IBM 7852 Model 400
External Data/FAX Modem

Technical Reference

OPTIONS
by IBM

First Edition (August 1996)

The following paragraph does not apply to the United Kingdom or any country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This publication could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time.

It is possible that this publication may contain reference to, or information about, IBM products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that IBM intends to announce such IBM products, programming, or services in your country.

Requests for technical information about IBM products should be made to your IBM reseller or IBM marketing representative.

© Copyright International Business Machines Corporation 1996. All rights reserved.
Note to U.S. Government Users — Documentation related to restricted rights — Use, duplication or disclosure is subject to restrictions set forth in GSA ADP Schedule Contract with IBM Corp.

Contents

© Copyright IBM Corp. 1996

Chapter 1: Introduction and Description

Introduction

This manual is divided into 6 chapters with several appendices following. The appendices repeat much of the information contained in the chapters, but are in a more condensed form.

Description

Chapter 2 - Software Configuration

Chapter 2 documents communication software configuration recommended specifically for the IBM 7852-400. There is also some discussion of how to identify the limitations and capabilities of your computer before the software installation is done. Other issues covered include setting up initialization strings, changing default parameters, configuring software for the remote system and file transfer protocols.

Chapter 3 - AT Command Mode Operation

This may be the most important chapter of the manual. It begins with an introduction and discussion on Command Mode fundamentals. Next there is a summary of the modem's commands and responses. We then go into a detailed explanation of each IBM 7852-400 command, providing examples where applicable.

Chapter 4 - S-Registers

Chapter 4 covers the IBM 7852-400 's S-Registers, which enable the user to establish, read, and modify various modem options. All of the S-Registers are charted and explained, followed by instructions on accessing the S-Registers and reading or changing their values.

Chapter 5 - DIP-Switch Settings

The IBM 7852-400 printed circuit board options are covered in this chapter. Sixteen DIP-Switch settings, a berg jumper and the modem's speaker volume control are explained in detail, including all default settings.

© Copyright IBM Corp. 1996

Chapter 6 - FAX operation

This chapter discusses the use of the IBM 7852-400 for faxing. AT commands are discussed and their responses are detailed.

FAX Appendix A - Sample DCE Control Sessions

FAX Appendix B - Alphabetic Index of Commands, Parameters and Responses

Appendix A - ASCII/HEX/Decimal Conversion Chart

Appendix B - Command Summary

Appendix C - S-Register Summary

Appendix D - Result Code Summary

Appendix E - V.25bis Operation

Appendix F - RS232C Interface Specifications

Appendix G - IBM 7852-400 Systems' Escape Methods

Chapter 2: Software Configuration

Introduction

Since your communications software configuration is affected by the capabilities of your computer, this chapter begins with a discussion of the limitations of some serial ports and how to identify them. It then discusses communications configuration in general and recommends settings specifically for the IBM 7852-400.

Serial Port Limitations

When you configure your software, you need to consider how the hardware on both ends of the connection will affect the connection. Some serial ports, particularly those in older PC-compatible computers, may limit the performance of the IBM 7852-400. You should know if yours is one of them.

The limiting factor is an integrated circuit called a Universal Asynchronous Receiver/Transmitter or *UART* All data from your modem flows through it. The UARTs typically used in PC-compatible computers are types 8250, 8250A, 16450, and 16550AFN. The 8250 is unreliable above 9,600 bps, and the 8250A and 16450 are unreliable above 19,200 bps.If the modem sends data to the UARTs above those speeds, the UARTs may not be able to process the data fast enough to keep from losing some of it. The 16550AFN, however, can safely handle data to 115,200 bps.

When a modem communicates with V.42bis 4-to-1 compression enabled, it sends up to four times as much uncompressed data to the serial port as it receives compressed over the telephone line. Therefore, a modem communicating at 14,400 bps may require a serial port that can reliably transfer data at four times 14,400 bps, or 57,600 bps; at 19,200 bps it may require one that works reliably up to four times 19,200 bps, or 76,800 bps; and at 28,800 and 33,600 bps it may require one that works reliably up to a maximum of 115,200 bps. If your serial port cannot handle these speeds, we recommend that you replace your present serial card with one that has a 16550AFN UART or equivalent.

© Copyright IBM Corp. 1996

How Can You Identify Your UART Type?

If you have MS-DOS 6.0 or later, you can find your UART type from a diagnostic program called *MSD* To use it, type **MSD** at the DOS prompt. After the opening screen, select COM Ports.... The last line of the report tells you what type UART you have for each COM port. MSD does not distinguish between the 8250 and the 8250A. However, if you have an IBM AT or newer computer, you likely have an 8250A or 16450 UART installed, both of which are reliable to 19,200 bps. If you would like more detailed information about your UART than MSD can provide, you can download shareware UART identification programs from the IBM Communications Forum on CompuServe, or from a local BBS.

The 16550 UART and Windows 3.1

Windows 3.1 may cause a loss of data when communicating at high speed, even with a 16550 UART installed. Because Windows is multitasking it switches between several programs running at the same time, it can make the serial port wait briefly while Windows performs other tasks. Meanwhile, incoming data can be lost. The older 8250A and 16450 UARTs can store data in a one-byte first in-first out (FIFO) buffer (a memory area in the UART in which the first bit in is the first out), but once the buffer is full, the data is lost. The 16550 has a 16-byte FIFO buffer, which accounts for much of its high speed. However, in Windows 3.1, the 16550's FIFO buffer is disabled by default. To enable the buffer, use Notepad to open the SYSTEM.INI file in your Windows directory, and add the following line to the [386Enh] section:

COMnFIFO=1

where n is the number of the COM port the 16550 is installed on. For example, if the 16550 is installed on COM2, the line should be:

COM2FIFO=1

After you save SYSTEM.INI you must restart Windows for the change to take effect.

However, there is another problem when the FIFO buffer is enabled: Windows cannot recognize the COM port because of a bug in the Windows 3.1 serial port driver, COMM.DRV. The only way around this problem is to replace the COMM.DRV file in the WINDOWS\SYSTEM directory with another driver. Several drivers are available commercially or on BBSs that will solve this problem. A freeware driver called CyberCom is available as CYBERC.ZIP on CompuServe in the IBM

Communications Forum, Library 0. CyberCom will enable Windows communications at speeds up to 115,200 bps if you have a 16550 UART installed.

Configuring Your Software

Communications software must be configured to work with your modem, your computer, and the remote system it is calling. Fortunately, most communications programs make the process easy by providing a default *initialization string* for your modem as well as defaults for most of the other required parameters.

Configuring Software for Your Modem

Because remote computers may have different connection requirements such as speed, number of bits, parity, log-on sequences, etc., communications software is typically configured by *sessions* , each session having a unique configuration for a given connection (e.g., to a BBS or commercial online service). Most communications programs, however, have a separate modem configuration menu because modem configurations rarely change from session to session.

The most important configuration is the modem *initialization string*. This is a sequence of commands the software uses to configure the modem when the communications software is loaded or when a session begins. Always begin the initialization string with the *AT*tention command **AT**, then follow it with the modem reset command, **&F** Issuing a reset command before other commands ensures that you are starting with a known state.

The rest of the commands in the initialization string depend on the capabilities of the modem and what you want it to do. Some older communications programs require you to create the initialization string by yourself. Most modern communications programs, however, provide you with a ready-made initialization string that is automatically selected when you choose your modem model from a list. It is a poor idea to use an initialization string intended for another modem, especially one from another manufacturer, because modem capabilities and command implementations vary from modem to modem. However, if your IBM 7852-400 does not appear on a modem list, you may use the MultiModemII initialization string from MultiTech.

PC Initialization Strings

We recommend the following initialization string for a IBM 7852-400 connected to a PC-compatible computer when sharing a line with a telephone:

AT &F X4 S0=0 ^M

This string resets the IBM 7852-400 to the factory default settings, selects extended result codes with *NO DIAL TONE* and *BUSY*, and turns off auto-answer. **^M** must end every string sent to the modem from software. It is the ASCII code for the RETURN key on most keyboards, and the default code for the carriage return character in the IBM 7852-400 and most communications programs. The carriage return character is defined in the IBM 7852-400 in S-register **S3**; if you change it, you must also change the carriage return character code used in your communications software. If you send a command directly to the modem in terminal mode rather than indirectly through communications software, you must end the command string by pressing the RETURN key (<CR>) instead of adding **^M** to the string.

The following initialization string is for a IBM 7852-400 on a telephone line that functions solely as a *DATA LINE:*

AT &F X4 S0=2 ^M

Changing Default Parameters

By default, the IBM 7852-400 will answer after the first ring and try to communicate with a modem on the other end of the line. If you have one telephone line for voice, fax, and modem communications, the IBM 7852-400 may attempt to answer all incoming calls, voice as well as data. To change auto-answer to default off, open your communications program and type the following string in the terminal window:

AT &F S0=0 &F9 &W0 <CR>

This string selects the factory default parameters, then turns auto-answer off and stores that setting, along with all other current parameters, in nonvolatile memory. The **&F9** command causes the modem to load the values from nonvolatile memory the next time it receives the **&F** command. You will use the same initialization string as before:

AT &F X4 ^M

But now the IBM 7852-400 will load the values stored in nonvolatile memory when you turn on the modem and when you issue the **ATZ** or **AT&F** reset commands. (Note: Because it clears the command buffer, you should not use **ATZ** in an initialization string.)

Other Parameters

The default values for the other parameters in modem configuration menus rarely need changing. They typically include the dialing prefix (**ATDT** for touch-tone service and **ATDP** for rotary service), the dialing suffix (**^M**), the hang-up string (**+++ATH0^M**), and response messages (*RING, NO CARRIER, BUSY*, etc.). Communications software with a host mode might also include an auto-answer string (**AT S0=1^M**).

Configuring Software for Your Computer

You must configure your communications software to match your computer's configuration. If the IBM 7852-400 is connected to the COM2 serial port, you must tell the software you are using COM2. Another important parameter is the serial port baud rate. This is the speed at which your modem communicates with your computer, *not* the speed at which your modem communicates with another modem. When V.42bis data compression is enabled, you must have a serial port baud rate four times the transmission speed of the modem to fully optimize compression. So if your UART is fast enough, you should set the serial port baud rate to a *minimum* of four times the top speed of your modem.

If you have an 8250 UART, your most reliable serial port speed will be 9600 bps; if you have an 8250A or a 16450 UART, try 19,200 bps; if you have a 16550 UART or equivalent, a serial port setting of 115,200 bps can be set reliably.

Configuring Software for the Remote System

You must meet the requirements of the remote system for successful communications. Though the IBM 7852-400 can automatically match the speed of the other modem, you must specify parameters such as type of flow control, break length, number of data bits, number of stop bits, and parity. If you set these parameters incorrectly with the remote system, gibberish will appear on your screen.

Terminal Emulation

If you are accessing the remote computer as if from an on-site terminal, the keyboard codes used by your computer may not match the ones used by the remote computer. To be compatible with the remote computer, your software must be able to substitute the appropriate codes in what is known as *terminal emulation* Most communications programs can emulate the most common mainframe terminals, including the DEC VT100, VT 102, and VT52 terminals, and the basic TTY mode. If in doubt about which to choose for a BBS, try ANSI or VT100 first.

File Transfer Protocols

When you upload or download files with your modem, the host computer will ask which file transfer protocol you want to use. Most communications programs allow you to choose a default protocol. Your software's documentation should list the ones it can use (not all communications programs support all protocols). Zmodem is the recommended protocol for most transfers.

When to Disable Data Compression

If your serial port cannot keep up because it has an older UART, you may lose data when using data compression. Also, the speed advantage hardware compression gives you is entirely dependent on how much the data being transmitted can be compressed. If the data is already in compressed form, a .ZIP or a .SIT file, for example, trying to compress it more will actually slow the transmission slightly compared to transmitting the same file with compression disabled. This effect will be most noticeable if your modem negotiates MNP 5 compression with the other modem. V.42bis will not try to further compress a compressed file, but MNP 5 will.

The command to disable compression is **AT &E14 <CR>**. If you have an older UART or if you use your modem mostly for downloading long, compressed files from BBSs, you may want to include the **&E14** command in your initialization string as follows:

AT &F S0=0 X4 &E14 ^M

As a general rule, you should try to transmit files in already-compressed form rather than relying on V.42bis hardware compression. Because software compression is more efficient than hardware compression, you will have a higher throughput with the former. Of course, this efficiency

does not include the time spent compressing and decompressing .ZIP or .SIT files, but it will save on phone bills. And hardware compression will still be there for those occasions when it is inconvenient to compress a file with software. Note also that when you download files with compression disabled, you can use a slower serial port if you have an older UART.

Disabling Error Correction

By default, the IBM 7852-400 is set to auto-reliable mode. In this mode the IBM 7852-400 determines during the handshake whether the other modem is using V.42 error correction. If it is, the IBM 7852-400 then switches itself to reliable mode and enables error correction. If it is not, the IBM 7852-400 remains in non-error correction mode.

Normally, we recommend that you leave the IBM 7852-400 set to auto-reliable mode (**&E1**). However, you may encounter some circumstances in which the IBM 7852-400 will work better with error correction turned off For example, it has been reported that on CompuServe error correction will slow file transfers at modem speeds of 9600 bps and under. If this is a problem for you, you can turn off error correction with the command **AT &E0**, or you can include the command in your initialization string as follows: **AT &F S0=0 X4 &E0 ^M**

Chapter 3: Command Mode

Introduction

AT commands are the means by which you, and your communications software, are able to communicate with and configure your modem. They enable you to establish, read, and modify parameters in addition to dialing. The following provides both a summary and a detailed explanation of the AT commands recognized by the IBM 7852-400.

The AT commands are used *only* when the modem is asynchronous operating mode. They do not work when the modem is in synchronous mode. Information concerning the operation of the modem is provided for use when the modem is attached to a device that can send the modem asynchronous data, such as a personal computer or asynchronous terminal.

AT Command Editing

The ***BACKSPACE*** key on your keyboard can be used to edit characters in the AT command line. An AT command is not executed until the RETURN key is pressed. The BACKSPACE key erases the previous character for reentering.

The ***BACKSPACE*** key does ***not*** erase the ***AT*** characters once they are entered. If your keyboard has no ***BACKSPACE*** key, ***CTRL-H*** does the same thing. The character recognized by the modem as ***BACKSPACE*** may be changed to any other ASCII character with S-Register S5.

If you wish to cancel an entire command that has been entered but not yet executed, enter ***CTRL-X***. This also clears the command buffer. The effect is the same as backspacing to cancel the entire command, only quicker.

Characters entered in a command are stored in the modem's Command Buffer (*memory*) until executed by hitting RETURN. The Command Buffer's capacity is sixty characters. The Attention Characters ***AT*** do not count in the sixty allowed command characters. Spaces, which may be used for increased display readability, may be used when entering a command, but are not stored in the Command Buffer and are not counted in the sixty allowed characters. Hyphens, parentheses, etc. are not allowed.

© Copyright IBM Corp. 1996

If the sixty character limit is exceeded or if invalid characters are entered, the Command Buffer automatically erases, and an ***ERROR*** message appears. You would then re-enter your command within the sixty-character maximum, using only the allowed characters.

Functional Modes

The IBM 7852-400 can be in one of two functional states. These are "*Command mode*" and "*On-line mode*". There is also an in-between state, "*Wait-for-Carrier*", where the modem is out of Command mode but not yet really On-Line.

When the modem is initially powered up in asynchronous mode, it is in Command mode and is ready to accept commands from your keyboard or software. The IBM 7852-400 enters On-line mode after dialing, making a connection with another modem, and then detecting a valid carrier signal. If no carrier is detected within a certain time frame, the modem abandons the call and re-enters Command mode.

Once on line, the modem exits On-line mode if one of two conditions is met. If the carrier is lost or intentionally dropped, the modem hangs up and re-enters Command mode. Also, if the IBM 7852-400 recognizes the Escape sequence for which it is configured (i.e., either the Escape characters in the serial data stream, the Remote Escape characters in the modulated data stream, or the Break signal), the IBM 7852-400 will exit On-line mode, retain the datacomm link, and enter Command mode.

You can force the IBM 7852-400 into On-line mode without dialing by sending the ***ATD*** or ***ATA*** command to the modem.

Summary of AT Commands

A wide variety of autodial operations and modem options can be controlled when the IBM 7852-400 modem is in Command Mode. Remember, nearly all commands begin with ***AT***.

These commands are organized into several functional groups. An alphabetical summary of commands is provided in Appendix B.

Table 1 (Page 1 of 6). AT Command Summary

Function	Command	
Dial	***D***	Dial

Table 1 (Page 2 of 6). AT Command Summary

Function	Command	
	A: or :	Continuous Redial (Not active in BABT)
	$D	DTR Dialing
	$VD	Voice/Data Dialing
	N	Dial a Stored Number
Modify Dialing Procedures	***P/T***	Pulse/Tone Dialing
	&P	Set Pulse Dial Ratios (Not active in BABT)
	,	Automatic Pauses in dialing
	Y	Long Space Disconnect
	W	Wait for New Dial Tone
	;	Return to Command Mode After Dial Command
	R	Reverse Mode of Operation
	!	Flash On Hook
	$	AT&T "*Calling Card*" Tones
	@	Quiet Answer
Memorize Phone Numbers	***D..N***	Store Phone Numbers
	NN	Number Linking
	L	List Numbers Stored in Memory
Store Modem Configurations and Defaults	***&F***	Load Factory Defaults
	&W	Store Configuration & S-Register Parameters
	Z	Reset Modem
	V	Result Code Terse/Verbose
	#V	V.32terbo Enable/Disable
	&M	Synchronous/Asynchronous Mode Select

Table 1 (Page 3 of 6). AT Command Summary

Function	Command	
	&X	Synchronous Transmit Clock Select
Configure Command Responses	***Q***	Result Codes Enable/Disable Response
	&Q	Result Code Selection
	E	Echo Command Characters
	V	Result Code Terse/Verbose
	X	Result Code...Basic/Extended/Call Progress
Condition Phone Line	***&G***	Guard Tones (Not active in BABT)
	M	Monitor Phone Line
	&T	Remote Digital Loop Signal
	#T	Enable/Disable Trellis Coded Modulation
	B	Bell/V.21 Tones (Not active in BABT)
	#F	Fallback When On-Line
	&CD	Cleardown at Disconnect
	#A	Auto-Speed Detect
Control RS232C Interface	***&C***	Carrier Detect Control
	&D	Data Terminal Ready Control
	&R	Clear To Send Control
	&S	Data Set Ready Control
	&RF	CTS/RTS Control
	&SF	DSR/CD Control
Configure Error Correction	***&E0***	Normal Mode
	&E1	Auto-Reliable Mode
	&E2	Reliable Mode
	#L0	Negotiate V.42 Mode During Handshake
	#L1	MNP On/LAPM Off

Table 1 (Page 4 of 6). AT Command Summary

Function	Command	
	#L2	LAPM On/MNP Off
	#L3	Direct LAPM/Phase Out Handshake
	$A	Auto-Reliable Buffering
	$F	Enable/Disable Auto-Reliable Fallback Character
	$R	Retransmit Count
	$E	Error Correction at 300 bps
Configure Flow Control	***&E3***	Flow Control Disabled
	&E4	Hardware Flow Control
	&E5	Xon/Xoff Modem-Initiated
	&E6	Xon/Xoff Modem Responds/No Pass-Through
	&E7	Xon/Xoff Modem Responds/Pass-Through Allowed
	#X	Send Single/Multiple Xoff Characters
	&E8	Enq/Ack Off
	&E9	Enq/Ack On
	&E10	Normal Mode Modem Flow Control Off
	&E11	Normal Mode Modem Flow Control On
	&E12	Computer-Initiated/Off
	&E13	Computer-Initiated/On
	&BS	Maximum Block Size
	$EB	10/11 bit Asynchronous Format
	#P	Parity Selection
Configure Data Compression	***&E14***	Data Compression Disabled
	&E15	Data Compression Enabled
Configure Speed Conversion	***$BA0***	Speed Conversion On

Table 1 (Page 5 of 6). AT Command Summary

Function	Command	
	$BA1	Speed Conversion Off
	$MB	Set modem speed (e.g.,$MB33600)
	$SB	Set serial port speed (e.g.,$SB115200)
Execute Immediate Action Commands	***$H***	Help
	I	Product Code Inquiry
	I9	Windows 95 Autodetect Inquiry
	L5	List Current Operating Parameters
	L6	List S-Register Values
	L7	List additional Configuration Parameters
	L8	List On-Line Diagnostics
	H	Off Hook
	+++AT<CR>	EscapeSequence: Entering Command Mode while On-Line
	%E	Escape Sequence Options. . . Entering Command mode while On- Line
	A	Force Answer Mode
	O	Exit Command Mode/Go Back On-Line
Execute Line Probe Commands	***%DF***	Format Line Probe Display (Graph or Table Format)
	%DP	Enable/Disable Reading Line Probe From DSP during handshake
	L9	Display of Signal Strength Information
	L10	Display Signal to Noise Ratio (*SNR*)
	L11	Display of Noise Information
	&RP	Initiates Retrain to Read Line Probe Parameters
Read and Assign S-Register Values	***Sr?***	Read Current S-Register Value

Table 1 (Page 6 of 6). AT Command Summary

Function	Command	
	Sr=	Assign S-Register Value
Remote Configuration & Callback Security	***#CBN***	Passwords for Callback Phone Numbers
	#I	Change Login Password
	#DB	Callback Security Enable/Disable
	#RCBNxx	Erase Password Linked with Memory Location *xx*
	#S	Change SETUP Password
Test Modem	***U***	Self-Test Modem
	&T	Enable/Disable Digital Loopback Signal

Result Codes

The IBM 7852-400 Command mode provides you with several responses, or "*Result Codes*", that can aid you in Command mode operation. These Result Codes are displayed on your video monitor.

You can choose result codes that closely match those of the standard AT command set, or choose enhanced function result codes that have been used in other types of modems ("*Extended*" responses). The ***&Q*** command selects which result codes will be used.

You can choose to have these Result Codes displayed in either "*verbose*" (full words) or "*terse*" (digits) format. This is controlled by the ***ATV0*** (terse) or ***ATV1*** (verbose) commands. The IBM 7852-400 defaults to verbose format.

AT&Q0 selects Extended responses with Reliable/LAPM/Compression modifiers. The terse response code for *CONNECT 2400* is *9*. ***AT&Q1*** selects Standard AT command set responses. The terse result code for *CONNECT 2400* is *10*.

The following tables define the result codes generated by the ***&Q*** command (refer to Appendix D for Result Code Summary).

Table 2. &Q0 "Extended" Result Codes

TERSE		VERBOSE
0		OK
1	*	CONNECT
2		RING
3		NO CARRIER
4		ERROR
5	*	CONNECT 1200
6		NO DIALTONE
7		BUSY
8		NO ANSWER
9	*	CONNECT 2400
11	*	CONNECT 4800
12	*	CONNECT 9600
13	*	CONNECT 14400
19	*	CONNECT 19200
21	*	CONNECT 21600
24	*	CONNECT 24000
26	*	CONNECT 26400
28	*	CONNECT 28800
31	*	CONNECT 31200
33	*	CONNECT 33600

***** With MNP error correction on, RELIABLE (or R) is added to these result codes. With LAP-M error correction on, LAP-M (or L) is added to these result codes. With data compression on, COMPRESSED (or C) is added. (Note these "*Extended*" Result Codes are displayed when your modem is set-up to do so with an X1, X2, X3, or X4 command.)

