** Results of ROM checksum.
- I2** The modem tests RAM by writing and reading alternating hex bytes 55h and AAh into the RAM and returns a response (ERROR or OK) to the DTE.
- I3** Product type.
- I4** Current modem setting.
- I5** Nonvolatile memory (NVRAM) setting.
- I6** Link diagnostics.
- I7** Product configuration.
- I9** Plug-and-Play feature.
- I11** Diagnostics. One screen of data is sent to the DTE which contains the following information pertaining to the last link.

Ln Control Speaker Volume

- L0/L** Low volume.
- L1** Low volume.
- L2** Medium volume. (default)
- L3** High volume.

Mn Monitor Speaker On/Off

- M0/M** Speaker is always off.
- M1** Speaker ON until CONNECT. (default)
- M2** Speaker is always on.
- M3** Speaker ON after dial, until CONNECT.

On Return to On-Line Data Mode

- O0** Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE to the remote modem after an escape (+++). back
- O1** Enters on-line data mode with a retrain before returning to on-line data mode.

P Set Pulse Dial as Default

Causes the modem to assume that all subsequent dial commands are pulse dials. You may omit the " P " from the dial strings.

Q Result Code Display

Displays result codes.

- Q0** Displays result codes. (default)
- Q1** Quiet mode; no result codes.
- Q2** Displays result codes when in the answer mode.

Sn Reading and Writing to S Registers

- Sn?** Reads S Registers:
 Reads the contents of the S register specified by 'n'.

Sn=x Writing to Registers:
 Writes the value of x to the specified S register. All the registers will return the OK response if x is a legal value. However some registers will not actually write the value; these are: **S1**, **S13-S15**, **S20-S24**, and **S27**. (n=0-95, x=0-255).

- S\$** Display a list of the S-Registers.

T Set Tone Dial as Default

Causes the modem to assume that all subsequent dial commands are tone dial.

Vn Select Word or Digit Result Codes

- V0/V** Displays result codes in digital format.
- V1** Displays result codes in verbose format. (default)

Xn Extended Result Codes

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands.

ATX selects and deselects result codes and call progress options according to the result codes in Table 2-1.

Table 2-1 Result Codes

Result Code	Argument						
	X0	X1	X2	X3	X4	X5	X6
0/OK	X	X	X	X	X	X	X
1/CONNECT	X	X	X	X	X	X	X
1/CONNECT 28000		X	X	X	X	X	X
1/CONNECT 29333		X	X	X	X	X	X
2/RING	X	X	X	X	X	X	X
3/NO CARRIER	X	X	X	X	X	X	X
4/ERROR	X	X	X	X	X	X	X

5/CONNECT 1200	X	X	X	X	X	X
5/CONNECT 30666	X	X	X	X	X	X
5/CONNECT 32000	X	X	X	X	X	X
5/CONNECT 33333	X	X	X	X	X	X
6/NO DIAL TONE		X		X		X
7/BUSY			X	X	X	X
8/NO ANSWER*			X	X	X	X
9/RESERVED						
10/CONNECT 2400	X	X	X	X	X	X
10/CONNECT 34666	X	X	X	X	X	X
11/RINGING				X	X	X
13/CONNECT 9600	X	X	X	X	X	X
13/CONNECT 38666	X	X	X	X	X	X
18/CONNECT 4800	X	X	X	X	X	X
18/CONNECT 36000	X	X	X	X	X	X
20/CONNECT 7200	X	X	X	X	X	X
20/CONNECT 37333	X	X	X	X	X	X
21/CONNECT 12000	X	X	X	X	X	X
21/CONNECT 40000	X	X	X	X	X	X
25/CONNECT 14400	X	X	X	X	X	X
25/CONNECT 41333	X	X	X	X	X	X
43/CONNECT 16800	X	X	X	X	X	X
43/CONNECT 42666	X	X	X	X	X	X
85/CONNECT 19200	X	X	X	X	X	X
85/CONNECT 44000	X	X	X	X	X	X
91/CONNECT 21600	X	X	X	X	X	X
91/CONNECT 45333	X	X	X	X	X	X
99/CONNECT 24000	X	X	X	X	X	X
99/CONNECT 46666	X	X	X	X	X	X
103/CONNECT 26400	X	X	X	X	X	X
103/CONNECT 48000	X	X	X	X	X	X
107/CONNECT 28800	X	X	X	X	X	X
107/CONNECT 49333	X	X	X	X	X	X
151/CONNECT 31200	X	X	X	X	X	X
151/CONNECT 50666	X	X	X	X	X	X
155/CONNECT 33600	X	X	X	X	X	X
155/CONNECT 52000	X	X	X	X	X	X
212/CONNECT 53333	X	X	X	X	X	X
216/CONNECT 54666	X	X	X	X	X	X
220/CONNECT 56000	X	X	X	X	X	X

* Requires @; replaces NO CARRIER

Table 2-2 contains some special dialing functions. These functions are activated by the value of the ATX command. Note that neither *adaptive dialing* nor *fast dialing* can operate unless the ATX command is programmed for it. The second (*wait for second dial tone*) and third functions (*wait for answer*) implement a fixed delay only if the ATX command is not programmed for them.

Table 2-2 Special Dialing Functions

Dialing Function	X0	X1	X2	Argument		X5	X6
Adaptive dialing			X	X3	X4	X	X
Wait for second dial tone (W)				X	X	X	X
Wait for answer (@)			X	X	X	X	
Fast dialing			X		X		X

Arguments	0-7
0	Basic subset is selected (see Table 2-1).
1	Extended subset is selected (see Table 2-2). (default)
2-6	Advanced call progress codes are selected (see Table 2-1).
7	Reserved.
If no argument is given, an argument of 0 is assumed.	

Yn Selects Power-On/Reset Default Configuration

Y0/Y	NVRAM configuration 0. (default)
Y1	NVRAM configuration 1.
Y2	Factory configuration 0.
Y3	Factory configuration 1.
Y4	Factory configuration 2.

Zn Reset Modem

Z0/Z	Resets modem to NVRAM profile selected by Y command.
Z1	Resets modem to NVRAM profile 0.
Z2	Resets modem to NVRAM profile 1.
Z3	Resets modem to factory default profile 0. (&F0)
Z4	Resets modem to factory default profile 1. (&F1)
Z5	Resets modem to factory default profile 2. (&F2)

2.2.a Commands Preceded by &

&\$ Displays a List of Ampersand (&) Commands

&An Enables/Disables ARQ Codes

&A0	ARQ result codes disabled.
&A1	ARQ result codes enabled.
&A2	V.32 modulation indicator added.
&A3	Protocol indicators added LAPM/MNP/NONE (error control) and V.42bis/MNP5 (data compression). (default)

&Bn Sets Modem's Serial Port Rate

&B0	Variable, follows connection rate.
&B1	Fixed serial port rate. (default)
&B2	Fixed in ARQ mode, variable in non-ARQ mode.

&Cn Select DCD Options

&C0/&C	Maintains an ON status for the Data Carrier Detect (DCD).
&C1	Uses the actual state of the carrier from the remote modem for DCD. (default)

&Dn DTR Option

Controls Data Terminal Ready (DTR) Operations.

- &D0** DTR override.
- &D1** DTR toggle cause online command mode.
- &D2** Normal DTR operations. (default)

&F Fatch Factory Configuration

Loads a Read-Only (Non-Programmable) Factory Configuration.

- &F0** Generic template.
- &F1** Hardware flow control template.
- &F2** Software flow control template.