Table 3. &Q1 "Standard AT" Result Codes

TERSE	VERBOSE
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200
6	NO DIAL TONE
7	BUSY
8	NO ANSWER
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 14400
19	CONNECT 19200
21	CONNECT 21600
24	CONNECT 24000
26	CONNECT 26400
28	CONNECT 28800
31	CONNECT 31200
33	CONNECT 33600

***** Reliable/Compression modifiers are not displayed with Standard AT Result Codes.

Dialing Commands

The following sections deal with commands that are used to control the way in which the modem will dial telephone numbers. They include commands that are used to control the actual dialing process and commands that are used to modify the manner in which the modem dials numbers. The commands also include commands that are used to store and recall telephone numbers in the modem's memory.

Dialing Action Commands

These commands are used to instruct the modem to dial the telepnone.

Dial Command D

The letter ***D*** in a command causes the IBM 7852-400 to dial the telephone number immediately following it. For example, if you enter **ATD5551212** and hit RETURN, the IBM 7852-400 dials the number 555-1212.

The ***D*** command is also used in conjunction with a telephone set for manual dialing. You dial the number on your telephone set, and after hearing the answer tone on your handset, you type ***ATD*** on your keyboard and hit RETURN. Then hang up the headset. Unless you have a specific need to dial in this manner, we recommend you use the first method, where the telephone number is entered on your keyboard.

The IBM 7852-400 gives you several choices of dialing methods. You can use tone or pulse dialing, by inserting a letter ***T*** or a ***P*** in the command string. (See Section on Dial Modifiers).

You can also configure the modem to either wait for and detect dial tones and busy signals (which we call "*Wait-for-Dial-Tone*" dialing or "*Smart*" dialing), or work with timed pauses without dial tone and busy signal detection (which we call "*Blind*" dialing. for more information see section on "*X*" Command.)

Note: There is another method of dialing, called "*DTR Dialing*", where by manipulating the DTR signal on pin 20 of the RS232C/V.24 interface, a number stored in the modem's memory is automatically dialed. See Section on DTR Dialing (***$D*** command) for details.

Continuous Redial A: or :

(not used in UK models)

If you select the Wait-For-Dial-Tone method of dialing (see X3 or X4 command), you can command the IBM 7852-400 to continuously redial (up to 10 redials for DOC units) a busy number until your call is answered. This is done with the ***A:*** command.

This command would be used only if you had already reached a busy number after executing a normal dial command. You simply enter ***A:*** (you need not enter AT, nor do you need to hit RETURN), and the modem will

redial the number for you. If you again reach a busy signal, it redials again and again until it no longer detects a busy signal. You can stop the IBM 7852-400 from redialing by pressing any key.

Another method used to cause the modem to redial a phone number continuously is to enter a colon***:*** at the end of the phone number. The result is the same as if you had entered ***A:*** after personally observing that the number was busy on the first dialing attempt. Using the colon in the dialing string is a step saver.

Dialing a Stored Number N

A telephone number that you have stored in the IBM 7852-400's number memory may be automatically dialed by entering **ATNn** where n = 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9. For example, a number stored at N3 would be dialed by entering ***ATN3***and RETURN. Do ***not*** include the letter D in this command, or the stored number will be erased (also see the section on Phone Number Memory Commands).

DTR Dialing $D

An alternate method of causing the IBM 7852-400 to automatically dial is DTR Dialing. Data Terminal Ready (DTR) is a signal that comes into the modem from the terminal or computer to which it is connected, on pin 20 of the RS232C interface. In DTR dialing, the modem automatically dials a stored number as soon as it receives a high DTR Signal. The DTR dialing method is popular in synchronous applications.

To activate DTR Dialing, enter **AT$D1** and hit RETURN. The modem dials the phone number stored in the N0 location of memory when it receives a high DTR signal. DTR must remain high for the duration of the call, until disconnect. To deactivate DTR dialing, enter **AT$D0** and hit RETURN.

Note when using DTR Dialing in a synchronous application, be sure DIP-Switch #8 is in the UP position to disable V.25*bis* Command mode.

Voice/Data Dialing $VD

Another alternate method of causing the IBM 7852-400 to automatically dial is Voice/Data Dialing. With Voice/Data Dialing, the modem automatically dials the phone number stored in the N1 position of memory whenever the Voice/Data switch is toggled. You must first enter **AT$VD1&W0<CR>**. This command string enables Voice/Data dialing when the Voice/Data toggle switch is activated. To disable Voice/Data Dialing (default), enter the command ***AT$VD0*** **W0<CR>**.

Dial Modifier Commands

There are several command characters that can be included within a dialing command (following the letter ***D***), called "*Dial Modifiers*". They have various functions, including the selection of Pulse or Tone Dialing, pauses in the dial sequence, automatic redials if a number is busy, and reverting to the Command mode or switching to the Answer mode after dialing.

Pulse or Tone Dial P T

The IBM 7852-400 dials numbers using either pulse or tone dialing, or a combination of both methods. Pulse dialing is a method used by rotary-dial telephones, which involves the timed opening and closing of line relay.Tone dialing is the method used by pushbutton (*touch tone*) telephones, and is sometimes referred to as DTMF, or Dual-Tone Multi-Frequency dialing.

The method used is selected by including a **P** for **Pulse** or a **T** for **Tone** in the dialing command, right before the digits you wish to have dialed in that manner.

For example, you would pulse-dial the number 555-1212 by entering ATDP5551212 and hitting RETURN. You could tone-dial the same number by entering ATDT5551212 and hitting RETURN. If neither Pulse nor Tone dialing is specified in the dial command, the IBM 7852-400 uses whatever method used last. If the modem has been reset or just powered up, it uses Pulse dialing, even if the letter P is not included in your dial command.

Nearly all telephone systems in the U.S. are now compatible with tone dialing. Since that is the faster method, you will probably choose the tone method for your dialing.

An example of combining pulse and tone dialing could involve a PBX system where 9 had to be pulse-dialed first, then the rest of the number tone-dialed after pausing for a second dial tone. The number would be dialed by entering ***ATDP9,T5551212*** and RETURN. The comma causes a pause.

Set Pulse Dial Ratios &P

(Not valid in UK models)

This command sets the time ratios between the open and closed portions of the dialing pulse frequencies. To set the dialing pulse ratio of 60 mSec to 40 mSec, enter ***AT&P0.***

To set a ratio of 67 mSec to 33 mSec, enter***AT&P1***. The factory default is ***&P0***.

Automatic Pauses in Dialing ,

You can cause the IBM 7852-400 to pause during the dialing sequence by entering a comma character where the pause is desired. This pause lasts two seconds. If a longer pause is desired, more than one comma may be entered consecutively, with each comma causing a two second pause. You also have the option of changing the length of the pause caused by the comma, from two seconds to any other value from 0 up to 255 seconds. This is done by setting S-Register S8. Note that with the UK model, the length of pause range can be set 4-7 seconds (default is 4); and that entering multiple commas is not permitted. Each comma in a dialing command counts as one of the sixty allowed characters.

Long Space Disconnect Y

When two modems are connected in Normal mode (i.e. without error correction) there is no "*polite*" means of requesting a disconnect. A link disconnect request packet is sent under reliable connections. As a result some "*garbage*" may be received when a hangup command is issued. The **Y1** command enables the modem to use the break signal which accomplishes the hangup as an instruction to shut off its receiver and disconnect (both modems must have **Y1** enabled for this feature to be effective). **Y0** (factory default) disables this function.

Wait for New Dial-Tone W

A ***W*** inserted in the dialing command causes the IBM 7852-400 to wait for another dial tone, and not resume dialing until another dial tone is detected.

It is not necessary to enter a ***W*** at the beginning of the dialing command to wait for a modem dial tone, because the modem will do that first (pause automatically).

In order for this command to work, you must select Wait-For-Dial Tone dialing with the ***X2*** or ***X4*** command, so that your modem will be able to detect the dial tone.

Return to Command Mode After Dial Command Execution ;

A semicolon (***;***), entered as the last character a dialing command causes the IBM 7852-400 to return to the Command mode immediately after executing the command, instead of waiting for a carrier signal and going on line.

For example, entering ***ATDT5551212;*** would tone-dial the number, and do nothing afterwards except go back into Command mode. This can be useful in dialing applications where modem data transfer is not desired, such as voice communications, or in applications involving the use of touch tones as a data entry method, such as bank-by-phone.

Reverse the Mode of Operation R

In certain operations you may need to reverse the mode of operation for your modem from originate to answer or answer to originate so that it would answer the phone and go into answer mode. This command turns off the reversing function with the ***R0*** command and turns it on with the ***R1*** command with the modem in either command mode. If you want to reverse from the originate mode, use ***R*** (with no number) in the dialing string.

Flash On Hook !

Some switchboard systems react to a momentary On Hook. An exclamation mark inserted in the command causes the modem to "*flash*" on hook for a half of a second (90 mSec in BABT), as if you had held the switch hook button on a telephone down for a half second.

For example, to flash On Hook after dialing the number 555-1234 in order to transfer to Extension #5678, you might enter ***ATDT5551234,,!5678***. The commas cause a 4 second pause (just to be safe).

"Calling Card" Detect Tones $

The IBM 7852-400 has the capability to detect AT&T "*calling card*" tones for the purpose of utilizing the user's calling card number to originate an on-line connection. A ***$*** symbol placed in the dialing string causes the modem to pause and wait for an AT&T "*calling card*" or a 1600 Hz tone (prevalent in the United Kingdom). When the tone is detected, the rest of the dialing string is processed. If no tones are detected within the time period set by S-Register S7 (default 45 seconds), the modem will abort by indicating a *NO CARRIER* message. Hitting any key also aborts the ***$*** command.

The following is an example of this command:

ATDT10288061278535OO$123456789
(access/phone number) (credit card #)

Quiet Answer @

The **@** command causes the IBM 7852-400 to wait before processing the next symbol in the dialing string. The wait is for one or more ringbacks followed by 5 seconds of silence.

If the time specified by S-Register S7 passes before the rings and silence, a *NO ANSWER (R)* result code is processed. The **@** command is used for accessing a system that does not provide a dial tone.

For example, ***ATDT5551212@6313550*** causes the IBM 7852-400 to dial the first number (555-1212) and wait for the time specified in ***S7*** for at least one ringback and 5 seconds of silence. If a busy signal is detected, the IBM 7852-400 hangs up and generates a ***BUSY*** result code. If it does not detect 5 seconds of silence, a ***NO ANSWER*** result code is generated after hanging up. If 5 seconds of silence is detected, the second number (631-3550) is then dialed.

Phone Number Memory Commands

The modem is capable of saving and using telephone numbers within its non-volatile memory. This can save time and reduce errors if you have several numbers that need to be dialed often.

Storing Phone Numbers D...N

A telephone number and command line of up to sixty characters may be stored in the 7852-400's number memory. As many as ten of these numbers may be stored. Each number will be given a name, using the codes N0, N1, N2 up to N9.

A phone number is stored by entering ***ATD***, then the number as it would be dialed, along with any ***P, T, R, ;*** or comma characters, and then entering ***N*** followed by the number's "*name*," which would be any number from 0 through 9, and then hitting RETURN.

For example, the tone-dialed number 1-800-555-1212 would be stored as number ***N3*** by entering ***ATDT18005551212N3*** and RETURN. The number is ***not*** dialed with this store command. After storing a number, check to see that it has been stored correctly by typing ***ATL*** and hitting RETURN.

When phone numbers are stored, the entire command line is also stored so that you can effectively create a macro for each number. For example, if you know a particular number needs to have extended result codes, detect busy or dial tone, error correction, Xon/Xoff flow control, pacing, and data compression enabled, the command line would be: ***ATX4&E1&E5&E13&E15DT18005551212N3***. This would store the entire command at location **N3**.

Number Linking NN

You may command the IBM 7852-400 to dial another number automatically if the first number dialed is busy. This would be useful in a situation where a computer can be accessed through more than one phone number. This is called "*linking*".

To link the number in N1 to the number N2, simply enter ***ATN1N2*** and hit RETURN. Several numbers can be linked in the same command. For example, you could link N1 to N2 to N3 to N4 by entering **ATN1N2N3N4** and RETURN or you could link N1 to N2 and back to N1 and then back to N2 by entering **ATN1N2N1N2** and RETURN.

The only limit on the number of numbers that can be linked is the 60 characters allowed in a command line. Number linking can not be used with blind dialing, since busy signals would not be detected. You would have to select the Wait-for-Dial tone dialing method using the ***X*** Command in order to use the Number Linking feature.

Listing Numbers Stored in Memory

Telephone numbers that you have stored in the 7852-400's memory may be listed and displayed with the **L** command. It will display all ten stored N numbers in a format like that shown ***L*** below. All digits and command letters will be shown. The number's "*name*" (0 thru 9) is shown first, followed by the complete dialing command and telephone number as originally entered.

Simply enter ***ATL*** and hit RETURN to display these numbers on your video screen or printer. An example of an **L** command listing is shown below:

0 DT14082345678

1 DT16125551212;

2 DP9,T14089876543

3 DT3738315,12101,16126313550

4 DT6313551R

5

6 DP9,4258513

7

8 DTX4&E1&E5&E13&E15DT16126313550

9 DT12138880123

Configuration and Default Storage Commands

The modem's configuration and default operation parameters may be stored inside the modem, so that the modem resets to the same state at every reset.

Store Configuration & S-Register Parameters in Non-Volatile Memory

&W

The IBM 7852-400 can store configuration parameters and S-Register values in its non-volatile read/write Random Access Memory (*RAM*) memory. The **&W** command does this, which prevents any reconfiguration from being lost on a power-down or Reset (*ATZ*) condition.

&W0 (or **AT&W**) causes the IBM 7852-400 to store your customized AT command settings and S-Register values in its nonvolatile RAM. ***&W0*** also sets the modem so that it reads your customized settings stored in nonvolatile RAM when powered down or reset. (The ***&W0*** command only changes the settings stored in nonvolatile RAM that you specifically intend to alter. All other default parameters are applicable.)

&W1 causes the IBM 7852-400 *not* to store your customized settings to nonvolatile RAM so that, after powering down or resetting the modem, it reads the factory default settings stored in ROM.

Loading Factory Defaults &F

The ***&F*** command provides a choice between customized configuration settings in RAM and the factory default configuration settings in ROM. The ***&F8*** and ***&F9*** commands define the function of the ***&F*** command.

The IBM 7852-400 is shipped from the factory with a pre-configured set of command and S-Register default settings. This set of factory defaults can be recalled by issuing the ***&F*** command. In addition to being able to recall the factory-installed defaults, the ***&F*** command can also recall those defaults stored under ***&W0***. This is done using the ***&F9*** command. If you have stored parameters with the ***&W0*** command and wish these settings to always be used as your defaults, you would enter ***&F9&W0***.

To return the ***&F*** command to read factory installed defaults, enter ***&F8&W0***. ***&F8*** is the factory default. Many asynchronous data communications programs issue the ***&F*** command automatically- the***&F9*** command allows the user to select their own factory defaults. Note that the ***&F8/&F9*** commands should be used with ***&W0***.

Following is a summary of how the **&F** and **Z** reset commands interact with the **&W** command; note how the **&F** reset command operates differently from the **Z** reset command:

Previous Command	AT&F	Power-On and ATZ
AT&W1 (default)	ROM	ROM
AT&W0	ROM	NVRAM
AT&F8&W0	ROM	NVRAM
AT&F9&W0	NVRAM	NVRAM

Modem Reset Z

The ***Z*** command can be used to reset the entire Command Mode buffer and the result is the same as if you had disconnected, and then reconnected power to the modem. When an ***ATZ*** command is executed, the state of the &W command determines where the default values originate. ***&W0*** defaults come from RAM and ***&W1*** defaults come from ROM.

V32terbo Enable/Disable #V

Other types of V.32/V.32bis modems have problems handshaking when the IBM 7852-400 includesV.32terbo mode (19,200 bps) in its handshaking process. The bits that are used in the rate sequence for V.32terbo can cause handshaking failure. The ***#V*** command gives the user the option of including V.32terbo as part of the handshaking process in both Originate and Answer modes. Entering ***AT#V0&W0<CR>*** includes V.32terbo mode in handshaking. Entering ***AT#V1&W0<CR>*** disables the IBM 7852-400 V.32terbo mode in the handshaking process (default).

Async/Sync Mode Switching &M

This command can be used to set the on-line mode to either synchronous or asynchronous. ***AT&M0*** will set the IBM 7852-400 to Asynchronous mode, and all communications will be Asynchronous, in both On-line and Command modes. ***AT&M1*** causes the IBM 7852-400 to communicate asynchronously when in Command mode and switch to synchronous mode while on-line. The modem defaults to***&M0***(asynchronous communications) on reset or power-up.

Synchronous Transmit Clock Select &X

The **&X** command selects the Synchronous Transmit Clock Source in conjunction with DIP-Switch #11. DIP-Switch #11 in the UP position enables External clocking. DIP- Switch #11 in the DOWN position enables Internal clocking (default position). External clocking is when the DTE provides transmit clocking to the modem on pin 24 of the RS232C interface

&X0 is the default setting, which allows DIP-Switch #11 to control Internal/External Clocking (default Internal). Internal clocking is when the modem provides transmit clock to the DTE on pin 15 of the RS232C/V.24 interface. The **&X1** command overrides DIP-Switch #11 and selects External clocking. If DIP-Switch #11 is UP (External clocking), you can not override Internal clocking. **&X2** enables Slave Clocking. The &X2 Command causes the IBM 7852-400 to generate the transmit clock timing (pin 15) from the receive clock (pin 17) from the DTE (therefore 15 and 17 are the same). In this mode (Slave Clocking), all timing is controlled by the receive clock.

Command Response (Result Code) Commands

Echo Command Mode Characters E

If the IBM 7852-400 is connected to a full-duplex computer, it may be necessary for the modem to be configured to echo back characters entered while in the Command Mode in order for them to be displayed. The **E** command is used to configure the Command Mode echo, with **ATE0** disabling the echo and **ATE1** enabling the echo (default).

Result Codes Enable/Disable and No Response Answer Q

The ***Q*** command enables or disables Result Codes and the No Response Answer mode of operation. Result Codes may be disabled altogether in certain applications, such as computer-controlled auto dialing, using the ***Q*** command. ***ATQ1*** disables Result Code transmissions. ***ATQ0*** (or ***ATQ***) enables Result Code transmission.

Regarding No Response Answer, you may want the answer mode handled without responses and echo turned off, but want the originate mode still intelligent. This is called the No Response Answer mode. ***ATQ2*** selects the No Response Answer mode. If you do not select any mode, the factory default setting (enable Result Codes) is automatically selected.

Result Codes ("Extended" or "Standard AT") &Q

The IBM 7852-400 gives you a choice between the Extended Result Codes, and Result Codes that more closely match the standard AT command set responses.

&AT&Q1 selects **AT responses** with no Reliable/Compression modifiers. With this command, the terse result code for *CONNECT 2400* is *10*.

AT&Q0 selects **Extended responses** with Reliable/Compression modifiers. With this command, the terse result code for ***CONNECT 2400*** is *9*.

Result Codes (Verbose/Terse) V

The **V** command controls whether the modem's result codes are displayed as word ("*verbose*") or single digit ("*terse*") messages.

For example, if after dialing, no carrier signal is detected, the resulting message can be displayed either as *NO CARRIER*, or as the digit *3*.

Entering ***ATV0*** (or ***ATV***) causes the IBM 7852-400 to display the Result Codes as digits, while ***ATV1*** displays them as words. If you do not select a method, the factory default setting causes the modem to display Result Codes as words.

Result Codes (Basic and Extended) and Call Progress Selection X

The ***X*** Command is used to select one of twopossible dialing methods ("*dumb*" or "*smart*"),and to select various response combinations related to these methods. You can chooseto have certain responses suppressed, or whether or not you want speed indications along with the *CONNECT* responses. You can also pick and choose certain responses in order to match up with "*Standard AT*" responses. (Refer to Appendix D for a summary of Result Codes.)

The IBM 7852-400 provides "*Basic*" and "*Extended*" Result Code sets. The difference between the two is the Basic set provides one response (*CONNECT*) to indicate a connection, while the Extended set provides several responses for different speeds (*CONNECT, CONNECT 2400, CONNECT 4800, CONNECT 9600, CONNECT 14400 CONNECT 19200, CONNECT 21600, Etc.*).

When the Extended set is chosen, you also have the option of matching them up with Standard AT 2400 response code sets, by including or not including the BUSY and/or NO DIAL TONE responses while excluding

the DIAL TONE response. The ***X*** command is used to select which responses are provided.

Regarding the modem's method of dialing, the IBM 7852-400 can detect standard dial tones and busy signals. This capability ("*smart dialing*") allows the modem to wait for a dial tone, and when one is detected, to begin dialing immediately.

The IBM 7852-400 also can detect a distant busy signal, if after dialing, it reaches a busy number. This is useful because it allows the modem to immediately abandon a call, rather than wait 45 seconds for a carrier signal that will never come. S-Register S7 defines the wait for carrier time.

The IBM 7852-400 gives you a choice between the ***wait-for-dial-tone*** ("*smart*") method we just described, and ***blind*** ("*dumb*")***dialing***, where instead of detecting actual dial tones, the modem relies on timed pauses. When the wait-for-dial-tone method is chosen, the busy signal detection capability is also activated. The ***X*** command is also used to select which dialing method is used.

Five different ***X*** commands are available (X0 through X4), with five different effects on the modem's Result Codes.

X0 Provides the basic (short) result codes and provides "*dumb*" dial capabilities.

X1 Provides the extended result codes and provides "*dumb*" dial capabilities. The remaining ***X*** commands affect Call Progress, and turn on Extended Result Codes.

X2 Looks for *dial tone only* and will not provide a busy response.

X3 Looks for busy only and not look for dial tone.

X4 Looks for dial tone and for busy.

The factory default setting is **X0,** which selects Basic Result Codes and the blind ("*dumb*") method of dialing.

Phone Line Conditioning Commands

Guard Tones &G (Not used for UK models)

The ***&G*** command is used to control the presence or absence of guard tones from the transmitter when in Answer mode, at either 1200 or 2400 bps.

Guard tones are used in Europe and other areas for the modem to function in the telephone systems. Guard tones are not used in the United States. ***&G0*** (default), turns off CCITT guard tones. ***&G1*** turns on 550 Hz guard tones. ***&G2*** turns on 1800 Hz guard tones. This command is not used in BABT models.

Bell/V.21 Tone B (Not used for UK models)

The ***B*** command selects the frequency that the modem uses for its answer tone. (The answer tone is the tone transmitted by a modem receiving a call to the modem that called it, which initiates the handshaking between the two modems.) At higher speeds (2400 to 33.6K bps) there is no conflict, because all use CCITT frequencies. At lower speeds (0-1200 bps), in the U.S., some modems use the Bell frequency of 2225 Hz. However, the CCITT specification for V.22 has an answer tone frequency of 2100 Hz.