&Gn Set Guard Tone

- &G0** No guard tone. (default)
- &G1** 550 Hz guard tone.
- &G2** 1800 Hz guard tone. U.K. require B0 setting.

&Hn Sets Transmit Data (TD) Flow Control

- &H0** Flow control disabled.
- &H1** Hardware flow control. Clear to Send(CTS). (default)
- &H2** Software flow control, XON/XOFF.
- &H3** Hardware and software flow control.

&In Sets Receive Data (RD) Software Flow Control

- &I0** Disables flow control (XON/XOFF) of received data. All ASCII characters are transparent to the modem except the escape sequence. (default)
- &I1** The modem responds to XON/XOFF characters defined in the S22 and S23 registers, respectively, and passes the characters to the remote DCE.
- &I2** The modem responds to XON/XOFF characters defined in the S22 and S23 registers, respectively, but does not pass the characters to the remote DCE.
- &I3** Enables Hewlett Packard host mode. The modem receives an ENQ (decimal 05 ASCII) character every 80 characters from the host by the RS-232 line and returns an ACK (decimal 06 ASCII) character to the host by the RS-232 line under two conditions:
 - 1)The modem responds immediately if the transmit buffers are empty.
 - 2)The modem responds with ACK if the transmit buffers are 90% full, and responds with ACK when the transmit buffers fall below 30% full.
- &I4** Enables Hewlett Packard terminal mode. The modem receives an ENQ from the remote DCE and passes it to the DTE. The modem sends no further data to the DTE until it responds with an ACK.
- &I5** Enables special flow control.

&Kn Enables/Disables Data Compression

&K0	Data compression disabled.
&K1	Auto enable/disable. (default)
&K2	Data compression enabled.
&K3	MNP5 compression disabled.

&Mn Sets Error Control (ARQ)

1200 bps and higher.

&M0	Normal mode, error control disabled.
&M1	Reserved.
&M2	Reserved.
&M3	Reserved.
&M4	Normal/ARQ. (default)
&M5	ARQ mode.

&Nn Sets Connect Speed

If connection cannot be established at this speed, the modem will hang up. Sets ceiling connect speed if &Un is greater than 0. See &Un.

&N0	Variable rate. (default)
&N1	300 bps.
&N2	1,200 bps.
&N3	2,400 bps.
&N4	4,800 bps.
&N5	7,200 bps.
&N6	9,600 bps.
&N7	12,000 bps.
&N8	14,400 bps.
&N9	16,800 bps.
&N10	19,200 bps.
&N11	21,600 bps.
&N12	24,000 bps.
&N13	26,400 bps.
&N14	28,800 bps.
&N15	31,200 bps.
&N16	33,600 bps.

&N17	28,000 bps.
&N18	29,333 bps.
&N19	30,666 bps.
&N20	32,000 bps.
&N21	33,333 bps.
&N22	34,666 bps.
&N23	36,000 bps.
&N24	37,333 bps.
&N25	38,666 bps.
&N26	40,000 bps.
&N27	41,333 bps.
&N28	42,666 bps.
&N29	44,000 bps.
&N30	45,333 bps.
&N31	46,666 bps.
&N32	48,000 bps.
&N33	49,333 bps.
&N34	50,666 bps.
&N35	52,000 bps.
&N36	53,333 bps.
&N37	54,666 bps.
&N38	56,000 bps.
&N39	57,333 bps.

&Pn Select Pulse Dialing Make/Break Ratio

&P0/&P Sets a 39/61 make/break ratio @ 10 pps - used in USA. (default)

&P1 Sets a 33/67 make/break ratio @ 10 pps.

&Rn Sets Receive Data (RD) Hardware Flow Control, Request to Send (RTS) (see also &In)

&R0 Reserved.

&R1 Modem ignores RTS.

&R2 Received Data to computer only on RTS.

&Sn Controls Data Set Ready (DSR) Operations

Determines whether DSR operates in accordance with the EIA-232-D specification or remains ON

&S0 DSR is always ON. (default)

&S1 DSR will become active after answer tone has been detected and inactive after the carrier has been lost.

&Tn Testing and Diagnostics (See Chapter 4)

Begins test modes.

&T0 Ends testing.

&T1 Initiates analog loopback.

&T2 Reserved.

&T3 Initiates local digital loopback.

&T4 Enables remote digital loopback.

&T5 Prohibits remote digital loopback. (default)

&T6 Initiates remote digital loopback.

&T7 Initiates remote digital with self-test and error detector.

&T8 Initiates analog loopback with self-test and error detector.

&Un Sets Floor Connect Speed

Sets floor connect speed when &Un is set greater than 0, &Un is the ceiling connect speed. See &Nn (28.8 modems only).

&U0 Disabled. (default)

&U1 300 bps.

&U2 1,200 bps.

&U3 2,400 bps.

&U4 4,800 bps.

&U5 7,200 bps.

&U6 9,600 bps.

&U7 12,000 bps.

&U8 14,400 bps.

&U9 16,800 bps.

&U10 19,200 bps.

&U11 21,600 bps.

&U12 24,000 bps.

&U13 26,400 bps.

&U14	28,800 bps.
&U15	31,200 bps.
&U16	33,600 bps.
&U17	28,000 bps.
&U18	29,333 bps.
&U19	30,666 bps.
&U20	32,000 bps.
&U21	33,333 bps.
&U22	34,666 bps.
&U23	36,000 bps.
&U24	37,333 bps.
&U25	38,666 bps.
&U26	40,000 bps.
&U27	41,333 bps.
&U28	42,666 bps.
&U29	44,000 bps.
&U30	45,333 bps.
&U31	46,666 bps.
&U32	48,000 bps.
&U33	49,333 bps.
&U34	50,666 bps.
&U35	52,000 bps.
&U36	53,333 bps.
&U37	54,666 bps.
&U38	56,000 bps.
&U39	57,333 bps.

&Wn Store the Current Configuration to Nonvolatile RAM

&W0	Writes the current active configuration to profile 0 in nonvolatile RAM.
&W1	Writes the current active configuration to profile 1 in nonvolatile RAM.

&Yn Sets Break Handling

&Y0/&Y	Destructive, but doesn't send break.
&Y1	Destructive, expedited. (default)
&Y2	Nondestructive, expedited.

&Y3 Reserved.

&Zn=s Writes Phone Number Strings to NVRAM at Position n (n=0-3)

&Zn=L Writes Last Executed Dial String to NVRAM at Position n (n=0-3)

&Zn? Displays the Phone Number Stored at Position n (n=0-3)

&ZL? Displays the Last Executed Dial String

<Ctrl>C Cancels the display of the help screens.

<Ctrl>K Cancels the display of the help screens.

<Ctrl>S Stops/restarts help screens.

2.2.b Commands Preceded by

#CID= n

n=0 Caller ID OFF. (default)

n=1 Formatted Caller ID.

n=2 Unformatted Caller ID.

2.3 Dial Modifiers

This section describes all of the dial modifiers which are used in dial strings.

@ Answer

"@", placed after a phone number, this modifier tells the modem to wait for 5 seconds of silence before dialing the next number in the dial string. @ is usually used to access a secure computer system that provides a silent answer as permission for further entrance.

, Pause

",", placed anywhere in the dial string, tells the modem to pause for the number of seconds specified by S-register S8 before processing the rest of the dial string.

! Initiate a Hookflash

!", placed anywhere in the dial string, tells the modem to initiate a hookflash, which means to hang up for 0.5 seconds and then go off-hook again before processing the rest of the dial string. This modifier allows access to PBX features like call transferring .