The***ATB0*** command enables CCITT frequencies including V.21 (300 bps) and V.23 (1200/75 bps). The ***ATB1*** command enables Bell frequencies including Bell 103 (300 bps). The IBM 7852-400 default is ***ATB0***. This command is not used in BABT models.

Phone Line Monitoring Speaker M

The IBM 7852-400 has an internal on-board, speaker which functions like the speaker in atelephone handset to enable you to monitor phone line activity. The ***M*** command can be used to determine when the speaker is operational.

Entering ***ATM0*** disables the speaker completely, while***ATM1*** causes the speaker to be on only until a carrier signal is detected. ***ATM2*** causes the speaker to remain on at all times. ***ATM3*** causes the speaker to be on during dialing and off during handshake. ***ATM1*** is the default setting, and the one that should be used in most applications.

Enable or Disable Recognition of Remote Digital Loop Signal &T

The IBM 7852-400 has several self-test features. The tests are activated with different ***U*** commands, such as ***ATU1***, and so forth. The ***&T*** command is a phone line conditioning command that enables or disables the modem's ability to recognize the Remote Digital Loop (*RDL*) test signal.

The ***AT&T4*** command lets the IBM 7852-400 respond to a RDL signal, and places itself in digital loop. The ***AT&T5*** command causes the modem to ignore the RDL signal. The factory default is ***&T5***.

Enable/Disable Trellis Coded Modulation #T

This command enables or disables the Trellis Coded Modulation of the IBM 7852-400. There is usually no need to disable (turn-off) Trellis codings except under an unusual line condition called impulse noise. AT#T0 turns Trellis coding off and AT#T1 turns Trellis coding on (factory default).

Fallback Modes When On-Line #F

If line conditions deteriorate, the IBM 7852-400 automatically drops its transmission speed ("*fallback*"). The ***#F*** command controls the different ways the IBM 7852-400 falls back. During operation, if the error rate becomes too great, the modem performs a retrain. If after the retrain, the error rate is still too high for 33600 bps operation, the modem initiates a retrain at 4800 bps. If after the first retrain the modem returns on line at 33600 bps, the modem then starts a counter and a timer. If three retrains occur within a two minute period, the modem falls back to 4800 bps.

Entering ***AT#F0*** (or ***AT#F***) allows no fallback when on-line. ***AT#F1*** allows the IBM 7852-400 to fallback (based on the error rate or if three retrains have occurred within a two minute period) from 33.6K to 31.2K to 28.8K to 26.4K to 24K to 21.6K to 19.2K to 16.8K to 14.4K to 12K to 9.6K to 4.8K bps. The ***AT#F2*** command enables incremental fall back from 33.6K to 4.8K, but also enables incremental fall forward (from 4.8K to 33.6K) if the phone line improves. ***AT#F2*** is the factory default setting.

Cleardown at Disconnect &CD

The ***&CD*** command is used for control of cleardown at disconnect in V.32, V.32bis, V.34 and V.34 enhanced modes. A cleardown usually adds 1-2 seconds to the time it takes for the modem to go on-hook after a disconnect. A cleardown makes a disconnect by the remote modem easier to detect and a subsequent reconnection more likely. Enter ***AT&CD0&W0<CR>*** to execute a cleardown at disconnect (default); and enter ***AT&CD1&W0<CR>*** to disable the cleardown function.

Auto Speed Detect #A

The function of the ***#A*** command is to detect and select the operational data rates (the "*starting*" speeds) with which the IBM 7852-400 uses for initial handshake and speed selection.

Remember, this command does not control the originating data rate of the modem (that is done by the Modem Baud Rate command ***$MBn***), but only the Answer mode "*starting*" speeds. Entering ***AT#A0*** (or***AT#A***) causes the IBM 7852-400 to operate starting at 33,600 bps, with fallback to 28,800 to 19,200 to 14,400 to 9600 to 4800 to 2400 to 1200 and to 300 bps. Entering ***AT#A1*** causes 33,600 bps operation only. Entering ***AT#A2*** causes the modem to operate at starting speeds of 33,600 bps, with incremental fallback to 28,800, 19,200, 14,400, 9600 and 4800 bps. The ***AT#A3*** command causes the modem to begin operation as a V.22*bis* modem at 2400 bps, with fallback to 1200 to 300 bps. ***AT#A0*** is the factory default value.

RS232C Interface Control Commands

Carrier Detect Control &C

The **&C** command allows you to control the status of the Carrier Detect signal (CD-Pin 8) on the RS232C line. You have four choices.

You can force the signal high, or allow it to act normally, or force the modem to reset when CD drops, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CD to act in this manner.

To allow CD to act normally, enter the command ***AT&C1*** (the factory default setting). To force CD on, enter ***AT&C0***. To reset the modem to its current parameters when CD drops, enter ***AT&C4***. To set up CD so that it

drops for one second on disconnect and then comes up again, enter ***AT&C2***. (If you want the drop time to be something other than one second, use S-Register S24 to change this value.

Data Terminal Ready Control &D

Data Terminal Ready (DTR) on pin 20 of the RS232C interface is required in order for the IBM 7852-400 to operate. A high DTR signal tells the modem that the device to which it is connected is active, or "*ready*" to communicate through the modem. If the signal is not being provided on the RS232C interface, you can force DTR high with DIP-Switch #1.

DTR has some other IBM 7852-400 functions. DTR can be used to trigger a dialing sequence, called DTR Dialing. The condition of DTR can also be used to cause the modem to reset to its default parameters, just as if you had given the modem an ATZ command. To do this, enter the command ***AT&D3*** and hit RETURN. The modem will now reset itself whenever DTR is dropped from On to Off, and will also go on-hook (hang up) if it is on-line.

Entering ***AT&D0*** or ***AT&D*** causes the IBM 7852-400 to ignore DTR. Entering ***AT&D1*** causes the modem to go on-hook (*hang up*) with loss of DTR. The modem enters Command mode when DTR goes high again. Auto-answer is disabled while DTR is low. Entering ***AT&D2*** causes the modem to go on hook with loss of DTR. The modem enters command mode when DTR goes high again.

CTS Control &R

The ***&R*** command allows you to control the Clear to Send signal (CTS-Pin 5) on the RS232Cinterface. You have three choices. You can force the CTS signal high, allow it to act normally, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CTS to act in this manner.

To allow CTS to act normally, enter the command ***AT&R0***. To force CTS on, enter the command ***AT&R1*** (this is the factory default setting). When the modem goes on-line, CTS still provides flow control. To set up CTS so that it drops for one second on disconnect and then comes up again, enter the command ***AT&R2***. (If you want the drop time to be something other than one second, use S-Register S24 to change this value.).

Data Set Ready Control &S

The ***&S*** command allows you to control the status of the Data Set Ready signal (DSR - pin 6) on the RS232C interface. You have three choices. You can force the signal high, allow it to act normally, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require DSR to act in this manner.

To allow DSR to act normally, enter the command ***AT&S1*** (the default setting). To force DSR on, enter the command ***AT&S0***. To set up DSR so that it drops for one second on disconnect and then comes up again, enter ***AT&S2***. (If you want the drop time to be something other than one second, use S-Register S24 to change this value.)

CTS/RTS Interaction Control &RF

In typical operation, Clear to Send follows Request to Send when the modem is on-line. In other words, if RTS goes off, CTS goes off in response. The ***&RF0*** command enables CTS to follow RTS. In some applications, however, it may be necessary for CTS to operate independent of RTS. ***&RF1*** allows CTS to operate independently regardless of the state of RTS, and is the factory default. If this is the case, refer to the ***&R*** command for control of the Clear to Send signal.

DSR/CD Interaction Control &SF

In typical applications, Data Set Ready (DSR) follows Carrier Detect (CD). ***&SF0*** enables DSR to follow CD, and is the factory default.

&SF1 enables DSR to operate independent of CD. If this is your application, refer to the ***&S*** command for control of the Data Set Ready signal.

Error Correction Commands

You can use AT commands to place your IBM 7852-400 one of three V.42 (error correction) modes of operation. These are the **Normal, Auto-Reliable,** and **Reliable** modes.

Normal Mode &E0

In Normal mode of operation, the modem's V.42 error correction capabilities are disabled, and the modem functions as a non-error-correcting modem.

Auto-Reliable Mode &E1

In Auto-Reliable mode during the handshaking procedures at the start of the on-line connection, the IBM 7852-400 automatically determines whether or not the modem with which it is communicating is using V.42 error correction. If the IBM 7852-400 determines that the other modem is using V.42, it switches itself into MNP or LAPM Reliable (V.42) mode and its error-correction capability is enabled. If it is determined that the other modem is not using V.42, the IBM 7852-400 remains in Normal mode, without error correction. The default setting is Auto-Reliable mode (***&E1***).

The method the IBM 7852-400 uses to determine if the modem it calls is a V.42 modem involves the use of a "*Link Request*".

When the IBM 7852-400 is in Auto-Reliable mode and originates a call, it goes through normal handshaking procedures just like any dial-up modem. After establishing the on-line connection, the IBM 7852-400 transmits a Link Request message to the answering modem. (The Link Request message is generally about 33 coded characters.) If the answering modem replies with an appropriate V.42 acknowledgment response, the IBM 7852-400 switches into Reliable mode. Otherwise it stays in Normal mode. This V.42 Link Request handshaking procedure generally takes about five seconds.

When operating in V.42 Reliable mode, the IBM 7852-400 uses its memory, or buffer, to store data as it is received. During periods of error-caused retransmissions or compression slowdowns, this buffer may fill up. To prevent buffer overflow and subsequent loss of data, the modem uses "*flow control*" to signal the computer attached to its RS232C port that the modem buffer is close to being full. This causes the computer to pause in its data transmission until the modem is able to empty its buffer sufficiently to accept more data, at which time the modem signals the computer that it may resume transmission.

Reliable Mode &E2

In Reliable mode, the IBM 7852-400 uses its V.42 error correction capabilities during all transmissions, and must be connected to another modem with a similar protocol activated (MNP or LAP-M).

V.42 Mode Select #L

The V.42 standard implements both MNP Class 3 & 4 and LAP-M error correction methods. The V.42 Mode Select command ***(#L)*** selects which type of error correction (MNP or LAP-M) your IBM 7852-400 uses for transmissions.

The various ***#L*** command options are as follows.

#L0

Command The ***#L0*** Command allows a pair of modems to negotiate which V.42 mode **(MNP or LAP-M)** will be used in their transmissions.

Originate Mode

a. If both modems have LAP-M capability, the modems use LAP-M mode.

b. If one or both modems do not have LAP-M capability and both have MNP, the modems use the MNP mode.

Answer Mode

a. The answering modem responds to either an MNP Link Request or LAP-M Originator Detection Pattern (ODP) signal depending on which the originating modem issues.

#L1

Command The ***#L1*** Command sets your modem to MNP error correction and disables LAP-M. This command is for Originate mode only. In Answer mode, the modem still accepts MNP or LAP-M.

#L2

Command The ***#L2*** Command sets your modem to LAP-M error correction, and disables MNP. This command is for Originate mode only. Answer mode still accepts MNP or LAP-M.

#L3

Command In the prior commands, the modems use a two phase process to establish a V.42 connection (detection to establish whether the remote modem is also error correcting, and then protocol establishment to determine parameters and to establish the error correction connection). If you know that the other modem is a V.42 error correcting modem, and you wish to use LAP-M, the ***#L3*** command disables the detection phase and

goes directly to protocol establishment. Both modems must have ***#L3*** in effect.

Auto-Reliable Buffering $A

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. After this four-second period, the modem drops to Normal mode. Any data which is received during this period is typically discarded. The ***$A*** command can be used to cause the modem to buffer (save) data that is received during this Auto-Reliable time-out period. This data will then be output by the modem after the *CONNECT* message.

AT$A0 = Discard data received during auto-reliable time period.

AT$A1 = Buffer data received during auto-reliable time period.

The factory default is ***$A0***.

Enable/Disable Auto-Reliable Fallback Character $F

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. If a single CARRIAGE RETURN is received from the remote modem during this four second period, the Auto-Reliable modem assumes that the remote modem is not in Reliable mode and drops to Normal (non-error correcting) mode. The CARRIAGE RETURN is the only character which causes the modem to drop to Normal mode. Any other character will either be buffered or discarded.

The ***$F*** command can be used to disable this fallback-to-Normal-due-to-CARRIAGE-RETURN feature.

The Auto-Reliable fallback character (***$F***) and Auto Reliable buffering (***$A***) commands can be used together to cause the modem to buffer all data received up until the CARRIAGE RETURN, and then drop to Normal mode. All data received will then be output following the *CONNECT* message.

AT$F0 = Do not fall back to Normal if CARRIAGE RETURN received.

AT$F1 = Fall back to Normal mode if CARRIAGE RETURN received.

The factory default is ***$F0***.

Retransmit Count $R

If errors are received during a Reliable connection, the modem re-sends the block of data which contained an error. With the ***$R0*** command, if another error occurs, the block will be re-sent again. The modem counts the number of times that a data block is re-sent. If the same block of data is resent 12 times and still has not been received properly, the modem assumes that the transmission line is unsuitable for transmission, and abort the connection.

This retransmit counter is disabled by the ***$R1*** command. When the retransmit counter is disabled, the modem keeps trying to send data and will not abort, no matter how many times the same block is resent.

AT$R0 = Disconnect if retransmit count is exceeded.

AT$R1 = Do not disconnect due to retransmits.

The factory default setting is***$R0***.

V.42 Error Correction/300bps $E

At 300 bps, error correction is not typically used. ***$E1*** lets the IBM 7852-400 function at 300 bps in either Normal (***&E0***), Auto-Reliable (***&E1***) or Reliable (***&E2***) mode. ***$E0***, which is the modem's default, disables 300 bps/V.42 error correction altogether.

AT$E0 = No V.42 Error correction at 300 bps.

AT$E1 = V.42 Error Correction at 300 bps.

The factory default setting is ***$E0***.

Flow Control Commands

Flow control refers to the techniques used by computer devices to stop and restart the flow of data to and from each other. Flow control is necessary so that a device does not receive more data than it can handle. In the case of the IBM 7852-400, there is a need for flow control in both directions.Flow control for data passing from your computer to the modem is called Modem-Initiated Flow Control and flow control for data passing from the modem to your computer is called Computer/Terminal-Initiated Pacing.

The IBM 7852-400 supports both hardware and software Modem Initiated Flow Control. On the Computer/Terminal-Initiated Pacing side, it supports

hardware and software flow control, and a special version used by Hewlett-Packard compatible systems called ENQ/ACK Pacing. The IBM 7852-400 allows hardware and software pacing to be passed through the modem to the other end of the link so that your computer or terminal can control data start/stop activity through your modem. This is called Xon/Xoff Pass-Through. To state it simply, "*Flow Control*" is something the modem does to the computer, while"*Pacing*" is something the computer does to the modem.

Hardware Flow Control &E4

With Hardware Flow Control, the modem uses its RS232C interface to control the flow of data from the computer or terminal to which it is attached. The CTS (Clear to Send) signal on Pin 5 of the RS232C interface is brought low to stop the flow of data, and is brought high to restart it. When you select Hardware Flow Control as your Modem Initiated Flow Control method, you will also be selecting it for Pacing.

The difference between the two, however, is that Modem-Initiated Flow Control uses the Pin 5 CTS output signal, while Pacing uses the Pin 4 RTS input signal.

Modem commands are used to select the method of flow control used by the IBM 7852-400 when its error correction capabilities are used. If neither method is selected, the modem defaults to no flow control (***&E3***).

Xon/Xoff Flow Control &E5

Xon/Xoff is the most commonly used method of flow control. Under this method, control characters known as "*Xon*" and "*Xoff*" are inserted by the modem into the data to start and stop the flow of data from the computer or terminal to which the modem is attached. Xoff, which is a Control-S, stops the flow of data, and Xon, which is a Control-Q, restarts it. With regard to Binary Data, Xon/Xoff flow control is not recommended because an Xoff character may be part of the data and would trigger an Xoff of the modem or software package, which would halt data flow.

Xon/Xoff Pass-Through &E7

So far, you have had three choices to make regarding pacing:

1. You can set the modem to respond to Xon/ Xoff pacing.
2. You can set the modem to respond to RTS pacing.
3. You can set the modem to ignore pacing completely.

Well, we're not done with pacing yet. There's another choice you can make (which actually can apply to both pacing and modem-initiated flow control, although it applies mainly to pacing) and that is something called Xon/Xoff Pass-Through.

This means that if your modem is set to respond to Xon/Xoff commands, you can have the modem do one of the following:

1. The modem responds to the Xon and Xoff pacing commands while at the same time allowing these commands to pass through the modem and on to the remote location. We call this "*Respond, Pass- Through*".
2. The modem responds to Xon/Xoff pacing, but does not allow the pacing signals to pass through the modem and on to the remote location. We call this "*Respond, No Pass-Through*".

When Xon and Xoff commands are allowed to pass through the modem, the computer or terminal at the remote site will receive these commands, and depending on how it is configured, the computer or terminal may respond to them also.

When two 7852-400 modems are connected in Normal mode (not using error correction), Xon/Xoff can be used to control the flow of data between the modems. Flow Control can be turned on or off with the Normal Mode Modem Flow Control commands. When the modems are connected in Reliable mode, a different method of modem Flow Control is used, and the commands for Normal Mode Modem Flow Control are ignored.

When you are using Speed Conversion in Normal Mode, you must activate the modem's Normal Mode Modem Flow Control. (Speed Conversion is explained later in this chapter.)

Send Xon/Xoff Characters #X

The **#X** phone interface command allows the IBM 7852-400 to send either a single or multiple Xoff characters at the modem's buffer full level. When the modem's buffer reaches it's "buffer full" level, the next received character causes another Xoff to be sent for every character subsequently received by the IBM 7852-400.The **AT#X0** command (factory default setting) causes one Xoff to be sent until the buffer reaches the Xon level. The **AT#X1** command causes an Xoff to be sent for every character received after the modem reaches its buffer full level.

Hewlett-Packard ENQ/ACK Pacing &E9

If the IBM 7852-400 is being used with Hewlett Packard (or similar) equipment that employs ENQ/ACK pacing, the modem can be configured to respond to ENQ/ACK commands, making it compatible with HP systems. Doing so does not affect any other flow control or pacing already configured in the modem.

When configured for ENQ/ACK, the ENQ (Control-E) and ACK (Control-F) signals from the HP equipment will be accepted and responded to according to Hewlett-Packard protocol.

Normal Mode Modem Flow Control On &E11

When two 7852-400 modems are connected in Normal mode (not using error correction), Xon/Xoff can be used to control the flow of data between the modems. Flow Control can be turned on or off with the Normal Mode Modem Flow Control commands. When the modems are connected in Reliable mode, a different method of modem flow control is used, and the commands for Normal Mode Modem Flow Control are ignored.

When you are using Speed Conversion in Normal Mode, you must activate the modem's Normal Mode Modem Flow Control. (Speed Conversion is explained later in this chapter.)

Terminal/Computer Initiated Pacing &E13

As mentioned earlier, the IBM 7852-400 caninitiate flow control by issuing Xon/Xoff commands or toggling the CTS signal on the RS232C interface. The modem can also be configuredto react to similar commands and signals from the computer or terminal to which it is attached via the RS232C interface. We refer to the computer or terminal initiated flow control as Pacing. When the modem is set for Pacing On, the modem will respond to the terminal or computer pacing. When the modem is set for Pacing Off, it will ignore pacing.

In order for the IBM 7852-400 to be set for Pacing On, a modem-initiated method of flow control must be previously selected. Once this is done, the IBM 7852-400 will respond to either Xon/Xoff commands, or to the toggling of the RTS (Request to Send) signal on Pin 4 of the RS232C interface, depending on what you selected earlier as your Modem-Initiated Flow Control method.

Maximum Block Size &BS

The maximum size of Reliable mode data blocks can be controlled with the ***&BS*** command. MNP 3 sends blocks of 1 to 64 characters. MNP 4 and 5 typically send blocks of 1 to 256 characters and LAP-M typically send 128 characters. For MNP Classes 4 and 5/LAP-M, reducing the block size to 64 characters may give a smoother flow of data, and better throughput on noisy phone lines. Using smaller block sizes over good phone lines may cause a slight loss in throughput (*speed*).

AT&BS0 Maximum transmit block size of 64 characters

AT&BS1 Maximum transmit block size of 128 characters (LAP-M) 256 characters (MNP) The factory default setting is ***&BS1***.

Asynchronous Word Length Selection $EB

The IBM 7852-400 has an 11-bit capacity when operating asynchronously. The ***$EB*** command selects between 11-bit and 10-bit operation. ***AT$EB1*** enables the modem to function in an 11-bit format (one start bit, eight data bits, one parity bit and one stop bit). ***$EB0*** is the modem's default setting and enables the IBM 7852-400 to operate in 10-bit format (one start bit, seven data bits, one parity bit and one stop bit). ***$EB*** is functional in both command and on-line mode. ***$EB0*** automatically detects parity when any ***AT*** command is issued.

AT$EB0 10-bit asynchronous format The factory default setting is ***$EB0***.

AT$EB1 11-bit asynchronous format

Parity Selection #P

The ***#P*** command enables the setting of parity. ***AT#P0*** selects no parity. ***AT#P1*** selects odd parity. ***AT#P2*** selects even parity and is the default value. Note when setting up your data comm software, it is critical that both your remote and local system's parity selection be set identically.

AT#P0 No parity

AT#P1 Odd parity

AT#P2 Even parity

The factory default setting is ***AT#P2***.

Compression, Error Correction, Flow Control, Pass-Through and Pacing Commands

The IBM 7852-400 has a variety of commands to control its error correction and data compression options. These additional commands are listed below. (Remember to precede each command with the AT characters.)

Normal/Auto-Reliable/Reliable Mode Commands:

&E0 Normal Mode

&E1 Auto-Reliable Mode*

&E2 Reliable Mode

Modem-Initiated Flow Control Commands:

&E3 Disables flow control (no flow control)

&E4 Hardware flow control (CTS on/off and RTS on/off)*

&E5 Xon/Xoff flow control

Xon/Xoff Pass-Through Commands:

&E6 Modem responds to Xon/Xoff characters, but does not allow Xon/Xoff characters to pass through to remote site.*

&E7 Modem responds to Xon/Xoff characters, and allows them to pass through to remote site.

Xon/Xoff Pass-Through Commands:

#X0 Selects single Xoff character until Xon level returns*

#X1 Selects multiple Xoff characters after buffer levels is full.

Enq/Ack Pacing Commands:

&E8 Enq/Ack method of pacing off*

&E9 Enq/Ack method of pacing on

&E10 Normal Mode Modem Flow Control off*

&E11 Normal Mode Modem Flow Control (Xon/Xoff) on

Computer-or Terminal-Initiated Flow Control (Pacing) Commands:

&E12 Pacing off

&E13 Pacing on (either RTS on/off or Xon/Xoff depending on the setting of &E4 or &E5).* (factory default)

Data Compression Commands:

&E14 Data Compression disabled

&E15 Data Compression enabled*

*Factory Default setting

Speed Conversion Commands

Speed conversion is a necessary part of data compression since data must be presented to the modem faster than it can handle data, if data compression is to be effective.

Speed conversion allows the IBM 7852-400 to communicate at one speed over the phone line, and at another speed at the RS232C interface. The speed (also referred to as"*data rate*" or "*baud rate*") can be fixed at the RS232 interface independently of the baud rate of the on-line transmissions.

In addition to data compression, another popular application for speed conversion involves an auto-answer IBM 7852-400 connected to a computer that does not have autobaud capability. This means that the computer must be set at a fixed baud rate, regardless of whether the modem is communicating over the phone line at 300, 1200, 2400, 9600, 14,400,19,200, 24,000, 28,800 or 33,600 bps. In this application, speed conversion allows the modem to match its speed to that of the calling

modem, while at the same time communicating with the attached computer through its RS232C port at a fixed baud rate, which can be preselected at 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600 or 115,200 bps.

Speed Conversion $BA

When using speed conversion, you must set the modem so that it does not adjust its speed at the RS232C serial port, even if the modem does adjust its data rate. To turn Speed Conversion ON, enter the command ***AT$BA0&W0*** and hit RETURN.

To turn Speed Conversion OFF, enter ***AT$BA1&W0*** and hit RETURN. The modemill now match its RS232C speed to that of the computer, and will adjust its speed to any changes in the computer's speed in Originate mode, or to the speed of the originating modem in Answer mode. The speed at which the modem communicates over the phone line will always be the same as the speed at which it communicates via its RS232C serial port.

Modem Baud Rate $MB

The***$MB*** command presets the modem's ***transmission*** baud rate for originate operations, (i.e .,the speed of the modem's transmissions over the telephone lines when originating a call). With speed conversion, this transmission speed can be a different baud rate than the serial port speed.

When the IBM 7852-400 receives (answers) a call from another modem, it automatically switches its phone line transmission speed to match the calling modem. However, if the IBM 7852-400 originates a call to another modem that is unable to connect at the baud rate of the IBM 7852-400, it automatically drops to a lower baud rate in an attempt to match the speed of that modem. For example, if the IBM 7852-400 is set for 19,200 baud and calls another modem that has a top speed of 2400 baud, it drops to 2400 baud.

The command to set the Modem Baud Rate is ***AT$MBn***, where n can be 75 (in ITU V.23 mode) 300, 1200, 2400, 4800, 9600, 14,400,19,200, 28,800 or 33,600 as listed below:

AT$MB75 CCITT V.23
AT$MB300 300 bps
AT$MB1200 1200 bps
AT$MB2400 2400 bps
AT$MB4800 4800 bps
AT$MB9600 9600 bps

AT$MB14400 14400 bps
AT$MB19200 19200 bps
AT$MB28800 28800 bps
AT$MB33600 33600 bps

The factory default is 33600 bps.

Serial Port Baud Rate $SB

The ***$SB*** command presets the speed of the modem's serial (RS232C) port, in both Originate and Answer modes. Speed conversion allows you to set this serial port baud rate at a fixed speed of up to 115,200 bps, regardless of the modem's transmission speed setting.

In order for this command to be effective, the modem's Speed Conversion feature must first be turned off with the ***$BA*** command. When Baud Adjust is on, the IBM 7852-400 automatically adjusts its serial port baud rate to match the speed of the computer or terminal it is connected to, as soon as it receives its first AT command. However, in many applications, such as automatic answer, the modem may not receive AT commands, in which case it is very useful to be able to preset the serial port baud rate with this ***$SB*** command.

In addition to setting the modem's serial port speed, this command also sets the speed at which the modem issues Command mode responses.

The IBM 7852-400 will accept AT commands at any speed, regardless of the speed preset by the ***$SB*** command. If the modem receives such a command at a speed that is different than the preset speed, the modem switches its serial port baud rate to match the new AT command speed, although the baud rate value stored by the ***$SB*** command remains the same. This provides you with a convenient way to switch the serial port speed, and still make it easy to go back to the original speed automatically the next time the modem is powered up or reset with an ***ATZ*** command.

The command to set the Serial Port Baud Rate is***AT$SBn***, where n can be 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600 or 115200 bps as listed below:

AT$SB300 300 bps
AT$SB1200 1200 bps
AT$SB2400 2400 bps
AT$SB4800 4800 bps
AT$SB9600 9600 bps
AT$SB19200 19,200 bps

AT$SB38400 38,400 bps
AT$SB57600 57,600 bps
AT$SB115200 115,200 bps

The factory default is 115,200 bps.

*Some serial ports, particularly those in older PC-compatible computers, may limit the performance of a higher speed modem like the IBM 7852-400. The limiting factor is a circuit called a Universal Asynchronous Receiver/Transmitter, or UART. All data from your modem flows through it. 8250, 16450, and 16550 are UARTs typically used in PC-compatible computers. The 8250 is unreliable above 9,600 bps and the 16450 is unreliable above 19,200 bps. The 16550 UART, however, is reliable to at least 115,200 bps. With V.42bis data compression enabled, the IBM 7852-400 can achieve throughputs approaching 115.2K (depending on line quality and file content). If you presently do not have a 16550 UART in your PC, we recommend that it be replaced with a serial port that uses a 16550 UART. These adapters are available from many sources and are relatively inexpensive.

Immediate Action Commands

Help Screens $H

The Help command is designed to give you short explanations on how to use each IBM 7852-400 command. The Help command can be quite useful if your manual is not handy and you are in the middle of a communications session. Although the explanations are quite abbreviated compared to those in this manual, they should prove to be helpful reminders when needed.

At the time of this writing, we have three screens of Help information (Screen #1, #2 and #3), and more screens may be added in the future. The Help commands are structured so that you can call up one of three Help screens, as follows:

AT$H1 Help Screen #1
AT$H2 Help Screen #2
AT$H3 Help Screen #3

Note: The screens above are presented in multiple pages and are designed for *English only* operation. Examples of the information presented is shown in the figures on the next several pages. Please note that these screens are subject to change, and the screens that you see may not match these exactly.

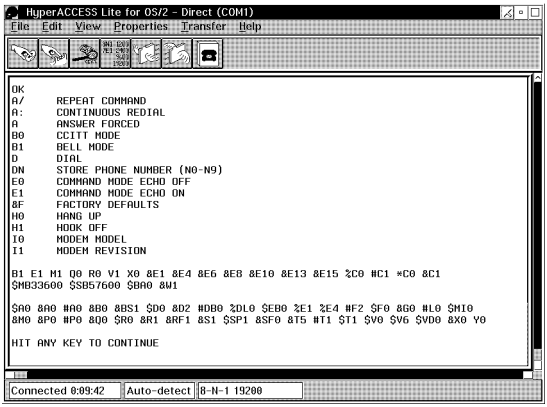

Figure 1. AT$H1 Help Screen (Page 1 of 6)

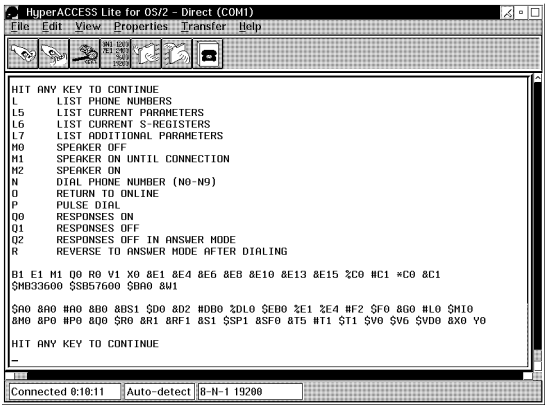

Figure 2. AT$H1 Help Screen (Page 2 of 6)

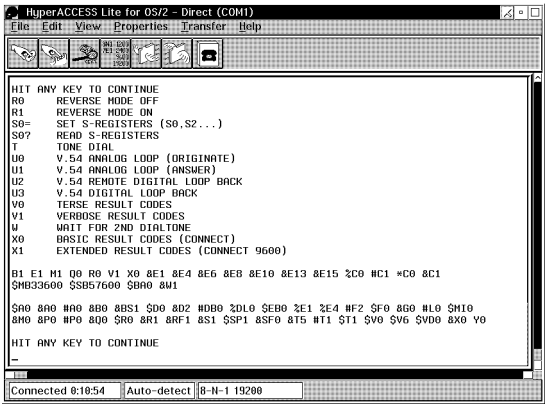

Figure 3. AT$H1 Help Screen (Page 3 of 6)

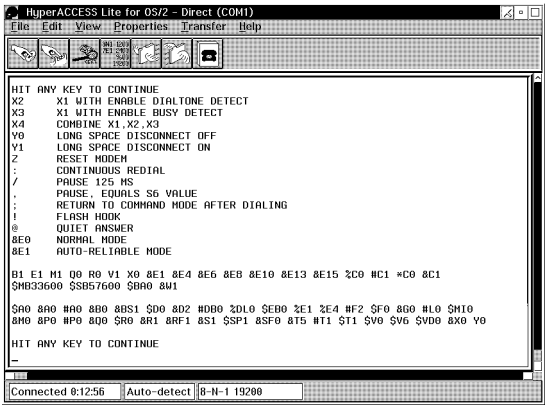

Figure 4. AT$H1 Help Screen (Page 4 of 6)

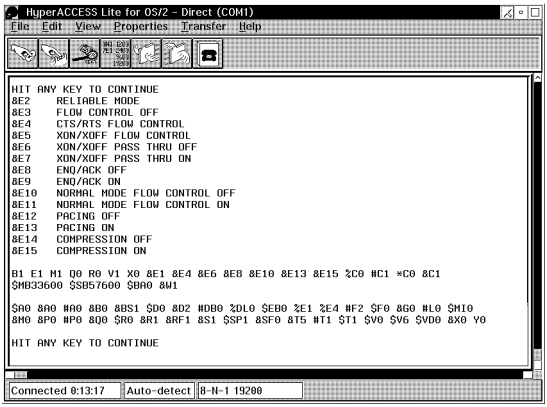

Figure 5. AT$H1 Help Screen (Page 5 of 6)

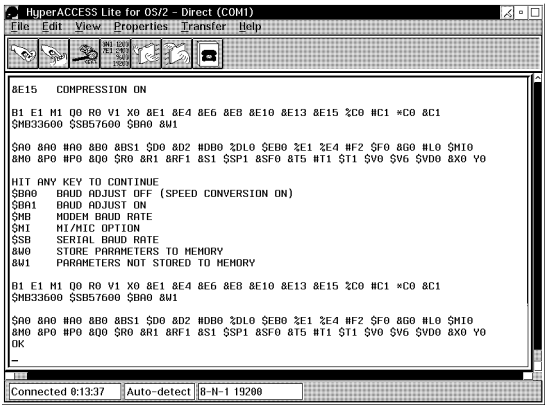

Figure 6. AT$H1 Help Screen (Page 6 of 6)

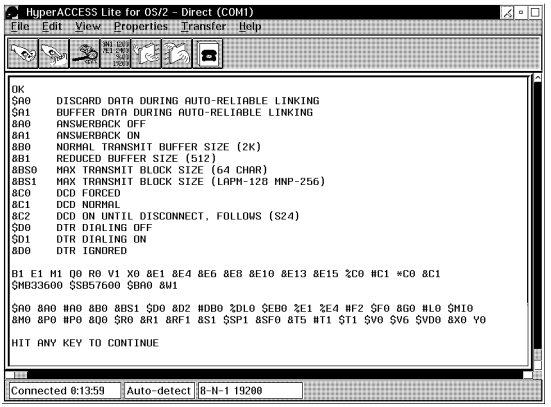

Figure 7. AT$H2 Help Screen (Page 1 of 6)

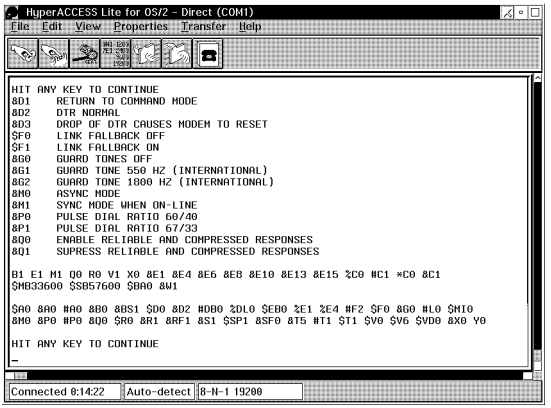

Figure 8. AT$H2 Help Screen (Page 2 of 6)

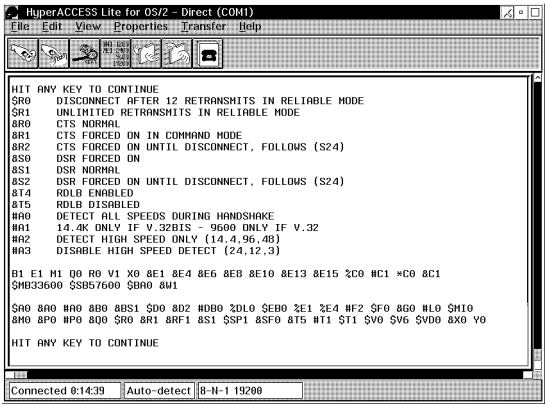

Figure 9. AT$H2 Help Screen (Page 3 of 6)

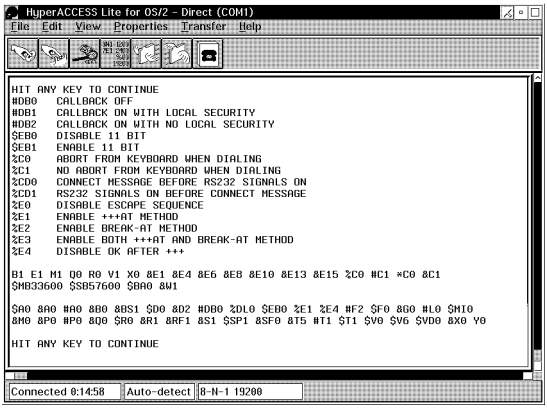

Figure 10. AT$H2 Help Screen (Page 4 of 6)

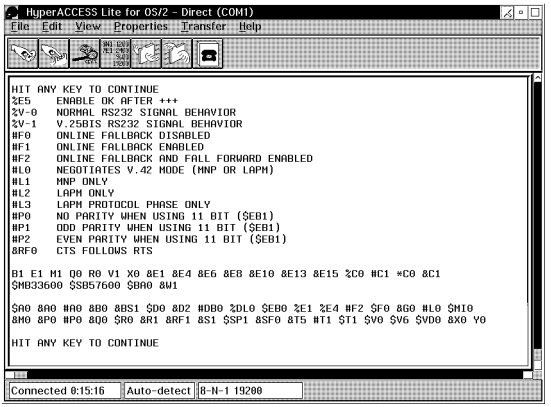

Figure 11. AT$H2 Help Screen (Page 5 of 6)

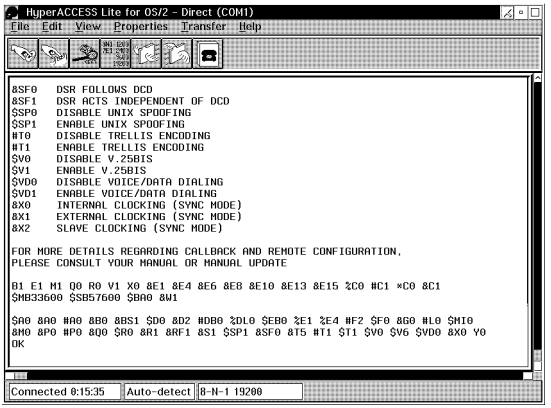

Figure 12. AT$H2 Help Screen (Page 6 of 6)

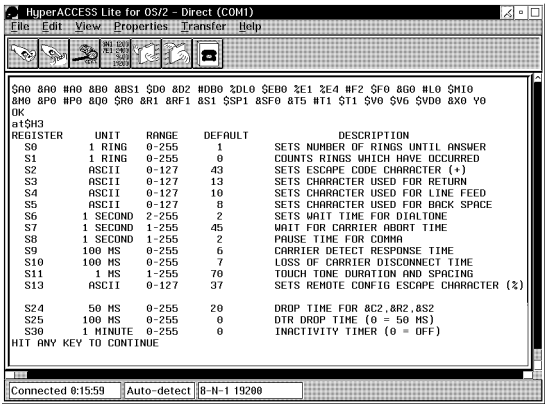

Figure 13. AT$H3 Help Screen (Page 1 of 2)

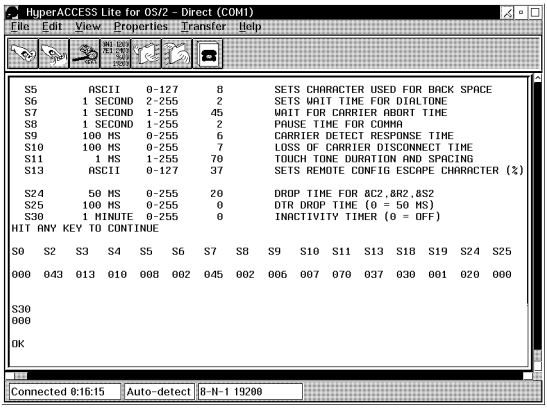

Figure 14. AT$H2 Help Screen (Page 2 of 2)

Inquiry for Product Code I

Some systems or software packages automatically check the "*identification*" of the modem with which they are communicating, by using the **I** command **.** This "*read*" command lets the software to determine the type of modem with which it is communicating.

When ***ATI*** or***ATI0*** is entered, the IBM 7852-400 responds with *247*. When **ATI1** is entered, the modem responds with a three-digit code indicating the firmware version number. When **ATI2** is entered, the modem responds with *IBM 7852-400*.

The response of the modem to various ATI inquiries is shown in the next two figures. Please note that the appearance and content of these screens may change over time.

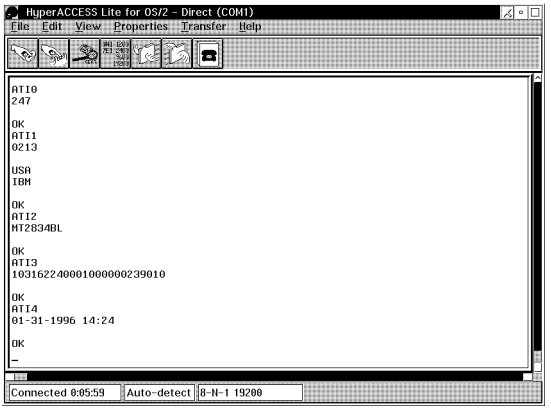

Figure 15. ATI responses (1 of 2)

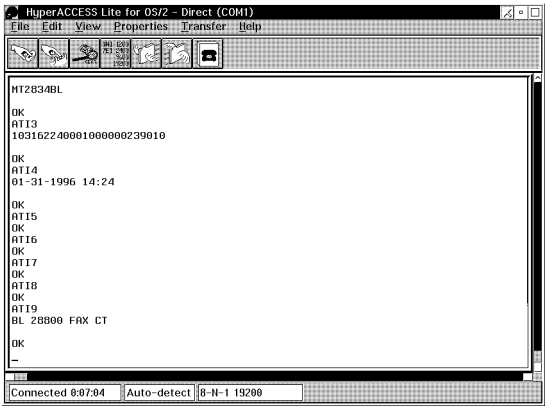

Figure 16. ATI responses (2 of 2)

ATI9 Inquiry I9

This read command permits an application to query the 7852-400's characteristics. When ***ATI9<CR>*** is entered the symbols *BL 28800 FAX CT* are displayed; which indicates to the application that your particular modem is a *IBM 7852-400, 28,800 bps, fax Class 2* capable modem.

Listing Current Operating Parameters L5 L7

The ***L5*** and ***L7*** commands list the current operating parameters of your modem. This information can be very useful when you are changing communications software or when you are changing modem default settings.

The command to list the modem's current operating parameters is ***ATL5*** for the basic parameters. Entering ***ATL7*** lists additional parameters on the IBM 7852-400.

An example of the modem's response to the ATL5, ATL6 and ATL7 inquiries is shown in Figure 17. Please note that the appearance and content of these screens may change over time.

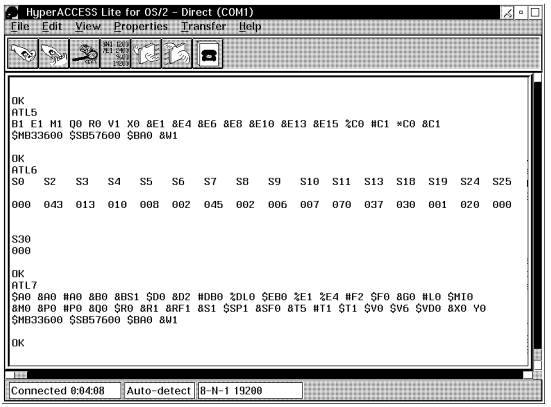

Figure 17. IBM 7852-400 response to ATL5 and ATL7 queries

Listing S-Register Values L6

Entering***ATL6*** lists the current values stored in the modem's S-Register. This information can be very useful if you wish to change S-Register values.

An example of the response of the modem to the ATL6 query is shown in Figure 17.

Listing On-Line Diagnostics L8

The***L8*** command displays the current on-line *CONNECT* status of the IBM 7852-400. This display can be printed and used as a modem status report or as diagnostic information (such as when calling Tech Support). To activate this command first type ***+++AT<CR>***(*on-line escape command while maintaining command mode*), then type ***ATL8***. What then displays on your monitor is your modem's current on-line condition (i.e., DSP and Firmware version, Link Type, Line Speed, Serial Speed, Type of Error Correction/Data Compression, Number of past Retrains,etc.).

Please note that the appearance and content of this screen may change over time. An example of an ***L8*** listing is shown below:

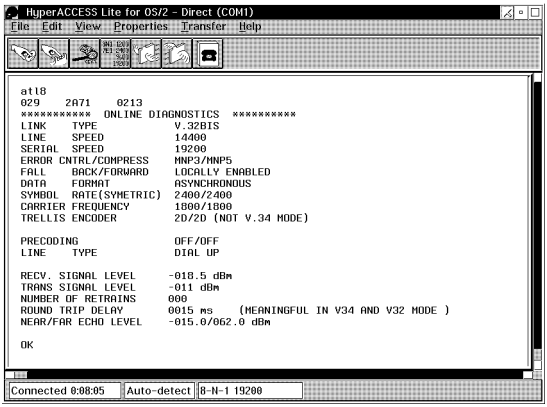

Figure 18. ATL8 Online Diagnostics Display

On-Line Diagnostics Illustration

Off Hook H

You can make the IBM 7852-400 hang up (go On Hook). Entering ***ATH1***<RETURN> brings the line Off Hook, just as if you picked up the telephone set. You can hang up by entering **ATH0 or ATH** (the default is 0 when no number is entered).