; **Return to Command State after Dialing**

";", which must be placed at the end of the dial string, returns to the command state after dialing the number placed ahead of it. A long telephone number would overflow the 40 character command buffer if placed all in one command line, so it must be broken into two or more command lines. Each part includes part of the number, and all but the last command line end with the ";" followed by a carriage return.

L **Re-dial Last Number**

The modem will re-dial the last valid telephone number. The **L** must be immediately after the **D** with all the following characters ignored.

P **Pulse Dialing**

P, placed ahead of a number, tells the modem to dial a number using pulse dialing.

S **Dial a Stored Number**

S is used to dial one of four numbers stored in nonvolatile memory. For example, instead of entering a dial string, you can use this command:

Command: **ATDTS=1<CR>**

T **Touchtone Dialing**

T, placed ahead of a number, tells the modem to dial a number using touchtone dialing.

W **Wait for Dialtone**

W, placed after a number, tells the modem to wait up to 30 seconds to detect a one-second continuous dialtone before dialing the next number. **W** is most often used in a PBX system to wait for the dialtone of an outside telephone line.

2.4 Commands Not Preceded by AT

Two commands, **A/** and **+++**, are neither preceded by the attention code **AT** nor followed by a carriage return.

A/ **Repeat Command**

A/ repeats the execution of the last command line stored in the command buffer. If the last command line is invalid, the ERROR result code will appear on the screen. Note that **A/** cannot be preceded by **AT**; if it is, ERROR will appear on the screen.

+++ **Escape**

+++ returns to the on-line command state (command state without breaking the established connection) from the on-line state.

To escape, stop transmitting data, wait at least one escape guard time (the default time is one second), and then enter three consecutive escape characters (the default character is +). After one more escape guard time (one second), the modem returns to the command state and sends the **OK** result code to the screen. Note that the escape command is the only command that can be recognized by the modem in the on-line state; it cannot be recognized in the command state.

2.5 Result Codes

The codes below are comprehensive.

AT&A0 disables or AT&A1 enables the /ARQ codes shown below. A setting of ATX1 or greater is required to enable the result codes. The default is AT&A1 (the /ARQ codes, messages 05 to 94, enabled). Setting the S27 register to 128 results in codes for connections 7200 and above being displayed as 9600 messages.

14/CONNECT/ARQ (valid only when X is set to 0)
15/CONNECT 1200/ARQ
16/CONNECT 2400/ARQ
19/CONNECT 4800/ARQ
24/CONNECT 7200/ARQ
17/CONNECT 9600/ARQ
22/CONNECT 12000/ARQ
26/CONNECT 14400/ARQ
47/CONNECT 16800/ARQ
88/CONNECT 19200/ARQ
94/CONNECT 21600/ARQ
100/CONNECT 24000/ARQ
104/CONNECT 26400/ARQ
108/CONNECT 28800/ARQ
152/CONNECT 31200/ARQ
156/CONNECT 33600/ARQ
181/CONNECT 32000/ARQ
185/CONNECT 36000/ARQ
189/CONNECT 40000/ARQ
193/CONNECT 44000/ARQ
197/CONNECT 48000/ARQ
201/CONNECT 49333/ARQ
205/CONNECT 50666/ARQ
209/CONNECT 52000/ARQ
213/CONNECT 53333/ARQ
217/CONNECT 54666/ARQ
221/CONNECT 56000/ARQ

Use AT&A2 and a setting of ATX1 or greater to substitute the following 4800 and 9600 bps result codes shown below. These codes display the call's modulation, x2, VFC, or V32, as well as ARQ or non-ARQ status.

120/CONNECT 2400/V34
38/CONNECT 4800/V32
124/CONNECT 4800/V34
40/CONNECT 7200/V32

128/CONNECT 7200/V34
33/CONNECT 9600/V32
132/CONNECT 9600/V34
41/CONNECT 12000/V32
136/CONNECT 12000/V34
45/CONNECT 14400/V32
139/CONNECT 14400/VFC
140/CONNECT 14400/V34
143/CONNECT 16800/VFC
144/CONNECT 16800/V34
147/CONNECT 19200/VFC
148/CONNECT 19200/V34
97/CONNECT 21600/VFC
111/CONNECT 21600/V34
101/CONNECT 24000/VFC
113/CONNECT 24000/V34
105/CONNECT 26400/VFC
115/CONNECT 26400/V34
109/CONNECT 28800/VFC
117/CONNECT 28800/V34
153/CONNECT 31200/V34
157/CONNECT 33600/V34
182/CONNECT 32000/x2
186/CONNECT 36000/x2
190/CONNECT 40000/x2
194/CONNECT 44000/x2
198/CONNECT 48000/x2
202/CONNECT 49333/x2
206/CONNECT 50666/x2
210/CONNECT 52000/x2
214/CONNECT 53333/x2
218/CONNECT 54666/x2
222/CONNECT 56000/x2
122/CONNECT 2400/ARQ/V34
39/CONNECT 4800/ARQ/V32
126/CONNECT 4800/ARQ/V34
44/CONNECT 7200/ARQ/V32
130/CONNECT 7200/ARQ/V34
37/CONNECT 9600/ARQ/V32
134/CONNECT 9600/ARQ/V34
42/CONNECT 12000/ARQ/V32
138/CONNECT 12000/ARQ/V34
46/CONNECT 14400/ARQ/V32
141/CONNECT 14400/ARQ/VFC
142/CONNECT 14400/ARQ/V34
145/CONNECT 16800/ARQ/VFC
146/CONNECT 16800/ARQ/V34
149/CONNECT 19200/ARQ/VFC
150/CONNECT 19200/ARQ/V34
98/CONNECT 21600/ARQ/VFC
112/CONNECT 21600/ARQ/V34
102/CONNECT 24000/ARQ/VFC
114/CONNECT 24000/ARQ/V34
106/CONNECT 26400/ARQ/VFC
116/CONNECT 26400/ARQ/V34
110/CONNECT 28800/ARQ/VFC

118/CONNECT 28800/ARQ/V34
154/CONNECT 31200/ARQ/V34
158/CONNECT 33600/ARQ/V34
183/CONNECT 32000/ARQ/x2
187/CONNECT 36000/ARQ/x2
191/CONNECT 40000/ARQ/x2
195/CONNECT 44000/ARQ/x2
199/CONNECT 48000/ARQ/x2
203/CONNECT 49333/ARQ/x2
207/CONNECT 50666/ARQ/x2
211/CONNECT 52000/ARQ/x2
215/CONNECT 53333/ARQ/x2
219/CONNECT 54666/ARQ/x2
223/CONNECT 56000/ARQ/x2

Use AT&A3 and a setting of ATX1 or greater to display LAPM, or MNP and data compression for the V42bis and MNP5 protocols.

CONNECT 56000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 54666/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 53333/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 52000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 50666/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 49333/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 48000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 44000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 40000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 36000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 32000/ARQ/x2/LAPM/V42BIS (or MNP/MNP5)
CONNECT 33600/ARQ/V34/LAPM/V42BIS (or MNP/MNP5)
CONNECT 31200/ARQ/V34/LAPM/V42BIS (or MNP/MNP5)
CONNECT 28800/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 26400/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 24000/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 21600/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 19200/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 16800/ARQ/(V34 or VFC)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 14400/ARQ/(V32, VFC or V34)/LAPM/V42BIS (or MNP/MNP5)
CONNECT 12000/ARQ/V32/LAPM/V42BIS (or MNP/MNP5)
CONNECT 9600/ARQ/V32/LAPM/V42BIS (or MNP/MNP5)
CONNECT 7200/ARQ/V32/LAPM/V42BIS (or MNP/MNP5)
CONNECT 4800/ARQ/V32/LAPM/V42BIS (or MNP/MNP5)
CONNECT 2400/ARQ/MNP/MNP5 (or LAPM/V42BIS)
CONNECT 2400/NONE
CONNECT 1200/ARQ/MNP/MNP5 (or LAPM/V42BIS)

3 - S REGISTER REFERENCE

Your modem has status registers. These registers are memory locations inside your odem which control your modem's operation. You usually do not have to worry bout setting any register because the default values work for most applications.