Escape Sequences- Entering CommandMode While Still On-Line +++AT<CR>

It is possible to cause the IBM 7852-400 to enter Command mode after the modem has gone on-line with a remote modem, without disconnecting the call. This is done by entering an Escape Code. The default Escape Code used by the IBM 7852-400 is three plus signs (+++) followed by the letters **A** and **T**, up to sixty command characters (most typically**"*H*"**, to hang up), and a RETURN. The number of command characters allowed after +++AT<CR> , is defined by S-Register S34. S-Register S34 defaults to ten command characters. When this is done, the modem escapes to Command Mode, executes the command (if any), and then remain in Command mode. For example, to hang up the modem at the end of a call, enter ***+++ATH*** and hit RETURN. There is no need to incorporate pauses before and after the plus signs, as done in earlier modems.

BREAK AT<CR>

The IBM 7852-400 provides an alternative Escape method, using a Break signal as the Escape Code.

The Break signal allows the start-stop DTE (data terminal equipment) to signal the modem without loss of character transparency. With this method, a ***BREAK*** signal is used instead of the three plus signs. The ***BREAK*** is followed by the letters ***A*** and ***T***, up to 60 command characters, and ***RETURN***. When this is done, the modem executes that command, but remains in On-Line mode unless the command was to hang up and/or reset the modem (an ***H*** or ***Z***), in which case the modem would be in the Command Mode after executing that command.

Escape Sequence Options - Entering Command Mode While On-Line %E

As mentioned, the default escape sequence setting is for the modem to respond to the **+++** escape method. Optional settings are for the modem to respond to the Break method, for the modem to respond to either the **+++** or the Break Methods, for the modem to ignore both methods and not escape, for the modem to respond with no "*OK*" to **+++**, and for the modem to respond with "*OK*" to **+++**. The ***%E*** command is used to select these options, as follows:

%E0	Modem Won't Escape
%E1	+++ AT<CR> Method (**default**)
%E2	Break Method
%E3	Either +++ or Break Methods
%E4 *	No "OK" Response to +++
%E5 *	"OK" Response to +++

*The ***%E4*** and ***%E5*** commands enable or disable an "*OK*" response, which is required by some software packages during an escape sequence.

Force Answer Mode A

You can force the IBM 7852-400 into Answer mode with the modem's **A**command. Entering ***ATA*** when in Command mode immediately brings your modem off-hook, out of Command mode and into On-Line Answer mode, and causes it to transmit its carrier signal over the phone line. If no responding carrier tone is received by your modem within forty-five seconds (or some other time as determined by S-Register S7), your modem stops transmitting its tone, hangs up, and goes back into Command mode.

Exiting Command Mode, Going Back On-Line O

You can bring the IBM 7852-400 out of Command mode and back into On-Line mode by entering **ATO** (where O is the letter O, not the number 0). In this case, the ***O*** command reverses what was done by entering the Escape Code. The ***O*** command will bring the modem into the same On-Line mode (Originate or Answer) that it was in prior to going into Command mode.

Line Probe Commands

Before V.34 negotiation takes place, remote and local modems transfer their functional capabilities using modulated calling and answering tones; indicating the common capabilities of the modem at each end.

Once this is done, a probing signal is passed between the modems to identify impairments in the telephone channel (e.g., Receive Signal Strength vs. Frequency, Noise vs. Frequency and Signal to Noise Ratio vs. Frequency). After receiving the results of the probing signal, the modem receivers and transmitters begin with the lowest speed and move up until reaching the highest speed at which they can exchange data. All this occurs in about five seconds.

There are a number of Line Probe Commands. These commands are configurable and can be stored to RAM (via ***AT&W0***).

These commands are listed below:

Enable/Disable Reading of Line Probe Information Commands:

%DP0 Do not read Line Probe information from DSP during handshake (Default).

%DP1 Read Line Probe information from DSP during handshake.

Format of Line Probe (Graph or Table) Commands:

%DF0 Data is displayed in Graph format. Y axis is shown in dBms (Default).

%DF1 Data is displayed in Table format. Numeric values are displayed for 150Hz to 3750Hz in 75HZ increments.

Immediate Action Line Probe Commands:

To activate these commands first type ***+++AT<CR>***(*on-line escape command while maintaining command mode*), then type the Command prefixed by an *AT*.

&RP This command initiates a retrain that makes the processor read Line Probe information. Valid only when on-line in V.34 mode.

L9 Displays Signal Strength information.

L10 Displays Signal to Noise Ratio information (*SNR*).

L11 Displays noise information.

Chapter 4: S - Registers

Introduction

Certain Command Mode configurations are stored in memory registers called, S-Registers. The ***S*** command is used to assign a value to, and to read the current value of an S-Register. To assign a value to an S-Register, enter the letter ***S***, followed by the S-Register number and an equals sign (=), and then a decimal response to the message "*ENTER THE NEW VALUE IN DECIMAL FORMAT*". To read an S-Register value, enter the letter ***S*** followed by the S-Register number and a question mark (?), then hit RETURN. To verify that the S-Register value was entered correctly, enter for example, ***ATS8?*** and hit RETURN. You should receive a response of the assigned value given to that S-Register. Refer to the section on Reading and Assigning S-Register Values.

S-Register Descriptions

The following sections define the S-registers used in the IBM 7852-400 modem and provide information concerning the parameters that are used for the various settings.

S0 Number of Rings Until Modem Answers

Unit	1 ring
Range	0-255
Default	1
Description	S0 defines the number of rings the modem waits before answering an incoming call. The default value is one ring (Decimal 1), which means that the modem answers the call immediately after the first ring. The maximum number of rings that can be configured is 255. Setting the value to zero (0) disables auto-answer completely.

© Copyright IBM Corp. 1996

S1 Rings Which Have Occurred

Unit 1 ring

Range 0-255

Default 0

Description S1 counts the number of rings that have occurred. It is a "*read only*" type of register and is seldom, if ever, used in typical operation. Each time an incoming ring signal is detected, S1 increases its value by one, up to a maximum of 255. If you set S1 to a value other than its default value of zero, or if the value is increasing with rings, this new value remains stored in S1 for eight seconds after the last ring is counted, after which time the value reverts to zero.

S2 Escape Code Character

Unit ASCII Character

Range 0-127

Default 43 (+)

Description S2 defines the escape code character. The default character is the plus (+) sign (Decimal 43), but may be set for any ASCII character. Setting an S2 value greater than 127 results in no escape character, and therefore no means of entering Command mode from On-line mode without breaking the on-line connection.

S3 Return Character

Unit ASCII Character

Range 0-127

Default 13 (^M)

Description S3 defines the character recognized as Carriage Return (RETURN) or "Enter". S3 may be set for any ASCII character.

S4 Line Feed Character

Unit ASCII Character

Range 0-127

Default 10 (^J)

Description S4 defines the character recognized as Line Feed. S3 may be set for any ASCII character.

S5 Backspace Character

Unit ASCII Character

Range 0-127

Default 8 (^H)

Description S5 defines the character recognized as BACKSPACE. S5 may be set for any ASCII character.

S6 Wait Time for Dial Tone

Unit 1 second

Range 2-255, 4-255**, 4-7***

Default 2, 4**,4***

Description S6 sets the time the modem waits after the RETURN key is pressed before executing a dial command. The default setting is two seconds (Decimal 2).

S7 Time for Carrier (Abort Timer)

Unit 1 second

Range 1-255, 1-55*

Default 45, 55*

Description S7 defines the Abort Timer (lack of carrier) delay time. The default value is 45 seconds (Decimal 45). This means that, after dialing, the modem waits for a carrier signal for up to 45 seconds and, if none is detected, aborts the call. The maximum S7 value is 255.

* Value for International and DOC units

** Value for International units only

***BABT models only

S8 Pause Time for Comma

Unit 1 second

Range 0-255, 4-255**, 4-7***

Default 2, 4**, 4***

Description S8 sets the length of the pause caused by a comma inserted in a dialing command. The default setting is two seconds, (or two units Decimal 2) or four seconds, where each unit is one second. S8 may be set for up to 255 seconds.

S8 also sets the time the modem waits before retrying a call after detecting a busy signal. Some computer systems need more than two seconds to reset (in which case you should increase the value of S8).

S9 Carrier Detect Response Time

Unit 100 mSec.

Range 1-255

Default 6

Description S9 sets the time delay between when the modem first detects a valid incoming carrier signal and when the modem turns on its Carrier Detect circuit. The default setting is 600 milliseconds, or six units of 100 mSec each (Decimal 6). S9 may be set for up to 25.5 seconds.

S10 Carrier Loss Disconnect Delay Time

Unit 100 mSec.

Range 0-255

Default 7

Description S10 sets the time a carrier signal must be lost before the modem disconnects. The default setting is 700 mSec, or seven units (Decimal 7) of 100 mSec. Maximum delay is 25.4 seconds (Decimal 254). Setting the S10 value to 255 causes the modem to not disconnect with loss of carrier. (This S-Register applies at speeds of 2400 bps and less.)

S11 Tone Dialing: Tone Spacing and Duration

Unit 1 mSec.

Range 1-255, 80-255*, 80-255***

Default 70, 80*, 80***

Description S11 sets the speed of tone dialing (spacing and tone duration times). The default value is 70 units (Decimal 7) or 80 units, where each unit is one mSec, meaning that each tone is on for 70 mSec with a 70 mSec pause between each.

The minimum S11 value allowed by most telephone systems is 50 mSec (50 units). Very few telephone systems can handle anything faster than that. The maximum S11 value is 255 mSec (255 units).

* Value for International and DOC units
** Value for International units only
***BABT models only

S13 Remote Configuration Escape Character

Unit ASCII Character

Range 0-127

Default 37 (%)

Description S13 defines the remote configuration escape character (which becomes your modem's remote configuration character). The default is three percent symbols (%%%). When the S13 character is entered three consecutive times from a remotely connected site, your modem responds with its Remote Configuration procedure.

S15 Callback Time Delay

Unit Seconds

Range 10-255

Default 20

Description S15 defines the time delay between Callback attempts after initial passwords have been exchanged between modems.

* Value for International and DOC units

** Value for International units only

***BABT models only

S16 Callback Attempts

Unit 1 Attempt

Range 1-255, 1-2***

Default 4, 2***

Description S16 defines the number of attempts allowed after initial passwords have been exchanged between modems.

S17 Changing Break Time

Unit 10 mSec.

Range 0-2.5 sec

Default 250

Description S17 defines the break time (*space*) sent to the local PC. The default is set for a 25 to 250 mSec break. The break time can be changed in 10 mSec increments by increasing or decreasing the value of S17.

S18 Automatic Leased Line Restoral

Unit 1 minute

Range 10-255

Default 30 minutes

Description When the modem is in dial back-up mode, it periodically checks the lease line to see if it is operational and tries to restore the lease line if possible. S18 defines how often attempts occur. The default of S18 is 30 minutes and can be set in one minute increments from 10 to 255 minutes. Setting the S18 restoral under 10 minutes causes excessive breaks in dial-up operation.

S19 Dial-Back Timer

Unit 1 minute

Range 0-255

Default 1

Description S19 is a timer that begins when the lease line goes down. S19 specifies the duration of time the modem attempts to reestablish the lease line connection.

S24 PBX/CBX Disconnect Drop Time for DSR/CTS/CD

Unit 50 mSec.

Range 0-255

Default 20

Description Some PBX and CBX phone systems require the modem's DSR, CTS, and/or CD signal(s) to behave in a certain manner when calls are disconnected. The modem's ***&R***, ***&S,*** and ***&C*** commands cause the modem to drop these signal(s) for a specified time period upon disconnect, and then bring the signal(s) up again. S24 defines the length of time that the signals drop. The default setting of 20 results in a one second drop time, which is what most PBX/CBX systems with this requirement need.

* Value for International and DOC units

** Value for International units only

***BABT models only

S25 DTR Dropout Time

Unit 100 mSec.

Range 0, 1 through 255

Default 0

Description S25 defines the amount of time that DTR must be dropped before the modem disconnects. Typically, a disconnect occurs when DTR is dropped for 50 milliseconds or more. This dropout time can be increased, up to a maximum of 25.5 seconds. The S25 unit value for zero is the default value of 50 mSec. For values from 1 through 255, the unit value is 100 mSec.

S26 Failed Password Attempts

Unit 1 failed attempt

Range 0-255

Default 0

Description S26 counts the number of times there has been a failed password attempt. For example, if you entered ***ATS26?*** the message *003* would be displayed, meaning someone has failed three times to gain access to your modem using its password security system.

S29 Local Inactivity Timer

Unit minutes

Range 1-255

Default 20

Description S29 defines the amount of idle time that can elapse between AT commands after the SETUP password has been entered. If this timer expires, the LOGIN and SETUP passwords will have to be re-entered.S29 only takes effect when the modem has been sent a ***#DB1*** command, which secures the modem from local and remote configuration or dialing (i.e., no AT commands can be sent until the LOGIN and SETUP passwords have been entered).

S30 Inactivity Timer

Unit 1 minute.

Range 0-255

Default 0

Description S30 causes the modem to disconnect if no data is transmitted or received for a specified time. This timer runs during both Reliable and Normal error correction connections. The timer restarts any time a data character is passed through the serial port (either sent or received). If noise on the phone line causes an error to be received during Normal mode, this also restarts the timer. The default value is off (0).

The inactivity timer is disabled by setting S30 to 0, which is the factory default setting.

S32 Time Elapse for Escape Sequence

Unit 1 second

Range 0-255

Default 20

Description S32 sets the time period to validate the escape sequence. If the time interval expires before the escape sequence is employed (by hitting RETURN), the escape sequence is aborted. The default is 20 units.

S34 Buffer Length of Command Mode...After On-line Escape Sequence

Unit ASCII Character

Range 0-60

Default 10

Description If the number of characters after AT exceeds the S34 buffer length value, the buffer is cleared and the escape sequence is aborted.

S36 Time Between DTR Inactive and Modem Off-Hook

Unit 1 Second

Range 0-255 seconds

Default 0

Description The DTR Busy-out feature uses S-Register S36 to set the time between DTR inactive (low) and the modem going *off-hook*. S36 can be set in one-second intervals from 0 to 255 seconds. With the default setting of S36=0, DTR Busy-Out is disabled (i.e., DTR won't Busy-Out).

S37 Time Between DTR Active and Modem On-Hook

Unit 1 Second

Range 0-255 seconds

Default 5

Description S37 sets the time between DTR being active and the modem going *on-hook* (not busy). S37 will only function in conjunction with S36.

S48 Program V.34bis Connect Speeds

Unit N/A

Range 33, 31, 28, 26, 24, 21,19,16,14,12, 96 and 48

Default 0

Description Defines which speed modem connects within the scope of Enhanced V.34 mode (e.g., S48 = 26 means maximum connect speed is 26.4K). This register compensates for line conditions that have trouble supporting higher Enhanced V.34 speeds (e.g., 33.6K, 31.2K, 28.8K, 26.4K, 24K...). The modem default is a value of 0, which indicates a connection attempt of 33.6K.

Reading and Assigning S-Register Values

The ***S*** command is used to assign a value to, and to read the current value of, an S-Register. To read an S-Register value, enter the letter ***S*** followed by the S-register number and a question mark (*?*), then hit RETURN. For example, entering ***ATS7?*** and hitting RETURN displays the value of S-Register S7 in a 3-digit decimal form. The number 8 would appear as *008*, the number 30 would appear as *030*, and the number 255 would appear as *255*.

To assign a value to an S-Register, enter the letter ***S*** followed by the S-Register number and an equals sign (=), and then a decimal response to the message "*ENTER THE NEW VALUE IN DECIMAL FORMAT*". Convert all ASCII characters to their decimal equivalents before entering them. S-Register decimal values range from 0-127 for ASCII characters, or 0-255 for numeric values. A complete ASCII conversion chart is located in Appendix A of this manual.

Examples of Assigning Values

1. Let's say you wish to have longer pauses caused by the comma in a dial command; five seconds instead of two. Entering ***ATS8=5*** assigns 5 as the value for S-Register S8 (meaning the modem pauses five seconds for a comma in a dial command).

2. In a second example, let's say that you wish to configure the IBM 7852-400 modem to answer incoming calls after the 30th ring instead of after the first ring. To configure S-Register S0 with a value of 30, enter ***ATS0=30*** and hit RETURN.

3. In a third example, let's say you are calling long distance to another country code, and it is taking a long time to connect. The S-Register S7 (Abort Timer) setting of 45 seconds, is insufficient. The abort timer times out and cancels the call before a connection is made. To change the S7 value to 55 seconds, enter Command mode, then enter ***ATS7=55*** and hit RETURN. Now, after dialing, the modem allows 10 more seconds for a carrier signal before aborting the call. The additional 10 seconds should provide enough time for international calls.

Examples of Reading Values

To verify that you entered the value correctly in the above examples, enter ***ATS8?*** and hit RETURN in the first example, ***ATS0?*** in the second, and ***ATS2?*** in the third example. You should receive the response *005* in the first example, *030* in the second example, and *055* in the third example.

When configuring the S-Registers, it is a good practice to include the verification read-entry in the same command line as the configuration assignment-entry. In the three preceding examples, enter ***ATS8=5S8?,*** ***ATS0=30S3?,*** and ***ATS7=55S7?***.

AT Command and S-Register Summary

The vast majority of installations are similar, with the modem being used to dial up a remote installation where the call is automatically answered. Your modem has a default configuration to dial another 33,600 bps modem that support error correction, data compression and flow control. If the answering modem is not compatible, the IBM 7852-400 can match protocols, provided the protocols are industry standard (i.e., ITU, AT&T or Bell) and not proprietary.

The ***&W*** command, used in conjunction with specific other AT commands and S-Registers, can reconfigure the modem to conform to a specific

application. The command **AT&W0** (or **AT&W**) causes the modem to store its current parameters in its nonvolatile RAM. The command also sets the modem upon power up, or when it is reset with an **ATZ** command, the modem reads all of its configuration and S-Register parameters from RAM, and not from the factory settings in ROM (note you may recall factory installed defaults by entering **AT&F8&W0**). The **&W** command changes the configuration parameters stored in RAM that you specifically intend to alter. All other default parameters remain unchanged.

The **AT&W1** command sets the modem so that it does not store its parameters in RAM, and on power up or when an **ATZ** command is issued, parameters are read from the factory default settings in ROM.

Before using the **&W** command, you may want to view the modem's current operating parameters. Use the **ATL5**, **ATL6** and **ATL7** commands to display the current modem configuration.

Chapter 5:DIP - Switch Settings

Introduction

There are several DIP-Switch options on the IBM 7852-400's printed circuit (PC) board. The DIP-Switches are accessible through a cut-out on the side of the modem. It is unlikely you will need to access the interior of the modem, but if you do, you must remove the modem's PC board from the modem's chassis. To remove the PC board from the modem chassis, remove the retaining screw (on the bottom of the modem near the RS232 connector), and slide the PC board out of the modem chassis.

DIP-Switch Option Settings

Switch #1 Forced DTR -- "DTR"

(Asynchronous-/Synchronous Mode/Leased/Dial--Up)

The IBM 7852-400 must have a high DTR signal in order to operate. DTR is provided to the modem by the terminal or computer to which it is attached, through pin 20 of the RS232C/V.24 interface. If your terminal or computer is not providing DTR to the modem, you can force the DTR signal high with DIP-Switch #1.

DTR function normally = Switch #1 UP

DTR forced On = Switch #1 DOWN

(Factory Default Setting = UP)

Switch #2 Flow Control &E4/&E5

(Asynchronous Mode/Leased Line /Dial-Up)

With Hardware Flow Control, the modem uses its RS232C/V.24 interface to control the flow of data from the computer or terminal to which it is attached. The CTS signal on Pin 5 of the RS232C/V.24 is brought low to stop the flow of data, and is brought high to restart it. Place DIP-Switch #2 in the UP position to enable Hardware Flow Control (***&E4***). Xon/Xoff Flow Control (***&E5***) is another flow control method. Xon/Xoff characters in the data dictate the start and stop of data flow from the computer or terminal. Place DIP-Switch #2 in the DOWN position to select Xon/Xoff Flow Control.

© Copyright IBM Corp. 1996

Hardware Flow Control (***&E4***) = Switch #2 UP

Xon/Xoff Flow Control (***&E5***) = Switch #2 DOWN

(Factory Default Setting = UP)

Switch #2 SDLC/BSC Option

(Synchronous Mode/Leased Line/Dial-Up)

Synchronous Data Link Control (*SDLC*) and Binary Synchronous Control (*BSC*) are two error correction protocols used in the IBM Mainframe environment. Place DIP-Switch #2 in the UP position to enable SDLC mode, and place DIP-Switch #2 in the DOWN position to enable BSC mode.

SDLC Mode = Switch #2 UP

BSC Mode = Switch #2 DOWN

(Factory Default Setting = UP)

Switch #3 Enable-/Suppress Responses -- "Q"

(Asynchronous Mode/Synchronous/Dial-Up)

In some Asynchronous mode applications, you may want to suppress all responses from the modem. Place DIP-Switch #3 in the DOWN position to enable Result Code responses (***Q0***). Place DIP-Switch #3 in the UP position, and answer mode is handled without responses and echo turned off. (***Q2***), but originate is still intelligent.

Enable Responses: Originate/Answer(***Q0***) = Switch #3 DOWN

Suppress Responses: Answer (***Q2***) = Switch #3 UP

(Factory Default Setting = DOWN)

*Switch #3 dB Transmission Levels

(Asynchronous/Synchronous Mode/Leased Line)

DIP-Switch #3 adjusts dB transmission levels required by some phone carriers. Place DIP-Switch #3 in the DOWN position to enable -9 dB transmission. Place DIP-Switch #3 in the UP position to enable -15 dB transmission.

-9dB Transmission = Switch #3 DOWN

-15dB Transmission = Switch #3 UP

(Factory Default Setting = DOWN)

Switch #4 5853 Emulation

(Synchronous Mode/Leased Line/Dial-UP)

The IBM 7852-400 can function in the IBM AS/400 environment (appearing like an IBM5853 modem). First, DIP-Switch #7 must be placed in the UP position. This establishes an RTS/CTS condition (state typical for an IBM5853 modem in half-duplex mode). Next, place DIP-Switch #4 in the DOWN position. This "*spoofs*" the IBM 7852-400 into operating like an IBM5853 modem in AS/400 applications. DIP-Switch #4 in the UP position disables this function. Note that the IBM 7852-400 must be in Command mode to allow AS/400 mode (DIP-Switch #8 DOWN); and in Synchronous mode (DIP-Switch #12 UP).

5853 Emulation Enabled = Switch #4 DOWN

5853 Emulation Disabled = Switch #4 UP

(Factory Default Setting = DOWN)

Switch #4 Reserved

(Asynchronous Mode/Leased Line/Dial-Up)

Switch #5 Enable/Disable Auto-Answer - "ANS"

Asynchronous Mode/Synchronous Mode/Dial-Up)

In some originate-only applications, you may wish to disable the IBM 7852-400's automatic answering capabilities. This may be true if you have a telephone set attached to a modem and wish to receive voice calls that you yourself would answer instead of the modem. Place DIP-Switch #5 in the UP position to enable Auto-Answer. Place DIP-Switch #5 in the DOWN position to disable Auto-Answer.

Auto-Answer Enabled = Switch #5 UP

Auto-Answer Disabled = Switch #5 DOWN

(Factory Default Setting = UP)

Switch #5 Originate/Answer Mode

(Asynchronous/Synchronous Mode/Leased Line)

The MT2834BL functions in either Originate mode or Answer mode. Place DIP-Switch #5 in the DOWN position to enable Originate mode. Place DIP-Switch #5 in the UP position to enable Answer mode.

Originate Mode Enabled = Switch #5 DOWN

Answer Mode Enabled = Switch #5 UP

(Factory Default Setting = UP)

Switch #6 Maximum Throughput Setting

(Asynchronous Mode/Leased Line/Dial-Up)

Some applications require you to dial into services with maximum throughput on, and other applications where maximum throughput must be off (i.e., service not supporting error correction, or the V.42 handshake interferes with logon sequence). DIP-Switch #6 is used for switching between these two modes. This DIP-Switch controls three important parameters (error correction, speed conversion and serial port speed), which in effect enables or disables maximum throughput.

Maximum Throughput Enabled = Switch #6 UP

Maximum Throughput Disabled = Switch #6 DOWN

(Factory Default Setting = UP)

Switch #6 Slave Clocking

(Synchronous Mode/Leased Line/Dial-Up)

In Synchronous mode, DIP-Switch #6 controls the option of having timing controlled by the receive clock. The originate modem, in effect, adjusts to the answer (remote) modem. Place DIP-Switch #6 in the DOWN position to enable Slave Clocking. Place DIP-Switch #6 in the UP position to disable Slave Clocking.

Slave Clocking Enabled = Switch #6 DOWN

Slave Clocking Disabled = Switch #6 UP

(Factory Default Setting = UP)

Switch #7 Request To Send Forced - "RTS"

(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

If your computer or terminal uses RTS-CTS protocol (typically used in some synchronous applications, but also if using hardware pacing for V.42 error correction or speed conversion), you may want to set RTS to function independently of CTS (DIP-Switch #7 UP). For most applications, especially asynchronous, this switch should be set so that RTS is forced On (DIP-Switch #7 DOWN)

RTS functions Normally = Switch #7 UP

RTS forced On = Switch #7 DOWN

(Factory Default Setting = UP)

Switch #8 Enable/Disable Command Mode -- "Com"

Asynchronous/Synchronous Mode/Leased/Dial-Up)

In some applications you may want to disable the IBM 7852-400's Command mode so that the modem does not recognize or react to AT or V.25*bis* commands. This may be true in strictly auto-answer applications where no call origination is required. Place DIP-Switch #8 in the DOWN position to enable Command mode. Place DIP-Switch #8 in the UP position to disable Command mode. The factory default setting is Command mode enabled.

Disable Command Mode = Switch #8 UP

Enable Command Mode = Switch #8 DOWN

(Factory Default Setting = DOWN)

Switch #9 Digital Loopback Test

(Asynchronous-/Synchronous Mode/Leased Line/Dial-Up)

When in Synchronous mode, this switch controls both Local Digital Loop and Remote Digital Loop tests while on-line. When the Voice/Data switch is toggled to the Answer mode position (UP) and DIP-Switch #9 is in the UP position, the IBM 7852-400 performs the Local Digital Loopback test. When DIP-Switch #9 is DOWN and the Voice/Data switch is toggled to Answer mode position (UP), the IBM 7852-400 performs the Remote Digital Loopback test.

Local Digital Loopback Test = Switch #9 UP

Remote Digital Loopback Test = Switch #9 DOWN

(Factory Default Setting = DOWN)

Switch #10 Leased Line/Dial-Up Operation -- "DDD"

(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The IBM 7852-400 operates in either leased-line or dial-up modes. This switch controls leased-line/dial-up operation. Place DIP-Switch #10 in the UP position for Dial-Up operation. Place DIP-Switch #10 in the DOWN position for Leased-Line operation

Dial-Up Operation = Switch #10 UP

Leased Line Operation = Switch #10 DOWN

(Factory Default Setting = UP)

Switch #11 "AT" Responses/Extended Responses

(Asynchronous Mode/Leased line/Dial-Up)

In Asynchronous mode, you can set the IBM 7852-400L to respond with Result Codes according to the "*Extended*" command response set (Switch #11 in the DOWN position), or to "*AT*" command response set (Switch #11 in the UP position). The ***&Q*** command performs the same function (choosing AT or Extended Result Codes).

"*AT*"Responses (***&Q1***) = Switch #11 UP

"*Extended*"Responses (***&Q0***) = Switch #11 DOWN

(Factory Default Setting = DOWN)

Switch #11 Internal/External Clocking

(Synchronous Mode/Leased Line/Dial-Up)

In Synchronous mode, the transmit clock can be supplied by the DTE on pin 24 of the RS232C/V.24 interface by placing DIP-Switch #11 UP. Place DIP-Switch #11 in the DOWN position to enable DCE to control clocking (internal clock via pins 15 and 17 of the RS232/V.24 interface).

External Clock (pin 24) = Switch #11 UP

Internal Clock (pins 15/17) = Switch #11 DOWN

(Factory Default Setting = DOWN)

Switch #12 Asynchronous/Synchronous Operation -- "Sync"

(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The IBM 7852-400 can operate in either Asynchronous mode or Synchronous mode. In Synchronous mode, start and stop bits are eliminated. The modem's internal clock circuits on the RS232C/V.24 pins 15 and 17 are activated. The IBM 7852-400's Command mode is not accessible in Synchronous mode. This switch is a means to alternate and to access either mode. In Synchronous mode, you may want to set the RTS forcing and CTS forcing DIP-Switches so that both of signals act normally (not forced on).

Synchronous Operation = Switch #12 UP

Asynchronous Operation = Switch #12 DOWN

(Factory Default Setting = UP)

Switches #13 and #14 Speed Switches

Synchronous Mode/Leased Line)

DIP-Switches #13 and #14 are used to set the IBM 7852-400's data transmission rate. Switches #13 and #14 are used in combination, typically in leased-line and call origination applications. Note that the modem baud rate command (***$MB33600***) overrides the setting of these speed selection switches (DIP switches #13 and #14).

28800 bps Operation =Switch #13 UP and Switch #14 UP

19200 bps Operation =Switch #13 DN and Switch #14 UP

14400 bps Operation =Switch #13 UP and Switch #14 DN

9600 bps Operation =Switch #13 DN and Switch #14 DN

(Factory Default Setting=Switch #13 UP and Switch #14 UP)

Switch #15 Carrier Detect/DSR Forcing --"DSR"

(Asynchronous/Synchronous Mode/Dial-Up/Leased Line)

Some terminals react in unusual ways to the toggling of the Carrier Detect (CD - RS232C/V.24 pin 6) signals. The most common symptom is that the modem does not respond to commands, or does not echo characters. In these cases, it is advisable to force these two signals On in order for the terminal to communicate properly with the modem in Command mode. This is done by setting DIP-Switch #15 DOWN. With DIP-Switch #15 in the UP position, both CD and DSR will be either on or off, depending on the On-Line status.

CD and DSR normal = Switch #15 UP

CD and DSR forced On = Switch #15 DOWN

(Factory Default Setting = UP)

Switch #16 2 Wire Operation

(Asynchronous/Synchronous Mode)

The IBM 7852-400 works over 2-wire leased lines. To select 2-wire operation, place Switch #16 UP.

2-Wire Leased Line = Switch #16 UP

Reserved = Switch #16 DOWN

(Factory Default Setting = UP)

Speaker Volume Control

You can adjust the volume of the IBM 7852-400's phone-line monitor speaker with a volume control knob, located on the back of the modem next to the RS232C connector. Turn the knob clockwise to increase the modem's volume and counterclockwise to decrease speaker volume. See Speaker Control Command (***M***).

Recording Option Configurations

This section lets you record any changes you may have made to the DIP-Switch settings. Circle the appropriate setting and record the effect for future reference.

Table 4. DIP-Switches

Switch	Function	Position	Effect
#1	Force DTR/DTR from Interface*	UP*	
		DOWN	
#2	Flow Control &E4*/&E5	UP*	
	(Async/Dial-Up/Leased Line)	DOWN	
#2	SDLC*/BSC (Sync)	UP*	
		DOWN	
#3	Result Codes Enable*/Disable	UP	
	(Async/Dial-up)	DOWN*	
#3	DbM Transmit -9dB*/-15dB	UP	
	(Async-/Sync-/Lease--Line)	DOWN*	
#4	AS/400 Enable*/Disable	UP	
	(Sync/Dial-Up/Leased line)	DOWN*	
#5	Auto-Answer Enable*/Disable	UP*	
	Async/Sync/Dial-Up)	DOWN	
#5	Answer*/Originate	DOWN	
	(Async/Sync/Leased Line)	UP*	
#6	Max-Thru Enable*/Disable	UP*	
	(Async/Dial-Up/Leased)	DOWN	
#6	Slave Clock Enable/Disable*	UP*	
	(Sync/Dial-Up/Leased)	DOWN	
#7	RTS/Normal*/Forced	UP*	
	(Sync/Async/Dial/Leased)	DOWN	
#8	Command Mode Enabled*	DOWN*	
	(Sync/Async/Dial/Leased)		
#9	Local/Remote* LoopBack	UP	
	(Async/Sync/Dial/Leased)	DOWN*	
#10	Dial-Up*/Leased-Line	UP*	
		DOWN	
#11	"*AT*"/"*Extended*" Result Codes*	UP	
	(Asynchronous)	DOWN*	
#11	Internal*/External Clocking	UP	
	(Synchronous)	DOWN*	
#12	Sync*/Async Mode	UP*	
		DOWN	

* Factory Default Setting

Table 5. DIP Switches

SWITCH	CONDITION	EFFECT
#13/#14	UP/UP*	28.8 K bps Operation
#13/#14	DOWN/UP	19.2 K bps Operation
#13/#14	UP/DOWN	14.4 K bps Operation
#13/#14	DOWN/DOWN	9600 bps Operation
#15	UP*	CD/DSR from Interface
#15	DOWN	CD/DSR Forced On
#16	UP*	2-Wire Leased Line
#16	DOWN	Reserved

* Standard Factory Default Setting

Chapter 6:FAX Operation

Introduction

This document is intended to provide users with specific fax command protocol information. It is assumed that users have an understanding of CCITT T.30 and T.4 concepts. The "fax command protocol" is defined here as the set of AT Commands used to control the sending/receiving of faxes. The term "fax" is defined as a specialized file transfer protocol for transferring black and white bit mapped images. These AT commands are used to control parameters for this file transfer and to initiate a particular action in the fax protocol. They also provide responses to indicate the progress and status of the transfer.

AT Command Implementation

The IBM 7852-400 implements an extension to the AT Command set for controlling fax transmission and reception, which is in compliance with EIA proposed standard TIA-592 as specified by EIA subcommittee TR29.2. It involves a set of new commands, responses and procedures. The best way to get an understanding of this is to present an example of the transmission and reception of a one page fax (or facsimile) using the fax command extensions.

What follows below are the commands and responses, in chronological order, given to and returned from the transmitting and receiving modems.

© Copyright IBM Corp. 1996

Table 6. Transmitting Modem

Line #	Command & Response	Comments
T1	AT+FCLASS=2	Set class to originate as a fax modem
T2	ok	
T3	AT+FLID="666 6676"	Set local fax id
T4	ok	
T5	ATDT5551212	Dial the receiving fax modem
T6	+fcon	We have received a fax connection
T7	+fcs:"555 1212"	This is the remote fax's identification string
T8	+fdis:0,2,2,2,0,0,0,0	This is the remote fax's capabilities
T9	ok	
T10	AT+FDT	Initiate speed negotiation and page transmit
T11	+fdcs:0,2,2,2,0,0,0,0	This is the negotiated fax parameters
T12	connect	Ready for page data
T13	<xon>	now
T14	<PAGE DATA>	send T.4 formatted page data
T15	ok	
T16	AT+FET=2	This is the last page
T17	+fpts:1	The page was received ok
T18	+fhng:0	Send one page done
T19	ok	

Table 7. Receiving Modem

Line #	Command & Response	Comments
R1	AT+FCR=1;+FAA=1	Tell the modem that the DTE can receive documents and to auto-detect the calling modem type (fax or data).
R2	ok	
R3	AT+FLID="555 1212"	Set local fax id
R4	ok	
R5	ring	
R6	ATA	Answer the call
R7	+fcon	We have received a fax connection
R8	+fts:"566 6676"	This is the remote fax's identification string
R9	+fdcs:0,2,2,2,0,0,0,0	This is the negotiated fax parameters (speed may change)
R10	ok	
R11	AT+FDR	
R12	+fcfr	We have sent a confirmation to receive
R13	+fdcs:0,2,2,2,0,0,0,0	This is the final negotiated fax parameters
R14	connect	Get ready to receive page data
R15	<DC2>	
R16	<page data>	receive T.4 formatted page data
R17	+fpts:1,1000	1000 lines received
R18	+fet:2	This is the last page
R19	ok	
R20	AT+FPTS=1;+FDR	Send page received OK message
R21	+fhng:0	Receive one page done
R22	ok	

We can now use the example to help explain the terminology for the fax command extensions.

Modes of Interaction

There are three modes of interaction with the modem. The first mode is AT command mode where serial data sent to the modem is interpreted as commands if preceded by an "AT". The second mode is command execution mode which is entered from AT command mode when an action command is given to the modem (e.g., on line T5 above the ATDT . . . . command is given). After an action command is given, the modem will display responses which indicate the progress of the command (e.g., the +FCON on line T6 indicates that the fax carrier signal was detected) and information received from the remote fax modem. If serial data is received at that point, the fax will be aborted and the phone call will be terminated. The third mode of interaction with the modem is the page connect mode. This mode of operation is entered after a +FDT or +FDR command is entered from AT command mode, the command is executed, and a "CONNECT " response is given, which indicates the start of page connect mode (e.g., Line T12- T14, Line R14-R16). When a +FDT command was used to enter page connect mode, the serial data sent to the modem should be the page image data (as specified by CCITT T.4 standard) for the current page being transmitted.

When a +FDR command was used to enter page connect mode, the serial data received from the modem will be page image data (CCITT T.4 format) for the page currently being received.

AT Command Mode

In AT command mode, regular AT commands and Fax AT commands can be given. Regular AT commands are used to control modem functions and functions common to modem and fax operation, such as dialing and answering (i.e., ATD, ATA). Fax AT commands have a different format than regular AT commands (which are described in the main modem manual). Fax AT commands consist of a "+F " followed by a command name, followed by either a "?" if reading a parameter, or an "=" followed by a new parameter value if setting a parameter, or an "=?" if inquiring the valid values of a parameter. If a command (regular or fax) is to follow a Fax AT command, then it must be followed by a "; ". Examples of Fax AT commands are all through the above example and an example of two Fax AT commands on one line is on line R1 of the example.

There are two types of Fax AT commands: action commands and parameter commands. Action commands initiate a sequence of events that do not execute instantaneously thus changing the execution mode to

command execution. Because of the mode change, action commands must be the last command on the line. Parameter commands execute "instantaneously" and more than one can appear on the same command line.

There are three types of parameter commands: set parameter, read a parameter and read the valid values for a parameter.

Note: When receiving fax responses from the modem, the state of the regular AT parameter V is important. If verbose mode is enabled (set by issuing an ATV1 command), then all responses will be preceded and followed by a Carriage Return-Line Feed combination. If terse mode is enabled (set by issuing an ATV0 command), then all responses will be followed by a Carriage Return. Also, regular AT responses are affected by the V parameters specified in the modem manual (e.g., verbose response: "OK ", terse response: "1"). All examples in this insert assume verbose mode.

When setting a parameter, the response will be an "OK " if the parameter set worked, or "ERROR" if the parameter value was invalid. When reading a parameter, the response will be given with the following format: a "+F" followed by the parameter name, followed by an "=", followed by the parameter value. When reading the valid values for a parameter, the response will be given as a valid parameter string described below. When action commands are given, responses may be given to report the progress of the action command. For example, the ATD command may give the responses +FCON, +FDIS:0,2,2,2,0,0,0,0 before the OK response is given. These responses to action commands have the following format: a "+F " followed by the parameter name, followed by a ": ", followed by the parameter value.

Parameters come in three different types: numbers, strings of characters and compound parameters consisting of more than one of the above parameter types.

Numeric parameters consist of a list of digits that form a number that is either in the range from 0 to 255, or 0 to 65535 based on what parameter is being set or read. Any number of leading zeros is permissible. A valid values string for numeric parameters consists of a list of numbers and number ranges separated by commas (e.g. 10, 20- 33, 30 means the valid parameter values include 10, 20, 21, 22, 23, and 30).

String parameters consist of a double quote followed by the exact string value, including leading and trailing spaces, followed by the closing double

quote. Non-printable characters cannot be put into a string. A valid values string for string parameters consists of a length value enclosed in parenthesis, and a list of valid character values and character value ranges separated by commas that indicate what characters can legally belong in the string (e.g. (20) (32, 43, 48-57) means that the string can be up to 20 characters long, and can consist of the characters 32, a space, 43, a plus sign, and the characters 48-57, which would be the digits 0-9).

Compound parameters consist of a list of numeric and string parameters separated by commas (e.g., DIS is a compound parameter that consists of eight numeric parameters and is set by the following command AT+FDIS=1,3,0,2,0,0,0,3). It is possible, based on what parameter is being set, to omit part of a compound parameter by either omitting a value or values in a compound parameter string or by omitting the end of compound parameter string (e.g., the DIS parameter could be set with the following command: AT+FDIS=,,2,0 which would set the third and fourth values of the DIS parameter and leave the rest unchanged. Notice that leading omitted parameters must still include a comma to hold their place, but trailing parameters and their commas can simply be omitted). It is possible to receive a compound parameter response from the modem which will have missing values (e.g., the +FPTS response will sometimes have only two values - +FPTS:1,1134 - and other times have five values - +FPTS:1,1134,30,4,0 - based on the setting of the +FCQ parameter). A valid values string for a compound parameter consists of a valid values string for each parameter enclosed in parentheses and separated by commas (e.g. the valid values string for +FDIS is +FDIS (0-1), (0-3), (0-4), (0-2), (0), (0), (0), (0-7) which indicates the number ranges for each of the eight numeric parameters). The following table illustrates examples of how each of the parameter types is set, or read, and how its valid values string is read.

Parameter Type	**Set**	**Read**	**Read Valid Values**
Numeric	AT+FLPL=1 ok	AT+FLPL? +flpl ok	AT+FLPL=? +flpl=0,1 ok
String	AT+FLID="123" ok	AT+FLID? +FLID="123" ok	AT+FLID=? +flid=(20) (32 -127) ok
Compound	AT+FDIS=,,2,0 ok	AT+FDIS? +FDIS=0,1,1,0,0, 0,0,4 ok	AT+FDIS=? (0-1), (0-3), (0-4),(0-2), (0), (0), (0-7) ok

Command Execution Mode

When in command execution mode, responses are given (in the same format as a parameters that are read except that the "=" following the parameter name is replaced by a ":") to indicate the progress of an action command. All action commands can be aborted by sending a single byte of serial data to the modem while it is in command execution mode. This not only aborts the command, it will also initiate the fax disconnect sequence.

Data Transfer Mode

Data transfer mode is entered after the "CONNECT " response is given (or a '1' response is given in terse mode). This is initiated by either a +FDT or +FDR action command.

When the connect response is initiated by a +FDT command, data sent to the modem after the connect response, is sent out across the phone line to receiving fax modem. This data is a compressed page bit map for the current page being transmitted. It must be formatted according to the CCITT standard T.4. When sending data to the modem, DLE characters (ASCII 16) are replaced by two DLE characters and the end of the fax page is indicated by a DLE ETX sequence (ASCII 16 followed by ASCII 3).

When the connect response is initiated by a +FDR command, data received from the modem after the connect response, is data received from the phone line from the transmitting fax modem. The data being received is a compressed page bit map for the current page being received. It is formatted according to CCITT standard T.4. When receiving data from the modem, DLE DLE character sequences are replaced by a single DLE character. The DLE ETX character sequence indicates that the end of the fax page has been received. A DLE and any other character following it should be discarded (and should not occur).

The baud rate between the DTE and the fax modem should be faster than the negotiated baud rate at which the page is transmitted between fax modems. This is because the link between the fax modems is synchronous and the link between the DTE and the fax modem is asynchronous. Thus, when transmitting a fax page, fewer bits are going out than are coming in (10 bits per character versus 8 bits per character). If the baud rates are the same or the DTE to fax modem baud rate is less, there will be errors in the fax page, because periodically the modem will run out of data to send. The recommended baud rate between the DTE and the fax modem is therefore

AT LEAST 19200, since the fastest fax modem to fax modem baud rate is 9600. The same logic applies when receiving fax page data.

The baud rate is set by the speed at which the dial command is given when originating a fax call, the speed at which the answer command is given when manually answering a fax call or the speed at which the last command is received before automatically answering the call when automatically answering calls.

Since we should set the baud rate to AT LEAST 1920, flow control will be required on transmitting so that no data is lost. Receive flow control may be required to accommodate delays in processing the received data. Flow control is done by using the XON (ASCII 17) and XOFF (ASCII 19) characters.

When transmitting, the DTE will stop transmitting page data to the modem when it receives an XOFF, and will resume transmitting page data when it receives an XON. The DTE will wait for the initial XON from the modem after the connect response is received, before it transmits, page data to the modem.

When receiving, the DTE can stop the data flow from the modem by issuing an XOFF to the modem and can resume the data flow by issuing an XON to the modem. Note that the modem cannot be XOFFed for too long because may it receive enough data to overflow its internal buffers. The DTE must send a DC2 character (ASCII 18) after the connect response is received, before the modem will transmit the received page data to the DTE.

The modem can cancel a page transmission by sending a CAN character (ASCII 24) to the DTE. Upon receiving the CAN character the DTE will send the end of page sequence to the modem (DLE-ETX) watch for responses to determine what to do next. There are two reasons why the modem might send a cancel to the DTE on page transmission: first, the +FPHCTO timeout may have occurred and this would result in a +FHNG: response as the modem hung up; second, the modem might cancel the DTE because it has sent enough lines for the negotiated page length. The DTE can also cancel page reception by sending a CAN to the modem and the modem will respond by sending a DLE ETX to the DTE and then it will display a +FHNG: response as the modem hangs up.

Commands and Responses

This chapter describes several sets of messages:

- Action Commands
- Responses (result codes)
- Parameters

Commands & Response Summary

All Commands and Responses are mandatory. Mandatory values are specified for each command and parameter.

Action Commands

+FDT= Begin or continue sending

+FET= End the page or document

+FK Kill operation, orderly fax abort

+FDR Begin or Continue Phase C Data Reception (Note 1)

DCE Responses

+FDCS: Report the DCS frame information.

+FDIS: Report the DIS frame information.

+FDTC: Report the DTC frame information.

+FPOLL Indicates polling request.

+FCFR Prepare to Receive prompt (Note 1)

+FTSI: Report the remote ID, TSI

+FCSI: Report the remote ID, CSI

+FCIG: Report the remote ID, CIG

Note 1: Noted parameters, commands and responses depend on capability to receive (+FCR).