The S registers are summarized in Fig. 3-1, along with their default values. Registers denoted with an "*" may be stored in one of the two user profiles by entering the **&Wn** command. One of these profiles may be loaded at any time by using the **Zn** command.

The factory default values are stored in ROM and are loaded into the active configuration at power-up or by the **Zn** command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the **&Yn** command, where 'n' is one of the two possible user profiles. The factory defaults can be loaded at any time by entering the **&F** command.

3.1 S Register Summary

Table 3-1 summarizes the S registers.

Table 3-1 S Registers

S Register	Description
S0	Sets the number of rings on which to answer when modem is set to auto answer mode (default=0).
S1	Stores the number of rings received. (default=0).
S2	Stores the ASCII decimal code for the escape code (+) character. (default=43)
S3	Stores the ASCII decimal code for the carriage return <cr> character. (default=13)
S4	Stores the ASCII decimal code for the line feed <lf> character. (default=10)
S5	Stores the ASCII decimal code for the backspace character <bs>. (default=8)
S6	Contains the time (number of seconds) that the modem waits before executing a dial string. (default=2)
S7	Stores the time (in seconds) that the modem waits to receive a carrier signal after executing a dial string or answering before returning on-hook and sending a NO CARRIER response code to the DTE. (default=60)
S8	Stores the time (in seconds) for the pause option (,) in the dial command.
S9	Stores the time (in tenths of a second) that the modem waits to receive a carrier signal before recognizing a valid connection (default=6). Note that the modem ignores settings greater than 2400 bps due to the length of handshaking sequences.
S10	Stores the time (in tenths of a second) that the modem waits after the loss of a carrier before disconnecting. (default=7)
S11	Stores the duration and spacing (in milliseconds) of dialed touch tones. (default=70)
S12	Stores the duration (in fiftieths of a second) for the guard time of the escape sequence. (default=50)
S13	Options register (default=0). Bit-mapped options are selected/deselected by the binary representation of the following decimal values: 1 Resets the modem when the DTR is not asserted.

- 2 Resets the non-MNP transmit buffer from 1.5K bytes to 128 bytes.
- 4 Sets the backspace key to delete.
- 8 Autodials the number stored in NVRAM location 0 when the DTR is asserted
- 16 Autodials the number stored in NVRAM location 0 if the software is reset or when the modem is powered up.
- 32 Disables V.32bis ASL mode.
- 64 Disables quick retrains.
- 128 Disconnects on the escape code.

S14 Reserved.

S15 Contains the ARQ options register (default=0). Bit-mapped options are selected/deselected by the binary representation of the following decimal values:

- 1 Disables ARQ/MNP for V.22.
- 2 Disables ARQ/MNP for V.22bis.
- 4 Disables ARQ/MNP for V.32/V.32bis/V.32terbo.
- 8 Disables MNP handshake.
- 16 Disables MNP level 4.
- 32 Disables MNP level 3.
- 64 MNP incompatibility. When S15=64, it performs the following:
 - * Increases time allowed to establish connection with some modem manufacturer's products by 1 second.
 - * Changes MNP link identifier from a Texas Instruments standard to generic for compatibility with some modem manufacturer's products.
 - * Eliminates remote end echo; this prevents connecting to itself if the remote DCE echoes the MNP link request.
 - * Changes the delay of some control characters for compatibility with some modem manufacturer's products.
- 128 Disables V.42 operation.

S16 Contains the test mode (default=0) settings as follows:

- 1 Reserved.
- 2 Dial test. When a touch tone digit is entered from the DTE in a dial string, the tone continues until a carriage return character from the DTE aborts it (for testing purposes).
- 4 Test pattern generation. A test pattern is generated by the modem and sent out over the phone link. Pressing any key terminates this function.
- 8-128 Reserved.

S17 Reserved.

S18 Stores the time (in seconds) for the diagnostics test mode, &T. A value of 0 disables the timer; a value of 1-255 is acceptable. (default=0)

S19 Stores the duration (in minutes) for the inactivity timer. If the modem senses no data transmission for a period of time exceeding the nonzero value in this register, it disconnects the call. A value of 0 disables the function (default=0). All other values enable it.

S20 Reserved.

S21 Stores the lengths (in 10-ms increments) of break characters sent from the modem to the DTE (default=10). This is used in MNP or V.42 mode only.

S22 Stores the ASCII decimal code for the XON character. (default=17)

S23	Stores the ASCII decimal code for the XOFF character. (default=19)
S24	Reserved.
S25	Set the duration, in hundredths of a second, that DTR must be dropped so that the modem doesn't interpret a random glitch as a DTR loss. (This register is useful for setting compatibility with older systems running under older operating software. Default value = 20).
S26	Reserved.
S27	<p>Connected bit-mapped operations. Contains various modulation and error correction control flags. (default=0)</p> <ul style="list-style-type: none"> 1 V.21/Bell 103 mode select. (default=Bell 103) 2 Enables unencoded modulation in V.32 mode. 4 Disables V.32 modulation. 8 Disables 2100Hz answer tone. 16 Enables V.23 fallback mode. 32 Disables V.32bis mode. 64 Reserved. 128 Software compatibility mode. All connect messages equal to or greater than 9600 bps are expressed as CONNECT 9600.
S28	<p>V.32 handshaking time. (0-25.5 seconds)</p> <ul style="list-style-type: none"> 0 Eliminates the V.32 answer tones for faster connection. 8 Default time all times are in tenths of a second. 255 Disables all connections, except V.32 9600 bps.
S29	V.21 answer mode fallback timer (in one-tenth-second intervals, default=20).
S31	TAD audio level adjust. (default=128)
S32	<p>Connect bit-mapped operations. Contains various modulation and call control flags. (default=2)</p> <ul style="list-style-type: none"> 1 V.8 call indicate enable. (default=off) 2 Enables V.8 mode. 4 Reserved. 8 Disables V.34 modulation. 16 Disables V.34+ modulation. (Note some modem references show reserved) 32 Disables x2 modulation. 64 Disables V.90 modulation. 128 Reserved.
S33	<p>V.34 & V.34+ connection-setup bit-mapped control flags. (default=0)</p> <ul style="list-style-type: none"> 1 Disables 2400 symbol rate. 2 Disables 2743 symbol rate. 4 Disables 2800 symbol rate. 8 Disables 3000 symbol rate. 16 Disables 3200 symbol rate. 32 Disables 3429 symbol rate. 64 Reserved. 128 Disables shaping.

S34	V.34 & V.34+ connection-setup bit-mapped control flags. (default=0) 1 Disables 8S-2D trellis encoding. 2 Disables 16S-4D trellis encoding. 4 Disables 32S-2D trellis encoding. 8 Disables 64S-4D trellis encoding. 16 Disables nonlinear coding. 32 Disables TX level deviation. 64 Disables preemphasis. 128 Disables precoding.
S35	Reserved.
S36-S37	Reserved.
S38	Sets an optional delay (in seconds) before the modem is forced to hang up and clear the transmit buffer, when the DTR drops during an ARQ call. This allows time for a remote modem to acknowledge receipt of all transmitted data before it is disconnected (default=0). The modem immediately hangs up when the DTR drops.
S39	Reserved for international usage.
S40	Reserved for international usage.
S41	Distinctive Ring options. (default=0) 1 Distinctive Ring Enable 2 Reserved 4 Reserved 8 Reserved 16 Reserved 32 Reserved 64 Reserved 128 Reserved
S42	Bit Mapped. (default=0) Bits 0-2 GPI definition (Macintosh Only): 000=not active 001=CD signal 010=RI signal 011=DSR signal 100=ARQ signal 101=undefined 110=undefined 111=undefined Bits 3-7 Reserved

4 - TESTING

The modem provides five testing features to identify fault location when transmission quality is not good: local digital loopback, local analog loop back, local analog loopback with self-test, remote digital loopback, and remote digital loopback with self-test. These tests are initiated with the **&Tn** command described in Chapter 2.

4.1 Local Analog Loopback

The local analog loopback test checks the integrity of the local computer or terminal and the local modem. During the test, the local modem internally loops data sent from the local computer or terminal back to the same computer or terminal as shown in Figure 4-1. During the test, data is not transmitted to the remote modem.

If characters are looped correctly during this test, both the modem and the local computer or terminal are functioning correctly. If incorrect characters appear on the screen, either the local computer or terminal or the local modem is in error.

To perform a local analog loopback, put the local modem in the command state. If it is on-line, issue the escape command + + +, to return to the command state.

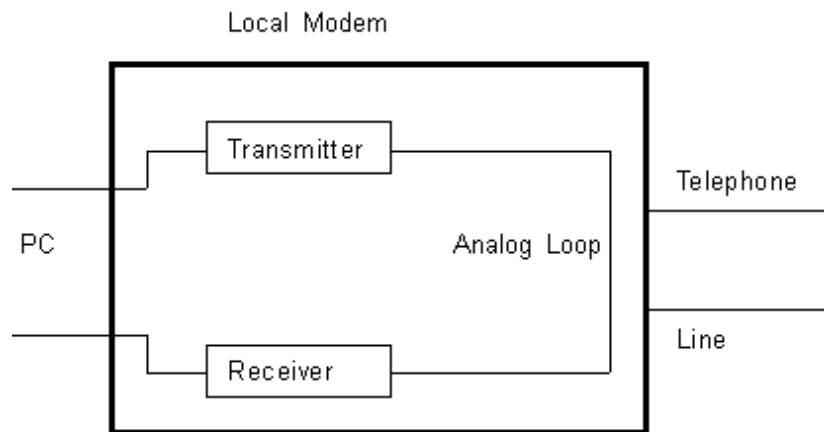


Fig. 4-1 Data Path for Local Analog Loopback

Example 1 - test timer disabled

Command: **AT&M0<CR>**
ATS18=0&TI <CR>

Result: **CONNECT 33600/V34/NONE**

Test message: **THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG**
1234567890

Escape: **+ + +**
(return to the on-line command state)

Result code: **OK**

Command: **AT&T0 <CR>** (end the test)

Result code: **OK**

Here, the test timer is disabled and the modem sets up an internal analog loop as shown in Figure 4-1. When the loopback is established, the modem goes on-line and the test message (any character you type)

is looped back on the screen for verification. Finally, +++ returns the modem to the command state and **&T0** ends the test and breaks the internal analog loop.

The following command sequence is the same as the previous one except that the test timer is set to 60 seconds. At the end of the test time, the timer expires, the test ends, and the test result is reported.

Example 2 - test timer enabled

Command: **AT&M0<CR>**
ATS18=60&T1<CR>

Result: **CONNECT 33600/V34/NONE**

Test message: **THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG**
1234567890

Escape: **+++**

Result code: **OK**

4.2 Local Analog Loopback with Self-Test

The local analog loopback with self-test checks the integrity of the local modem. In this test, an internally generated data pattern of alternate binary ones and zeros (reversals) at the selected bit rate is looped through the internal analog loop inside the local modem to an internal error counter as shown in Figure 4-2. An error count of 255 indicates that 255 or more errors were detected.

Example-the test timer is disabled and 12 errors are found during the test.

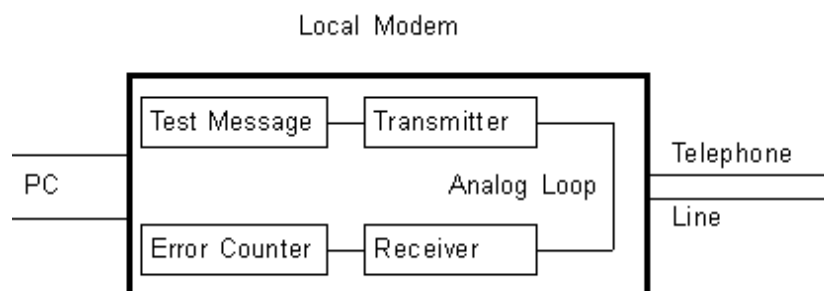


Fig. 4-2 Local Analog Loopback with Self-test

Command: **AT&M0<CR>**
ATS18=0&T8<CR>

Result: **OK**

Command: **AT&T0<CR>** (ends the test)

Test result: **000**

Result code: **OK**

4.3 Remote Digital Loopback

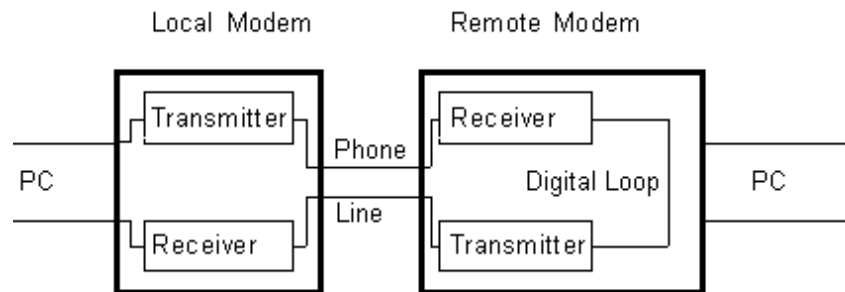


Fig.4-3 Data Path for Remote Digital Loopback

The remote digital loopback test checks the integrity of the local computer or terminal, the local modem, the telephone line, and the remote modem. During the test message is sent from the local computer through the local modem to the remote modem and looped through the remote digital loop inside the remote modem back to an internal error counter as shown in Figure 4-3.

During this test, data is not transmitted to the remote computer or terminal. If characters are looped correctly, the local computer or terminal, the local modem, the telephone line and the remote modem are all operating correctly.

To start a remote digital loopback, first make sure the modem is on-line with a remote modem.

Below, in the second command line, the timer is inactive, in the third command line, the test timer is activated for 60 seconds.

LOCAL

Command: **AT&M0<CR>**

Result: **OK**

Command: **ATDT1234** (dial remote number)

Result: **CONNECT 57600** (DTE set values)

Escape: **+++**

Result: **OK**

Command: **AT&T6<CR>**

Result: **CONNECT 28800**

Test message: **THIS IS MODEM TEST**

Escape: **+++**

Result: **OK**

Command: **AT&T0<CR>**

Result: **OK**

REMOTE

Command: **AT&M0S0=1&T4**

Result: **CONNECT 57600** (DTE set values)

4.4 Remote Digital Loopback with Self-Test

The remote digital loopback with self-test checks the integrity of the local modem, telephone line, and the remote modem. In this test, the modem activates an internal test pattern generator. A test data stream is sent over the telephone line to the remote modem and looped through a remote digital loop to an internal error counter in the local modem as shown in Figure 4-4.