+FNSF: Report received Non Standard Facilities frame

+FNSS: Report received Non Standard Setup frame

+FNSC: Report received Non Standard Command frame

+FHT: Debug Report transmitted HDLC frames

+FHR: Debug Report received HDLC frames

+FCON Indicates connection with a fax machine.

+FVOICE Indicates transition to Voice.

+FET: Post-Page Message Report

+FPTS: Page Transfer Status Report (post page responses)

+FHNG: Call terminated with status.

Parameters

+FCLASS Service Class Identification and Control

+FMFR Request DCE Manufacturer

+FMDL? Request DCE Model

+FREV? Request DCE Revision

+FDCC= Establish DCE capabilities

+FDIS= Current Session negotiating position

+FDCS= Current Session parameters (read only)

+FLID= Local FAX station ID String, TSI or CSI

+FCIG= Local FAX station ID String, CIG

+FSPL= Enable polling (Note 1)

+FLPL= Indicate document available for polling

+FPTS= Page Transfer Status (Note 1)

+FBUG= Session Message Reporting Enable

Note 1: Noted parameters, commands and responses depend on capability to receive (+FCR).

Option Parameters

+FCR= Capability to Receive

+FAA Auto Answer Mode

+FBUF? Buffer Size, read only

+FTBC Phase C data Transmit Byte Count

+FRBC Phase C data Receive Byte Count (Note 1)

+FCQ Copy Quality (Note 1)

+FBADMUL Multiplier to determine error rate threshold.

+FBADLIN Number of consecutive bad lines for a bad page.

+FCTCRTY CTC Retry Value

+FPHCTO Phase C Time-out.

+FAXERR Fax Error Value

+FMINSP Minimum Phase C Speed

+FECM Error Correction Mode control

+FBOR Phase C Data Bit Order

+FREL Phase C Received EOL alignment (Note 1)

+FDFFC Data Compression Format Conversion

+FWDFC Page Width Format Conversion

+FLNFC Page Length Format Conversion

+FVRFC Vertical Resolution Format Conversion

Note 1: Noted parameters, commands and responses depend on capability to receive (+FCR).

Service Class Identification & Selection

A FAX DCE described by this recommendation will report its Service Class capabilities, both the current setting and the range of services available. This is provided by the +FCLASS parameter. Currently defined values for the +FCLASS parameter are:

0 data modem

1 Service Class 1 (See EIA-578)(Not supported)

2 Service Class 2

3-255 reserved (Not supported)

The +FCLASS factory default setting is +FCLASS = 0. When +FCLASS is set to other than = 0, and a call is made, but the call fails or the modem is disconnected, the +FCLASS value returns to the default setting (+FCLASS = 0).

Service Class Indication, +FCLASS?

The current Service Class setting of a FAX DCE is tested by the "+FCLASS?" command. The response is a single value.

Service Class Capabilities, +FCLASS=?

The Service Classes available from a FAX DCE are tested by the "+FCLASS=?" command. The response is a string of values, separated by commas. For example, a DCE that supported data communication and both Service Classes would respond:

```
<CR><<LF>0,1,2<<CR><<LF><<OK><<CR><<LF>
```

Service Class Selection, +FCLASS=<value>

The Service Class may be set by the DTE from the choices available (see above), using the "+FCLASS=<value>" command.

Request Manufacturer Identification, +FMFR?

The modem sends out the manufacturer's name (i.e. "IBM Systems").

Request Model Identification, +FMDL?

The modem sends out the modem's model number.

Request Product Revision Identification, +FREV?

The modem sends out the modem's revision number.

Action Commands

These commands transfer data, and punctuate sessions. They also release specific T.30 messages. All action commands must be the last command on a command line. this is indicated by the terminating <CR>. All action commands initiate processes. The DCE does not accept other commands from the DTE until the DCE issues a final result code (e.g. OK, CONNECT). The DCE will abort the process if it receives any character before the final result code is issued.

Originate a Call

Example Syntax: ATD<CR>

or CRN (V.25 bis)

A Service Class 2 Facsimile DCE supports a DTE command to originate a call. The specification of an Originate command is not covered in this manual.

The DTE may issue an Originate command to initiate a call or to resume a session after procedure interruption. If the origination command is unsuccessful, the DCE will report an appropriate failure or error type result code.

Manual call placement

DCE response: +FCON
[+FNSF: <nsf fif>]
[+FCSI: <remote ID string.]
+FDIS: <T.30 subparameter string>
[+FPOLL] - if remote has doc to poll
OK

A Service Class 2 facsimile DCE dials, detects call progress and generates the CNG tone. Then it waits for a DIS frame. On detection of the first Phase B preamble (V.21 ch. 2 modulated by 300 bit/s HDLC flags) it reports the "+FCON" message to the DTE.

The facsimile DCE generates a DCS frame based on the received DIS frame and on the previously set +FDIS parameter. A +FDT command from

the DTE releases the DCE to transmit that DCS frame; a +FDR command releases the DCE to transmit a DTC frame.

The DTE reports the initial received T.30 negotiation messages, including the DIS frame, the optional CSI ID string, and optional NSF frame. The +FDIS: report is followed by the OK final result code.

Restart from Procedure Interrupt

If the DTE had initiated a session with an Originate command, the DTE should resume a session after a procedure interrupt by issuing another Originate command.

Answer a Call

Example Syntax: ATA <CR> Supports a DTE command to answer an incoming call. The specification of an Answer command is beyond the scope of this document.

The V.25bis CIC command may be used, if the DCE is so configured. The DTE may issue an Answer command in response in incoming Ringing, or to resume a session after procedure interruption. If the Answer command is unsuccessful, the DCE reports an appropriate failure or error type result code, such as NO CARRIER, or V.25bis equivalents.

Manual call answer

DCE response: +FCON

(answer & [+FNSS:<nss fif>]

receive) [+FTSI:<remote ID string.]
+FDCS:<T.30 subparameter string>
OK
(DTE should issue +FDR command here)

DCE response: [+FNSC:<NSC FIF data.]

(polling [+FCIG:<remote ID string>

by remote +FDTC:<T.30 subparameter string>

station) OK
(DTE should issue +FDT command here)

On receipt of an Answer command from the DTE, a Service Class 2 FAX DCE answers and generates the CED tone. Then it generates a DIS frame (derived from the +FDIS parameter), and hunts for the first T.30 negotiation frames. On detection of the first Phase B preamble (V.21 ch.2

modulated by 300 bit/s HDLC flags) it reports the "+FCON" message to the DTE.

The DTE reports the initial received T.30 negotiation messages, including the DCS frame, the optional TSI ID string, and the optional NSS frame. The+FDCS: report is followed by the OK final result code.

Automatic answer

Automatic answer is accomplished by using the ATS0 register. See your modem owner's manual for more details on its use. If configured for automatic answer, the DCE answers an incoming call in compliance with T.30, and report the same messages as described for manual answer.

Restart from Procedure Interrupt

If the DTE had initiated a session with an Answer command, the DTE should resume a session after a procedure interrupt by issuing another Answer command.

Connection as Data modem

If configured to do so by the +FAA parameter, the DCE may adaptively answer as a facsimile DCE or as a data DCE. If the DCE answers as a data DCE, it will reset the +FCLASS parameter to 0, and issue appropriate final result codes (e.g. CONNECT, NO CARRIER) to the DTE.

Data Transmission, +FDT [=DF,VR,WD,LN]

Syntax: +FDT[=DR,VR,WD,LN]<CR>

The FDT command prefixes Phase C data transmission. When the DCE is ready to accept Phase C data, it will issue the negotiation responses and the CONNECT result code to the DTE. The DF, VR, WD and LN subparameters are optional, as described below.

In Phase B, the +FDT command releases the DCE to proceed with negotiation, and release the DCS message to the remote station. In Phase C, the +FDT command resumes transmission after the end of a prior transmit data stream or block.

Initiate page transmission

Phase B DCE transmit response:

[+FNSF:<NSF FIF data>] - if new NSF received

[+FCSI:<remote ID>] - if new CSI received

[+FDIS:<subparameters from remote station] - if new DIS received

+FDCS:<negotiated session subparameters>
CONNECT

<XON> - when ready for data

After placing a call, or after finishing a document exchange, the DTE can command the DCE to re-enter T.30 Phase B to attempt to negotiate a document transmission.

Respond to polling

Phase B DCE polled response:

[+FNSC:<NSC FIF data>] - if new NSC received

[+FCIG:<remote ID>] - if new CIG received

[+FDTC:<subparameters from remote station>] - if new DTC received

+FDCS:<negotiated session subparameters>
CONNECT

<XON> - when ready for data

In response to a polling request by the remote facsimile station, the DTE can command the DCE to re-enter T.30 Phase B to attempt to negotiate a document reception.

Continue a page

Phase C DCE response: CONNECT
<XON>

The DTE may issue more than one +FDT[=DF, VR, WD, LN] command for a given page, so that different files, may be concatenated together. These files may have different format parameters, if format conversion is enabled. (Page punctuation is implemented by the +FET=<ppm> command).

Phase C data framing

Phase C data may be presented to the DCE in stream mode. In stream mode the DCE will expect Phase C data to follow until it detects <DLE><ETX> termination characters; the DCE must filter the stream.

The DCE will acknowledge the end of the data by returning the OK result code to the DTE.

If there is data underrun before the next FDT or FET command, the DCE will zero-fill pad as per T.4 until the Phase C timeout (+FPHCTO) is reached, or until more data is received. The DCE appends an RTC pattern to the transmit data after an FET command is received from the DTE.

Phase C data format

The Phase C data will be of the format specified by the negotiated T.30 DCS frame, unless specified otherwise by the optional embedded parameter DF, VR, WD & LN. The +FDCS:<string> response is defined.

If the optional DF, VR, WD or LN parameters are used, any needed format conversion must be enabled, using the format conversion parameters.

The DCE will use the negotiated minimum Scan Time parameter from the DCS frame, and insert sufficient fill bits to pad each line to the minimum scan time. This is reported in the +FDCS:ST subparameter. If the DCE finds more than one consecutive EOL in Phase C data (e.g. RTC), it will insure that only one EOL is sent.

Note 1: Phase C data must conform to T.4 specifications.

Note 2: The DTE need not include a final RTC, since the DCE will append an RTC in response to an FET command.

Note 3: Some facsimile machines treat two EOLs a an RTC.

Escape from transmission, <CAN>

The DCE may request the DTE to halt Phase C transmission by sending an ASCII <CAN> cancel character (024) to the DTE. The DTE should terminate Phase C transmission, issue <DLE><ETX>, and wait for the OK response code from the DCE.

This mechanism may be used if the DCE detects that the call is lost (e.g. receives a DCN), or if the DTE sends too much data to the DCE (more than the negotiated number of lines, or more than the negotiated partial page size in ECM).

Transmit Page Punctuation, +FET=n

Command Syntax: +FET=<ppm>

DCE response: +FPTS:<ppr> - when receive from remote
[+FVOICE] - if procedure interrupt
OK

This command is used to punctuate page and document transmission after one or more +FDT commands. This command generates T.30 Post Page Messages selected by the <ppm> code.

The +FET=<ppm> command indicates that the current page or partial page is complete; no more data will be appended to it. The value indicates if any additional pages are to be sent and, if so, whether there is a change in any of the document parameters.

The DTE can command the DCE to generate PRI-Q messages with the +FET=<ppm> command, using ppm codes 4-6. This command must be sent within the timeout specified by +FPHCTO after sending Phase C data, else the DCE must end the page and document transmission. If the Phase C timeout is reached, the DCE will send an EOP post page message and terminate the session.

The remote facsimile station responds to the post page message with a post page response. The DCE reports this using the +FPTS: <ppr> response.

End a page

The +FET=<ppm> command causes the DCE to append an RTC (6 EOL) pattern as needed, and enter Phase D by sending the selected T.30 Post Page message.

The +FET=1 (EOM) command signals the remote station that the next document will have a new DCS negotiated; this causes the session to re-enter Phase B.

Procedure Interrupt Negotiation

The DTE may request procedure interrupt by issuing an +FET=<pri-q> command after sending a page. If the remote station confirms the request, it will return a PIN or PIP T.30 post page response message, reported by the +FPTS: 4 (PIN) or +FPTS: 5 (PIP) DCE responses. In this case, the DCE will suspend the T.30 session, and report the +FVOICE response and OK result code to the DTE.

The remote facsimile station may request procedure interrupt by generating a PIN or PIP message, which will be reported by the DCE. The DTE may grant that request by issuing a +FET=<pri-q> command. In this case the DCE will suspend the T.30 session, and report the +FVOICE response and OK result code to the DTE.

Table 8. Post Page Message Codes

PPM Code	T.30 Mnemonic	Description
0	[PPS-]MPS	another page next, same document
1	[PPS-]EOM	another document next
2	[PPS-]EOP	no more pages or documents
3	PPS-NULL	another partial page next
4	[PPS-]PRI-MPS	another page, procedure interrupt
5	[PPS-]PRI-EOM	another doc., procedure interrupt
6	[PPS-]PRI-EOP	all done, procedure interrupt

Begin or Continue Phase C Receive Data, +FDR

Syntax: +FDR<CR> The +FDR command initiates transition to Phase C data reception. This can occur after answering, after dialing, after a document is received, or after a page is received.

The DCE will report the negotiated T.30 parameters, with the remote ID and NSS frame information if available. When the DCE is ready to commence data transfer, it will issue a CONNECT response code. If the DCE cannot resume data transfer, because there is no more data, it will respond OK. When the DTE is ready to accept data, it will issue a <DC2> character (018) to the DCE.

When the DCE delivers that last byte of a page, the DCE will report the Page Transfer Status via the +FPTS:<ppr> response.

After a Page Transfer Status Report, the DCE will report the post page message from the remote facsimile station via the +FET:<ppm> response , which signals the intentions of the remote station.

The DCE will hold the post page response message to the remote facsimile station (MCF, etc), represented in the +FPTS parameter until the next +FDR command. The DTE may modify the +FPTS parameter before issuing the +FDR command, which releases that message. The DTE must issue a +FDR command to release Post Page Messages.

Initiate document reception

The +FDR command may be issued in Phase B after an answer command, or in Phase B after a previous document. The DCE responses are as follows:

stream mode:

+FCFR - when CFR sent

[+FNSS:<NSS FIF data.] - if new NSS received

[+FTSI:<remote ID>] - if new TSI received

[+FDCS:<negotiated subparameters>] - if new DCS

CONNECT

- (<DC2> needed from DTE here) <Phase C Data stream> <DLE><ETX> +FPTS:<ppr>, <1c>[,<blc>, <cblc>][, <lbc>] +FET:<ppm>

OK - (DTE must issue +FDR command to release post page response)

Initiate polling

The DTE may issue an +FDR command to initiate polling. The command indicates that the DTE has no pages to send, but can receive. The command releases a [CIG &] DTC message in response to the remote station's DIS signal, instead of a [TSI &] DCS message.

Continue document reception

The DTE may issue a +FDR command in Phase D, which releases the post page message, and indicates readiness to receive another page. The DCE responses are as shown:

if another page, stream mode:

CONNECT

- (<DC2> needed from DTE here)
  <Phase C Data stream>

<DLE><ETX> - if stream mode
+FPTS:<ppr>, <1c>[, <blc, <cblc>][, <lbc>]
+FET:<ppm>
OK - (DTE must issue
+FDR command to
release post page
response)

if done receiving (EOP or DCN):
+FHNG: <hangup cause code>
OK

Phase C data framing

Phase C data will be presented to the DTE in stream mode. The DCE will transfer a stream of data to the DTE, followed by the <DLE><ETX> stream termination characters. The DCE will filter the stream.

Phase C data format

The received data format is that negotiated under T.30, reported by the +FDCS: VR, BR, WD, LN, DF, EC, BF, ST response. The DCE deletes the terminating RTC (6 EOLs) patterns. The DCE may strip zero fill bits from the data, to minimize storage needs. The DCE may byte-align EOLs, controlled by the +FREL parameter.

Escape from reception, <CAN>

From the +FDR command until the end of Phase C Data, the DCE is in a data transfer state, and will not respond to DTE command lines. The DCE responds to three ASCII control characters: <DC1> (017) & <DC3> (019) flow control characters, and Cancel <CAN> (024). On receipt of <CAN> character, the DCE will terminate reporting of received data by sending trailing <DLE><ETX> characters to the DTE, and the DCE will execute an implied +FK command, conducting an orderly disconnection.

Procedure Interrupt Negotiation

The receiving DTE may request procedure interrupt by setting the +FPTS=<ppm> parameter to 4 (PIN) or 5 (PIP) before issuing a post page +FDR command. If the remote station confirms the request, it will return a PRI-Q T.30 post page response message, reported by a +FET:<pri-q> DCE response . In this case, the DCE will suspend the T.30 session, and report the +FVOICE response and OK result code to the DTE.

The remote transmitting facsimile station may request procedure interrupt by generating a PRI-Q message, which will be reported by the DCE in the +FET:<ppm> response . The DTE may grant that request by setting the +FPTS=<ppr> parameter to 4 (PIN) or 5 (PIP) before issuing an additional +FDR command. In this case, the DCE will suspend the T.30 session, and report the +FVOICE response and OK result code to the DTE.

Session Termination, +FK

Syntax:+FK

The +FK command causes the DCE to terminate the session in an orderly manner. In particular, it will send a DCN message at the next opportunity and hang up. At the end of the termination process, the DCE will report the +FHNG response with result code.

This operation can be invoked by using the ASCII <CAN> (cancel) character during Phase C data reception . The DCE should wait until the current page completes, except in reception of unlimited length; in that case, the DCE may halt reception and terminate the session at any time.

DCE Responses

The DCE will send information responses to the DTE as a facsimile session proceeds. They indicate the state of the facsimile session, and convey needed information. These messages are solicited messages, generated in execution of DTE action commands described in section 2.3.

For all of the following information responses, the DCE will precede them with <CR><LF>, and follow them with <CR><LF> if in verbose mode (ATV1) or follow them with just a <CR> if in terse mode (ATV0).

Facsimile Connection Response, +FCON

+FCON indicates connection with a fax machine. It is released by detection of HDLC flags in first received frame. +FCON is generated in response to an Originate command or Answer command.

T.30 Phase B Negotiation Responses

The DCE will provide the on-line status of several session parameters, when they are available in the T.30 handshaking. These include the remote ID string and the DIS/DCS/DTC parameters.

Report DIS/DCS/DTC frame information,

+FDCS:<string>

Syntax: +FDCS:VR,BR,WD,LN,DF,EC,BF,ST current session
Syntax: +FDIS:VR,BR,WD,LN,DF,EC,BF,ST remote identification
Syntax: +FDTC:VR,BR,WD,LN,DF,EC,BF,ST request for polling.
These responses report the T.30 session parameter frames.

+FDCS:<string> reports the negotiated parameters. Phase C data will be formatted as described by the subparameters. This message may be generated in execution of +FDT or +FDR commands, before the CONNECT result code, if new DCS frames are generated or received.

+FDIS:<string> and +FDTC:<string> report remote facsimile station capabilities and intentions. If the remote has a document to poll, a +FPOLL response will trail +FDIS:<string>; if the remote station wants to poll, the +FDTC:<string> response is generated. These messages are generated in execution of Originate , Answer, +FDT or +FDR commands.

Indicate Confirmation to Receive, +FCFR

Syntax: +FCFR

The DCE will send a +FCFR response to the DTE upon reception of an acceptable TCF training burst and a valid DCS signal from the remote machine. This indicates that the DCE will receive Phase C data after the remote station receives the local DCE's CFR message. The +FCFR message is generated in execution of a +FDR command.

Remote Polling Indication, +FPOLL

Syntax: +FPOLL

+FPOLL indicates that the remote station has a document to poll, and invites the DTE to poll it . This response is generated in execution of Originate , Answer , +FDT or +FDR commands. <|,13>The DTE may respond to an +FPOLL message with either the "begin transmit" command, AT+FDT, if it does not wish to poll, or the +FDR command, to indicate willingness to poll the remote station.

Report the remote ID

Syntax: +FTSI:"<TSI ID string>" Transmit Station ID
Syntax: +FCSI:"<CSI ID string>" Called Station ID
Syntax: +FCIG:"<CIG ID string>" Polling Station ID

These report the received remote ID string if any. These responses are generated in execution of Originate , Answer , +FDT or +FDR commands.

Report received Non Standard negotiation frames

Syntax: +FNSF:<NSF FIF string> Non Standard Facilities
Syntax: +FNSS:<NSS FIF string> Non Standard Setup
Syntax: +FNSC:<NSC FIF string> Non Standard Commands

These responses report a received Non Standard negotiation frames, one per frame. These responses are generated in execution of Originate , Answer , +FDT or +FDR commands. The NSF Facsimile Information Field (FIF) frame octets are presented in hex notation, and separated by spaces. Flags and zero bits are removed. Frame octets are reported in the order received. For each frame octets the LSB is the first bit sent or received.

The facsimile DCE reports the frame; it need not act on it. Specification of any other Non standard behavior is beyond the scope of this document.

T.30 Phase C Page Reception Responses

Receive Page Transfer Status, +FPTS:<ppr>..<cblc>

Syntax: +FPTS:<ppr>,<lc>[,<blc>,<cblc>][,<lbc>]

The +FPTS:<ppr> is generated by the DCE at the end of Phase C data reception, in execution of +FDR command .

The <ppr> is generated by the DCE; it depends on the DCE capabilities at T.4 error checking, controlled by the +FCQ parameter.

The receiving DCE will count lines, and may optionally generate bad line counts. These values are:

<lc> line count

<blc> bad line count

<cblc> consecutive bad line count (+FBADLIN).

<lbc> lost byte count, due to DCE buffer overflow

The line counts are qualified by the DCE's copy checking capabilities, controlled by the +FCQ parameter . A DCE that does not do error checking may omit the bad line counts. All numbers are expressed in decimal.

A receiving DTE may inspect <ppr> and write a modified value into the +FPTS parameter. The DCE will hold the corresponding Post Page Response message until released by a +FDR command from the DTE.

Table 9. T.30 Post Page Response Message Codes

Value	Mnemonic	Description
0	PPR	Partial page errors.
1	MCF	Page good.
2	RTN	Page bad; retrain requested.
3	RTP	Page good; retrain requested.
4	PIN	Page bad; interrupt requested.
5	PIP	Page good; interrupt requested.
6	ERR	Partial page reception failed after 4 retries (ECM only).
7	CTR	Acknowledge a CTC message(ECM).

T.30 Phase D Post Page Responses

Post Page Message response, +FET:<ppm>

Syntax: +FET:<ppm>[,<pc>,<bc>,<fc>]

The +FET:<post page message> response is generated by a receiving facsimile DCE after the end of Phase C reception, on receipt of the post-page message from the transmitting station. The +FET:<ppm> response is generated in execution of a +FDR command . The <ppm> codes correspond to the T.30 post page messages.

Transmit Page Transfer Status, +FPTS:<ppr>

Syntax: +FPTS:<ppr>

The +FPTS: response reports a <ppr> number representing the copy quality and related post-page message responses received from the remote DCE. The +FPTS:<ppr> response is generated in execution of a +FET=<ppm> command .