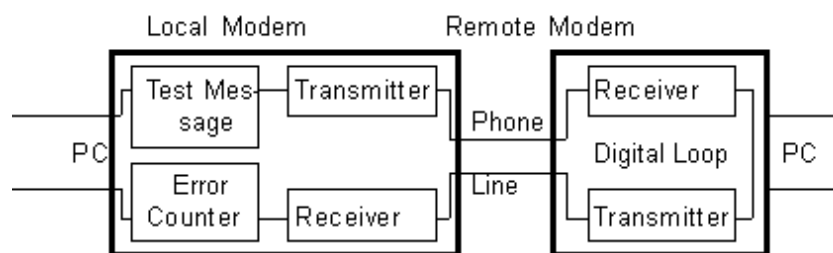


Fig. 4-4 Remote Digital Loopback with Self-test

To perform the remote digital loopback with self-test, first make sure that the modem is on-line to the remote modem. The modem can be either in the originating mode or in the answer mode.

Example - the test timer is set and the test is performed with no errors

LOCAL

Command: **AT&M0<CR>**

Result: **OK**

Command: **ATDT1234** (dial remote number)

Result: **CONNECT 57600** (DTE set values)

Escape: **+++**

Result: **OK**

Command: **ATS18=10&T7**

Result: **OK**
 000
 OK

Command: **AT&T0**

Result: **OK**

REMOTE

Command: **AT&M0S0=1**

Result: **CONNECT 57600** (DTE set values)

4.5 Local Digital Loopback

Local digital loopback checks the integrity of the remote modem and the phone line if the remote user suspects either to be the cause of transmission errors.

During this test the modem loops data internally sent from the remote modem back to the remote modem as shown in Figure 4-5. During the test, data is not received by the local personal computer. Local digital loopback is useful when a remote modem is unable to request a remote digital loopback.

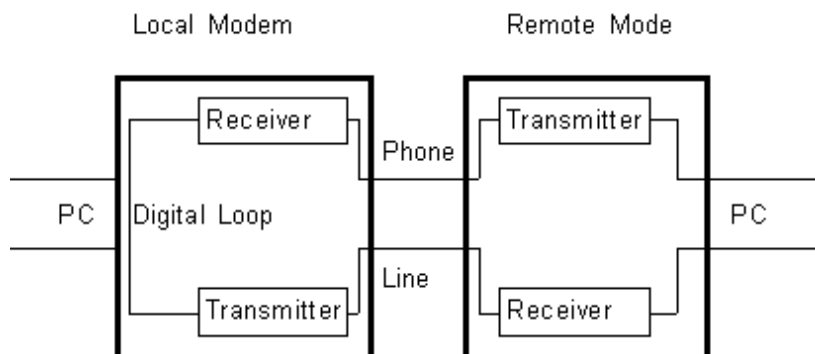


Fig. 4-5 Data Path for Local Digital Loopback

To start a local logical loopback first make sure that the modem is on-line with a remote modem. The modem can be in either the originate or answer modem.

Example -To implement a local digital loopback test

Command: **AT&M0**

Result: **OK**

Command: **ATDT1234** (dial remote number)

Result: **CONNECT 57600** (DTE set values)

Escape: **+++**

Result: **OK**

Command: **AT&T3**

Result: **OK**

REMOTE

Command: **AT&M0S0=1**

Result: **CONNECT 57600** (DTE set values)

Test message: **THIS IS MODEM**

Escape: **+++**

Result: **OK**

Command: **AT&T0**

Result: **OK**

4.6 Grant or Deny RDL Request from Remote Modem

The modem can grant a request from the remote modem for a remote digital loopback test with the **&T4** command (default). Once the modem grants the request, it sets up an internal digital loop as in Figure 4-5. When the remote modem terminates the remote digital loopback test by sending a termination sequence. The modem breaks the external digital loop.

The modem can deny the request for a remote digital loopback test with the **&T5** command. To set **&T5** as the default, issue:

Command: **AT&T5&W<CR>**

Result Code: **OK**

5 - TROUBLESHOOTING GUIDE

This chapter describes common problems in the installation, configuration and regular usage of your Fax/Data Modem. To test the Fax/Data Modem, a communication software package is needed and the package must include a mode that allows you to operate your Fax/Data Modem by directly issuing internal commands to the modem.

Follow the procedures in the following sections to resolve these common problems:

No Response From Your Modem

1. If you are using the internal add-on card modems, make sure that the COM port address you have set your modem to corresponds to the appropriate selection in the communications software which you are using.

2. Issue the **ATZ** command to reset your modem. The returned result code should be "0" or "OK" depending on what communications program you are using. Your modem is OK if you get one of these responses. If there is no response after issuing the **ATZ<CR>**, continue to the next step.
3. Check if there are any other interface cards in your computer that use the same COM port address as your modem. If so, you must set your modem to another COM port address. (Keep in mind that on most systems, only two COM ports are available. One of them must be used as either 1 or 3, while the other must be used as 2 or 4.) For example, if a mouse is set to COM 1, your modem should be set to COM2 or COM4. Continue to the next step if the COM port address is OK.
4. Issue the command: **AT&F1&W <CR>**, if a "0" or "OK" result code is displayed on the screen, your modem is OK. Otherwise, contact your dealer for assistance.

Your Modem Does Not Dial Out

Make sure that your modem responds normally as described in section 4.1. If you can communicate through the keyboard, check whether the modem is properly connected to the phone line.

Your Modem Does Not Connect After It Has Dialed a Phone Number

The problem may have several causes. The phone line may be too noisy or the telephone cord may be poor. Try the line with a regular phone. Also the remote modem may not recognize your modem's baud rate.

Your Can't Transmit After You Have Connected to the Remote Modem

In this case, check the communication parameters of the remote modem, then configure your software to the same number of data bits, stop bit, and parity.

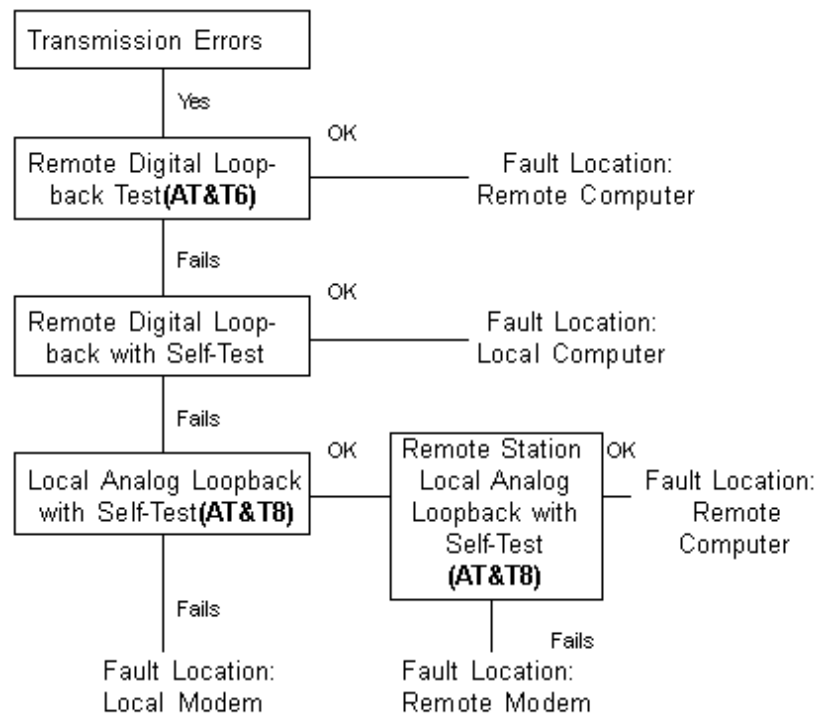


Fig. 5-1 Troubleshooting Flowchart

Finding the Source of Transmission Errors

A failure in modem communication is usually characterized by unacceptably high error rates or a total inability to communicate; it may be the fault of the local computer or terminal, the local modem, the telephone line, the remote modem or terminal. Figure 5-1 gives an algorithm for finding the source of errors.

If you have any further questions or problems, please contact your dealer.

6 - APPLICATION EXAMPLES

6.1 Dialing a Remote Modem

Command line: ATDP9WT002, (886)-7128423<CR>

This command line instruct the modem to dial a remote modem through a PBX. The modem first use pulse dialing to dial 9 (the access code of the PBX), wait for outside dial tone, and then use touch tone dialing to dial 002 once a one-second continuous dial tone is detected within 30 seconds, pause for 2 seconds (if S8=2) and then dial 8867128423.

6.2 Dial a Stored Number

Command line: AT&Z2=T03,709394<CR>

Command line: **ATDS2<CR>**

The first command line store the dial string T03, 709394 to the 3rd location in NVRAM. Afterwards you can use the second command line to dial this stored number. The dial string T03, 709394 will appear on the screen to indicate the number being dialed.

6.3 Manual Answer an Incoming Call

Command line: **ATA <CR>**

The factory setting of the S-register S0 is S0=0. This condition disables the auto answer capability so that you must issue an ATA command to answer a call. At power up, your modem always monitors if there are incoming rings. If incoming rings are detected, your modem will display result codes on the screen as :

```
RING
:
:
RING
```

Seeing that, you may issue the ATA command to answer the call. This command must be entered within the quiet interval between any two rings.

6.4 Auto Answer an Incoming Call

Command line: **AT S0=2 &W &Y <CR>**

Auto answer can be enabled by changing the setting of the S-register S0 to a value between 1 and 255. In the above command line, S0=2 instructs the modem to answer an incoming call automatically after the 2nd ring. The &W command writes this configuration to profile 0 in NVRAM. &Y command instruct the modem to load profile 0 as the active configuration on power-up. The last two commands make S0=2 the default value at power-up or reset.

This example also shows the insertion of space between two neighboring commands to make the command line more readable.

6.5 Voice to Data Switching

Command line: **ATA <CR> or ATX1D <CR>**

If you are talking with a remote modem user through the telephone set and want to initiate data communication with the remote modem, follow the procedures below:

1. You or the remote user issue an ATA command first to switch to data communication.
2. When the person on the other end hears an answer tone from the phone, issues an ATX1D command (X1 to disable the dial tone monitor) to instruct the modem to go off-hook and wait for a carrier. If connection is successful, the CONNECT XXXX result code will be displayed on the screen. Now you can hang up your phone and begin data communication with the remote modem.

A - TECHNICAL SPECIFICATIONS

Speeds (bps)

300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200, 21600, 24000, 26400, 28800, 31200, 33600,

28000, 29333, 30666, 32000, 33333, 34666, 36000, 37333, 38666, 40000, 41333, 42666, 44000, 45333, 46666, 48000, 49333, 50666, 52000, 53333, 54666, 56000 (ITU-T V.90)

Protocol

(Data) x2, ITU-T V.90, V.34+, V.32 bis, V.32, V.22 bis, V.23, V.22, V.21, Bell 212A and 103

(Fax) ITU-T V.17, V.29, V.27 ter, and V.21

Error Checking

100% reliable data transfer with V.42 bis/MNP 2-4

Data Compression

V.42 bis, MNP5

Standards

Enhanced 'AT' command set, Fax Class 1 & Class 2.0 command

Modulation

57.3K, 56K, 54.6K, 53.3K, 52K, 50.6K, 49.3K, 48K, 44.6K, 45.3K, 44K, 42.6K, 41.3K, 40K, 38.6K, 37.3K, 36K, 34.6K, 33.3K, 32K, 30.6K, 29.3K, 28K bps. (ITU-T V.90/X2)	PCM
33.6K, 31.2K, 28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200, 4800 bps. (V.34+)	TCM
14.4K, 12K, 9600, 7200, 4800 bps. (V.32bis)	TCM
9600 bps. (V.32)	TCM, QAM
4800 bps. (V.32)	QAM
14.4K, 12K, 9600, 7200 bps. (V.17)	TCM
9600, 7200 bps. (V.29)	QAM
4800, 2400 bps. (V.27 ter)	DPSK
2400, 1200 bps. (V.22 bis)	QAM
1200/75 bps. (V.23)	FSK
1200 bps. (V.22/Bell 212 A)	DPSK
300 bps. (V.21/Bell 103)	FSK

Operation

Full-or Half-duplex 33600 bps with 31200, 28800, 26400, 24000, 21600, 19200, 14400, 9600, 4800, 2400 and 1200 bps auto fallback.

Test Modes

Analog loopback, local digital loopback, and remote digital loopback

Audio Monitor

Built-in speaker, with software-controllable volume control

Guard Tone

550/1800 Hz

Compatibility:

ITU-T V.90/X2	57.3K, 56K, 54.6K, 53.3K, 52K, 50.6K, 49.3K, 48K, 46.6K, 45.3K, 44K, 42.6K, 41.3K, 40K, 38.6K, 37.3K, 36K, 34.6K, 33.3K, 32K, 30.6K, 29.3K, 28K bps
V.34+	33.6K, 31.2K, 28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200, 4800 bps.
ITU-T V.32bis	14.4K, 12K, 9600, 7200, 4800 bps.
ITU-T V.32	9600, 4800 bps.
ITU-T V.22 bis	2400, 1200 bps.
ITU-T V.23	1200/75 bps (V.23).
Bell 212A	1200 bps. (also ITU-T V.22)
Bell 103	300 bps. (also ITU-T V.21)
ITU-T V.17	14.4K, 12K, 9600, 7200 bps.
ITU-T V.29	9600, 7200 bps.
ITU-T V.27 ter	4800, 2400 bps.

Compliance

FCC Part 15&68

Command Buffer

40 characters

Phone Directory

4 x 36 digits

Transmit Level

-11±1dBm

Receive Sensitivity

-40±3dBm

Pulse Dialing Specifications

	USA	International
Make/Break Ratio	39/61	33/67
Break Length	61ms	67ms
Dial Pulse Length	100m	100ms
Dial Pulse Rate	10pps	10pps
Interdigit Time	800ms	800ms

B - QUICK REFERENCE

AT Commands

\$_____ Display a Basic Command List

A Go On-line in Answer Mode

Bn Select Protocol to 300 bps or 1200 bps

D Go On-line in Originate Mode

En Command Echo

Fn Sets Online Local Echo of Transmitted Data ON/OFF.

Hn Hang Up

In Identification

Ln Control Speaker Volume

Mn Monitor Speaker On/Off

Nn Automode Enable

On Return to On-line Data Mode

P Set Pulse Dial as Default

Q Result Code Display

Sr=n Sets Register r to n

Sn? Displays Contents of S-Register n

S\$ Displays a List of the S-Registers

T Sets Tone Dial

Vn Select Word or Digit Result Codes

Xn Extended Result Codes

Yn Select ther Default Profile

Zn Reset

&\$ Displays a List of Ampersand (&) Commands

&An Enables/disables ARQ codes

&Bn Sets Modem's Serial Port Rate

&Cn Select DCD Options
&Dn DTR Option
&F Fetch Factory Configuration
&Gn Set Guard Tone
&Hn Sets Transmit Data (TD) Flow Control
&In Sets Receive Data (RD) Software Flow Control
&Kn Enable/disable Data Compression
&Mn Sets Error Control
&Nn Sets Connect Speed
&Pn Select Pulse Dialing Make/Break Ratio
&Rn Sets Receive Data (RD) Hardware Flow Control
&Sn Controls Data Set Ready (DSR) Operations
&Tn Testing and Diagnostics (See Chapter 4)
&Un Sets Floor Connect Speed
&Wn Store the Current Configuration to Nonvolatile RAM
&Yn S Sets Break Handling
&Zn=s Writes Phone Number String s to NVRAM at Position n (n=0-3)
&Zn=L Writes Last Executed Dial String to NVRAM at Position n (n=0-3)
&Zn? Displays the Phone Number Stored at Position n (n=0-3)
&ZL? Displays the Last Executed Dial String
#CID Caller ID
DL Re-dial Last Number
DSn Dial a Stored Number
D\$ Display a List of Dial Commands
A/ Repeat Command
+++ Escape

Dial Modifier

Dn Dials the Specified Phone Number

P	Pulse (rotary) dial.
T	Tone dial. (default)
,	(Comma) Two-second pause; linked to S8 register.
;	(Semicolon) Return to Command mode after dialing;
!	(Exclamation point) Flashes the switch hook.
/	Delay for 125 msec. before proceeding with dial string.
W	Wait for second dial tone (X3 or higher); linked to S6 register.
@	Dials, waits for quiet answer, and continues (X3 or higher).
R	Originates call using answer (reverse) frequencies.
#,*	Extended touch tone pad tones.

C- GLOSSARY

ASCII - An acronym for American Standard Code for Information Exchange. ASCII is a seven-bit code which defines 128 standard characters, including control characters, letters, numbers, and symbols. An extra 128 characters comprise the extended ASCII set.

Baud Rate - The transmission rate between two serial devices, e.g., modems, fax machines, etc. Measured in Bits Per Second.

Blind Dialing - In blind dialing, the modem continues to dial, regardless of the existence of a dialtone, ring, or busy signal.

BPS - Bits Per Second; the number of bits that can be transmitted in one second.

Carrier Signal - The analog data signal that a modem sends over telephone wires.

ITU-T - International Telecommunication Unit - Telecommunication on Telegraphy and Telephony. This committee establishes standards for international telecommunications, including modems and fax machines.

COMx - Where (x = 1, 2, 3, or 4), COMx is the name(address) of serial communications ports on personal computers. Each serial port in a personal computer has a different number.

CTS - Clear To Send.

Default - The assumed value that is used for a command parameter when no other value is explicitly provided.

DCD - Data Carrier Detect.

DCE - Data Communication Equipment.

DTE - Data Terminal Equipment.

DTMF - Dual Tone Multifrequency(for touchtone dialing).

DTR - Data Terminal Ready.

FSK - Frequency Shift Keying.

Make/Break Ratio - The ratio of the off-hook (make) to on-hook (break) interval is the make/break ratio in pulse dialing.

Modem - A combination of the words MOdulator and DEModulator. Modems transform digital data into analog signals and back again.

Nonvolatile Memory - An area of memory inside the modem where the default configuration profile is stored. Values recorded in this memory will not be lost when the power is turned off.

Off-Hook - The condition when the modem has picked up the telephone line.

Off-Line Command State - A modem state in which the modem accepts, interprets and executes commands from an asynchronous computer or terminal.

On-Hook - The condition when the modem has not picked up the telephone line; the telephone is hung up.

On-Line - A carrier signal link with a remote modem has been established; communication is in progress.

On-Line State - A modem state in which the modem is connected with a remote modem. Data can be sent or received from the remote modem in this state. No commands will be accepted from the modem except the escape command which will bring the modem into the on-line command state.

On-Line Command State - A modem state in which the modem can accept or execute commands from an asynchronous computer or terminal while remaining connected with the remote modem. The user can return the modem to the on-line state by issuing the **AT0n** command or put it into the off-line command state by issuing command such as **ATZ** or **ATH**.

Parity - An error-checking method by which the modem verifies that the data just sent is correct.

pps - Pulse per second.

Profile - A list of default settings.

Protocol - A technical specification for serial communications; the protocols supported by the modem are listed in Appendix B.

PSK - Phase Shift Keying.

Pulse Dialing - A dialing form in which each digit is represented by a series of pulses. Rotary telephones all use pulse dialing.

QAM - Quadrature Amplitude Modulation.

Result Codes - The response the modem returns to the screen upon executing a command.

RAM - Random Access Memory.

ROM - Read-Only Memory. A chip inside the modem which stores the factory default settings. This memory cannot be changed.

RTS - Request To Send.

RX - Reception.

S Register - RAM locations in the modem which store the active configuration.

Serial Port - See COMx.

TCM - Trellis-Coded Modulation.

Touchtone Dialing - A dialing format in which each digit is represented by a musical frequency.

TX - Transmission.

ASCII CODE TABLE

Decimal	Hex	Value	Decimal	Hex	Value	Decimal	Hex	Value	Decimal	Hex	Value
000	00	NUL	032	20	(space)	064	40	@	096	60	'
001	01	SOH	033	21	!	065	41	A	097	61	a
002	02	STX	034	22	"	066	42	B	098	62	b
003	03	ETX	035	23	#	067	43	C	099	63	c
004	04	EOT	036	24	\$	068	44	D	100	64	d
005	05	ENQ	037	25	%	069	45	E	101	65	e
006	06	ACK	038	26	&	070	46	F	102	66	f
007	07	BEL	039	27	'	071	47	G	103	67	g
008	08	BS	040	28	(	072	48	H	104	68	h
009	09	HT	041	29	)	073	49	I	105	69	i
010	0A	LF	042	2A	*	074	4A	J	106	6A	j
011	0B	VT	043	2B	+	075	4B	K	107	6B	k
012	0C	FF	044	2C	,	076	4C	L	108	6C	l
013	0D	CR	045	2D	-	077	4D	M	109	6D	m
014	0E	SO	046	2E	.	078	4E	N	110	6E	n
015	0F	SI	047	2F	/	079	4F	O	111	6F	o
016	10	DLE	048	30	0	080	50	P	112	70	p
017	11	DC1	049	31	1	081	51	Q	113	71	q
018	12	DC2	050	32	2	082	52	R	114	72	r
019	13	DC3	051	33	3	083	53	S	115	73	s
020	14	DC4	052	34	4	084	54	T	116	74	t
021	15	NAK	053	35	5	085	55	U	117	75	u
022	16	SYN	054	36	6	086	56	V	118	76	v
023	17	ETB	055	37	7	087	57	W	119	77	w
024	18	CAN	056	38	8	088	58	X	120	78	x
025	19	EM	057	39	9	089	59	Y	121	79	y
026	1A	SUB	058	3A	:	090	5A	Z	122	7A	z
027	1B	ESC	059	3B	;	091	5B	[	123	7B	{
028	1C	FS	060	3C	<	092	5C	\	124	7C	|
029	1D	GS	061	3D	=	093	5D	]	125	7D	}
030	1E	RS	062	3E	>	094	5E	^	126	7E	~
031	1F	US	063	3F	?	095	5F	_	127	7F	DEL