Transition to Voice, +FVOICE

Syntax:+FVOICE

+FVOICE indicates that a procedure interruption has been negotiated, and the session has been suspended. This response is generated in execution of +FET=<pri-q> or +FPTS=<pip/pin> and +FDR commands.

The DTE responds to a +FVOICE message by suspending the session, and waits for the operator to determine if the session should be resumed or terminated.

Call Termination with Status, +FHNG:

Syntax:+FHNG:<hangup status code>

+FHNG indicates that the call has been terminated. The hangup cause is reported, and stored in the +FAXERR parameter for later inspection.

+FHNG:<hsc> is a possible intermediate result code to any DTE action command. It is always followed by the OK result code.

Hangup Status Codes

Upon termination of a call, the DCE determines the cause of termination, and reports it as part of the +FHNG:<hsc> response. It also stores this <hsc> code in the +FAXERR parameter for later inspection.

The hangup values are organized according to the Phases of the facsimile transaction as defined by T.30. In the Figure A/T.30 flow charts, there are decision boxes labelled "Command Received?"; this is referred to as COMREC in the table. Similarly, decision boxes labelled "Response Received?" are referred to as RSPREC in the table. A COMREC error or RSPREC error indicates that one of two events occurred: 1) a DCN (disconnect) signal was received, or 2) an FCS error was detected and the incoming signal was still present after 3 seconds.

The table values are in decimal notation. Leading zero characters are optional.

Table 10 (Page 1 of 2). Hangup Status Codes

Value	Cause Description
0-9	Call placement and termination:
0	Normal and proper end of connection
1	Ring Detect without successful handshake
2	Call aborted, from +FK or <CAN>
3	No Loop Current
10-19	Transmit Phase A & miscellaneous errors
10	Unspecified Phase A error
11	No Answer (T.30 T1 timeout)
20-39	Transmit Phase B Hangup Codes
20	Unspecified Transmit Phase B error
21	Remote cannot receive or send
22	COMREC error in transmit Phase B
23	COMREC invalid command received
24	RSPEC error
25	DCS sent three times without response
26	DIS/DTC received 3 times; DCS not recognized
27	Failure to train at 2400 bps or +FMINSP value
28	RSPREC invalid response received
40-49	Transmit Phase C Hangup Codes
40	Unspecified Transmit Phase C error
43	DTE to DCE data underflow
50-69	Transmit Phase D Hangup Codes
50	Unspecified Transmit Phase D error
51	RSPREC error
52	No response to MPS repeated 3 times

Table 10 (Page 2 of 2). Hangup Status Codes

Value	Cause Description
53	Invalid response to MPS
54	No response to EOP repeated 3 times
55	Invalid response to EOP
56	No response to EOM repeated 3 times
57	Invalid response to EOM
58	Unable to continue after PIN or PIP
70-89	Receive Phase B Hangup Codes
70	Unspecified Receive Phase B error
71	RSPREC error
72	COMREC error
73	T.30 T2 timeout, expected page not received
74	T.30 T1 timeout after EOM received
90-99	Receive Phase C Hangup Codes
90	Unspecified Receive Phase C error
91	Missing EOL after 5 seconds
92	-unused code-
93	DCE to DTE buffer overflow
94	Bad CRC or frame (ECM or BFT modes)
100-119	Receive Phase D Hangup Codes
100	Unspecified Receive Phase D errors
101	RSPREC invalid response received
102	COMREC invalid response received
103	Unable to continue after PIN or PIP
120-255	-reserved codes-

Facsimile Service Class 2 Parameters

All Service Class 2 parameters can be read, written and tested for range of legal values by the DCE.

T.30 Session Parameters

Group 3 FAX devices negotiate session parameters in DIS, DCS and DTC frames. The following parameters are provided to condition the facsimile DCE for the capabilities it will offer, and to report the session settings negotiated.

The three primary T.30 session parameters are +FDCC, +FDIS and +FDCS.

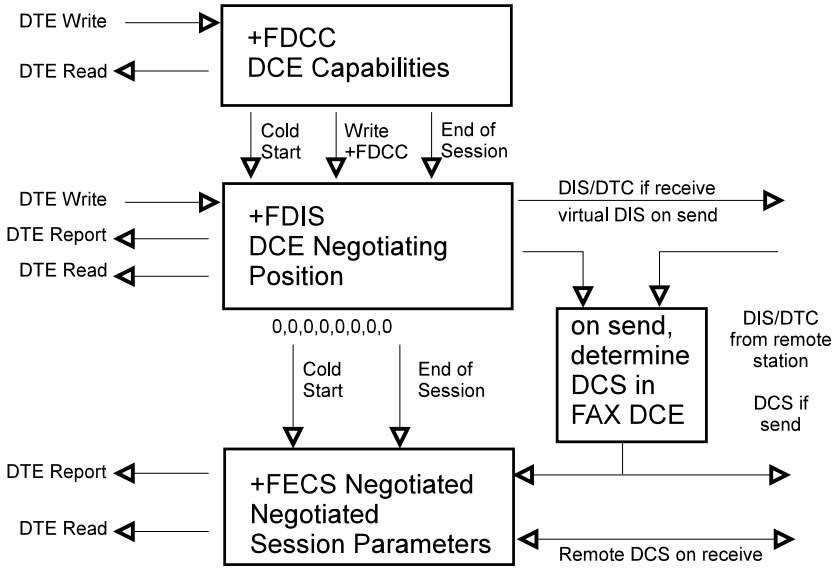

Figure 19. T.30 Session Parameters

DCE capabilities parameters, +FDCC

Write Syntax: +FDCC=VR,BR,WD,LN,DF,EC,BF,ST

Valid values:

Default values: 1,3,2,2,0,0,0,0

+FDCC allows the DTE to sense and constrain the capabilities of the facsimile DCE, from the choices defined in CCITT T.30. When +FDCC is modified by the DTE, the DCE will copy +FDCC into +FDIS.

Current Sessions parameters, +FDIS

Write Syntax: +FDIS=VR,BR,WD,LN,DF,EC,BF,ST

Valid values:

Default value: 1,3,2,2,0,0,0,0

The +FDIS parameter allows the DTE to sense and constrain the capabilities used for the current session. The DCE uses +FDIS to generate DIS or DTC messages directly, and uses +FDIS and received DIS messages to generate DCS messages. The DCE initializes the +FDIS parameter from the +FDCC parameter on initialization, when +FDCC is written, and at the end of a session.

Current Session results, +FDCS

Read Syntax: +FDCS?

DCE response: +FDCS=VR,BR,WD,LN,DF,EC,BF,ST

or: +FDCS=

Valid values:

Default value: 0,0,0,0,0,0,0,0

The +FDCS parameter is loaded with the negotiated T.30 parameters for the current session. A transmitting DCE generates DCS; a receiving DCE gets DCS from the remote station. The DTE may read this parameter.

The +FDCS parameter is initialized 0,0,0,0,0,0,0,0 on initialization, and at the beginning of a session. If the DTE issues a +FDCS? command in the initial state, the DCE will report:

<CR><LF>0,0,0,0,0,0,0,0<CR><LF>

The contents of +FDCS are spontaneously reported during execution of +FDR or +FDT commands, by the +FDCS:VR,BR,WD,LN,DF,EC,BF,ST response, using the same compound parameter format.

T.30 Session subparameters

Several commands and responses reference T.30 session negotiated parameters. These are described by a set of common subparameters.

The +FDCC, +FDIS and +FDCS compound parameters use these session subparameters. On writes, unspecified subparameters are unchanged.

The +FDIS:, +FDCS: and +FDTC: session report responses, use these subparameters.

Some subparameters are optionally used in the +FDT[=DF,VR,WD,LN] command.

For test response, ranges of values are reported for each subparameter, enclosed in parentheses characters. For example, a DCE response to +FDCC=? will report:

<CRLF>(0-1),(0-3),(0-4),(0-2),(0),(0),(0),(0-7)<CRLF>

Use Example: +FDIS=0,3,0,2,0,0,0,1 =

VR = 0 98 dpi vertical resolution,

BR	= 3	9600 bit/s,
WD	= 0	1728 pixels,
LN	= 2	unlimited length,
DF	= 0	1-D modified Huffman coding,
EC	= 0	no ECM,
BF	= 0	no BFT,
ST	= 1	5 ms scan time.

Note: The data type sent using the +FDT[=DF,VR,WD,LN] may be different, if conditioned by optional data conversion services. This is used for cancatenating dissimilar files.

Table 11. T.30 Session Subparameter Codes (N/S not supported)

Label	Function	Values	Description
VR	Vertical Resolution	0	Normal, 98 dpi
		1	Fine, 196 dpi
BR	Bit Rate	0	2400 bit/s V.27ter
	(Note 1)	1	4800 bit/s V.27ter
		2	7200 bit/s V.29 or V.17
		3	9600 bit/s V.29 or V.17
WD	Page Width	0	1728 pixels in 215 mm
		1	2048 pixels in 255 mm
		2	2432 pixels in 303 mm
		3	1216 pixels in 151 mm
		4	864 pixels in 107 mm
LN	Page Length	0	A4, 297 mm
		1	B4, 364 mm
		2	unlimited length
DF	Data	0	1-D modified Huffman
	Compression	1	2-D modified Read (N/S)
	Format	2	2-D uncompressed mode (N/S)
		3	2-D modified modified Read (N/S)
EC	Error Correction	0	disable ECM
	(Annex A/T.30)	1	enable ECM, 64bytes/frame (NS)
		2	enable ECM, 256B/frame (NS)
BF	Binary File	0	disable BFT (N/S)
	Transfer	1	enable BFT (N/S)
ST	Scan Time/Line	0	VR=normal VR=fine
		1	0 ms 0 ms
		2	5 ms 5 ms
		3	10ms 5 ms
		4	10ms 10 ms
		5	20ms 10 ms
		6	20ms 20 ms
		7	40ms 20 ms
			40ms 40 ms

Note 1:.When answering BR=2 and BR=3 means that the DCE supports V.25ter and V.29.

Note 2:. 2-D modified Read data compression format is supported in modems with firmware version 1.16 (after 1/96).

Local ID String, +FLID

Write Syntax: +FLID="<local ID string>"

Valid Values: 20 character ASCII string

Default Value: " "

If FLID is not a null string, it generates a TSI or CSI frame. Table 3/T.30 includes digits 0-9, "+" and space.

Local Polling ID String, +FCIG

Write Syntax: +FCIG="<local polling ID string>"

Valid Values: 20 character ASCII string

Default Value: " "

If FCIG is not a null string, it generates a CIG frame. CIG is used in polling sessions.

Indicate Document to Poll, +FLPL

Write Syntax: +FLPL=<value>

Valid Values: 1, 0

Default: 0

+FLPL=0 indicates that the DTE has no document to poll.

+FLPL=1 indicates that the DTE has a document ready for polling. The DCE reports this to the remote station in the DIS frame. The DCE resets this parameter to 0 after a polled document is sent.

Request to Poll, +FSPL

Write Syntax: +FSPL=<value>

Valid Values: 1, 0

Default Value: 0

+FSPL=0 indicates that the DTE does not want to poll.

+FSPL=1 indicates that the DTE can receive a polled document. The DCE resets this parameter to 0 after a polled document is received.

Capability to receive, +FCR

Write Syntax: +FCR=<value>

Valid Values: 1, 0

Default Value: 0

+FCR=0 indicates the DCE will not receive message data; also, the DCE will not be able to poll a remote device. This can be used when the DTE has insufficient storage, or if the DCE does not have a Phase C (V.27ter, V.29) demodulator. The DCE can send and can be polled for a file.

+FCR=1 indicates the DCE can receive message data. +FCR is sampled in CCITT T.30 Phase A and Phase D.

Session Message Reporting

Write Syntax: +FBUG=<value>

Valid Values: 1, 0

Default Value: 0

+FBUG=0 disables HDLC frame reporting.

+FBUG=1 enables the DCE to report the contents of Phase B and Phase D HDLC frames to the DTE, as they are sent and received, in addition to other responses. These will be reported using the +FHT: & +FHR: responses.

T.30 Procedure Control Parameters

The FAX DCE makes decisions at several nodes in the T.30 procedure under error conditions. These parameters allow a DTE to sense or determine FAX DCE policy for these procedure decisions. The FAX DCE will implement these parameters. However, it may report and accept the value that corresponds to a disable feature.

Page Transfer Status, +FPTS

Write Syntax: +FPTS=<ppr>

Valid Values: 1, 2, 3, 4, 5

Default Value: 1

The +FPTS parameter contains a value representing the post page response, including copy quality and related end-of-page status. These values

correspond to post page response messages defined in T.30. The receiving DCE sets this parameter after it receives a page of Phase C data. The transmitting DCE sets this parameter with the status reported by the receiving station. The DTE may inspect or modify this parameter.

These values are reported by the +FPTS:<ppr> response to the +FDR command.

The DCE may set this parameter to values 1, 2 or 3 based on its own copy quality checking, or access to received signal quality. Procedure interrupt values may be set by the DTE.

A receiving DTE may do its own Copy Quality checking, or decide to request a Procedure Interrupt from the remote station. The DTE will receive a report of the copy quality <ppr> as part of the +FPTS:<ppr>,<lc>,<blc>,<cblc> response . The DTE may modify this result before it issues the next action command (e.g.+FDR), which releases the corresponding post page response to the remote facsimile station.

Copy Quality Checking, +FCQ

Write Syntax: +FCQ=<value>

Valid Values: 0, 1

Default Value: 0

This parameter controls Copy Quality checking by the receiving facsimile DCE.

The DCE will generate a page transfer report, indicated with the +FPTS:=<ppr>,<lc>,<blc>,<cblc> response and posted in the+FPTS parameter. The +FCQ parameter setting also conditions the generation of bad line count <blc> and consecutive bad line count <cblc> subparameters.

+FCQ=0 The DCE does no copy quality checking. The DCE will generate Copy Quality OK (MCF) responses to complete pages, and set +FPTS=1.

+FCQ=1 The DCE can check 1-D Phase C data. The DTE must check copy quality for 2-D Phase C data.

Error Threshold Multiplier, +FBADMUL

Write Syntax: +FBADMUL=<value>

Valid Values: 0 to 255

Default Value: 20

This is one of two parameters used to determine of "Copy Quality OK" on the T.30 flow chart. The number of lines received with a bad pixel count is multiplied by this number. If the result exceeds the number of lines in the page, then the error rate is too high. A value of 20 corresponds to a 5% error rate.

A value of 0 implies that error checking is not present or is disabled.

Bad Line Threshold, +FBADLIN

Write Syntax: =FBADLIN=<value>

Valid Values: 0 to 255

Default Value: 10

This is another, independent parameter used to determine if "Copy Quality OK". If +FBADLIN consecutive lines have pixel count errors in normal resolution (98 dpi) mode then the copy quality is unacceptable. If +FBADLIN x 2 consecutive lines have pixel count errors in fine resolution (196 dpi) mode, then the copy quality is unacceptable. "Copy Quality Not OK" occurs if either the error percentage is too high or too many consecutive lines contain errors. Bad line counts are reported in +FPTS: response, described in section

A value of 0 implies that error checking is not present or disabled.

DTE Phase C Response Timeout, +FPHCTO

Write Syntax: +FPHCTO=<value>

Valid Values: 0-255, 100 millisecond units.

Default Value: 30

This determines how long the DCE will wait for a command after reaching the end of data when transmitting in Phase C. When this time- out is reached, the DCE will assume there are no more pages and no documents to send. It should then send the T.30 EOP response to the remote device.

T.30 Session Error Report, +FAXERR

```
Read Response Syntax:>+FAXERR=<table value>, read only
Valid Values:   0-255,
```

This read only parameter indicates the cause of a hangup.value. +FAXERR is set by the DCE at the conclusion of a fax session. The DCE will reset this to 0 at the beginning of Phase A off-hook time.

Minimum Phase C Speed, +FMINSP

Write Syntax: +FMINSP=BR

Valid Values: 0-3, in BR subparameter codes

Default Value: 0 (V.27ter @ 2400 bit/s)

This optional parameter limits the lowest negotiable speed for a session. This parameter is useful for limiting the cost of a transmission, by requiring a minimum transmission speed. If a facsimile cannot negotiate to a minimum speed, it will perform an orderly disconnect. The units are the same as those defined for the BR Bit Rate subparameter.

Phase C Data Format Parameters

Data Bit Order, +FBOR

Write Syntax: +FBOR=<value>

Valid Values: 0, 1

Default Value: 0

Supported Values: 0, 1

This parameter controls the mapping between PSTN facsimile data and the DTE-DCE link. There are two choices:

direct: the first bit transferred of each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

reversed: the last bit transferred of each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier

+FBOR=0 selects direct bit order for both Phase C data.

+FBOR=1 selects reversed bit order for Phase C data.

The effect of this parameter is illustrated for the EOL pattern below.

Phase C Received EOL Alignment, +FREL

Write Syntax: +FREL=<value>

Valid Values: 0, 1

Default Value: 0

+FREL=0 determines that EOL patterns are bit aligned as received.

+FREL=1 determines that the last received bits of EOL patterns are byte aligned by the DCE, with necessary zero fill bits inserted. There are two 2-byte patterns:

+FBOR=	binary EOL pattern	
0	0000xxxx	10000000
1	xxxx0000	00000001

xxxx represents previous data bits, zero bits, or other leading data.

Vertical Resolution Format Conversion, +FVRFC

Write Syntax: +FVRFC=<value>

Valid Values: 0, 1, 2

Default Value: 0

This parameter determines the DCE response to a mismatch between the vertical resolution negotiated for the facsimile session, reported by the +FDCS:VR subparameter, and the Phase C data desired by the DTE, indicated by the optional +FDT:VR subparameter, or the +FDIS=VR subparameter for +FDR operation.

FVRFC=0 disables mismatch checking. The DTE must check the +FDCS:VR subparameter, and transfer matching data.

FVRFC=1 enables mismatch checking, with an implied +FK command executed on mismatch detection.

FVRFC=2 enables mismatch checking, with resolution conversion of 1-D data in the DCE, and an implied +FK command executed on 2-D mismatch detection.

Data Compression Format Conversion, +FDFFC

Write Syntax: +FDFFC=<value>

Valid Values: 0

Default Value: 0

This parameter determines the DCE response to a mismatch between the data format negotiated for the facsimile session, reported by the +FDCS:DF

subparameter, and the Phase C data desired by the DTE, indicated by the optional +FDT:DF subparameter, or the +FDIS=DF subparameter for +FDR operation.

FDFFC=0 disables mismatch checking. The DTE must check the +FDCS:DF subparameter, and transfer matching data.

Page Length Format Conversion, +FLNFC

Write Syntax: +FLNFC=<value>

Valid Values: 0, 1, 2

Default Value: 0

This parameter determines the DCE response to a mismatch between the page length negotiated for the facsimile session, reported by the +FDCS:LN subparameter, and the Phase C data desired by the DTE, indicated by the optional +FDT:LN subparameter, or the +FDIS=LN subparameter for +FDR operation. A mismatch would require clipping or scaling a longer format to a shorter one.

FLNFC=0 disables mismatch checking. The DTE must check the +FDCS:LN subparameter, and transfer matching data.

FLNFC=1 enables mismatch checking, with an implied +FK command executed on mismatch detection.

FLNFC=2 enables mismatch checking, with page length conversion of 1-D data in the DCE, and an implied +FK command executed on 2-D mismatch detection.

Page Width Format Conversion, +FWDFC

Write Syntax: +FWDFC=<value>

Valid Values: 0, 1, 2

Default Value: 0

This parameter determines DCE's response to a mismatch between the page width negotiated for the facsimile session, reported by the +FDCS:WD subparameter, and the Phase C data desired by the DTE, indicated by the optional +FDT:WD subparameter, or the +FDIS=WD subparameter for +FDR operation. A mismatch would require clipping or scaling a wider format to a narrower one.

FWDFC=0 disables mismatch checking. The DTE must check the +FDCS:WD subparameter, and transfer matching data.

FWDFC=1 enables mismatch checking, with an implied +FK command executed on mismatch detection.

FWDFC=2 enables mismatch checking, with page width conversion in the DCE.

Miscellaneous Parameters

Answer Parameter, +FAA

Write Syntax: +FAA=<value>

Valid Values: 0, 1

Default Value: 0

+FAA=0 constrains the DCE to answer as set by +FCLASS.

+FAA=1 indicates the DCE can answer and automatically determine whether to answer as a facsimile DCE or as a data modem. If the DCE automatically switches, it will modify FCLASS appropriately.

Buffer Size, +FBUF

Read Syntax: +FBUF?

DCE response syntax: <bs>,<xoft>,<xont>,<bc>

where: <bs> = total buffer size,
<xoft> = XOFF threshold,
<xont> = XON threshold,
<bc> = current buffer byte count.

This parameter allows the DTE to determine the characteristics of the DCE's data buffer. Flow control is mandatory; buffers are needed for flow control. Use of the reported values would allow a DTE to transfer data without provoking XOFF.

Session Message Report Responses

The DCE may be commanded to report the T.30 Phase B and Phase D HDLC control frames as they are sent and received. This service supports session diagnostics and debugging DTE software. This service is enabled by the +FBUG parameter.

These messages are not generated in direct execution of DTE action commands; they are generated whenever the reported frame is sent or received, for each frame. The DTE should not attempt to change serial port speed or parity with +FBUG set. It is desirable to suppress echo of DTE commands, if the DCE provides that facility.

The data will be reported with each T.30 command separated by <CR><LF>. The fill bits will be removed. The frame octets, will be represented in hex notation, and separated by spaces. Flags and zero bits are removed. Frame octets are reported in the order sent or received. FCS bytes are deleted. Frame octets are presented with the LSB as the first bit sent or received.

The following is an example of a received DIS string report:

+FHR: FF 13 80 00 4E 78 FE AD<CR><LF>

Unless specified otherwise, the DCE reports these frames before the corresponding responses are generated. For example, the above examples would occur before the standard +FDIS: report was made.

Report transmit HDLC frames, +FHT:<string>

Syntax: +FHT:<transmitted HDLC frame octets>

This reports the HDLC data that was sent by the DCE.

Report received HDLC frames, +FHR:<string>

Syntax:< +FHR:<received HDLC frame octets>

This reports the HDLC data that was received by the DCE.

Sample DCE Control Sessions

Example sessions: Transmission and reception of Group 3 FAX images with Class 2 commands and responses. In this section, examples of the interchange between the DTE and the DCE are given for various cases.

Refer to CCITT Recommendation T.30 for descriptions and flow charts of Group 3 Facsimile Procedures, and for timing requirements.

NOTE 1: All streams of data denoted by <.<#01>.>, and terminated by the <DLE><ETX> characters (016, 003), are filtered with <016> data bytes replaced by <DLE><DLE>.

NOTE 2: All DCE information responses are preceded by <CR><LF>, and followed by <CR><LF>. All DCE result codes (CONNECT, OK) are shown in verbose form, and are followed by <CR><LF> characters. There are four cases for polling. One is Dial and Receive, the complement is Answer and Send. Sample session FAX A.3 & FAX A.4 illustrate the composite cases of turn-around polling.

The simple cases of polling without restriction are easy to accommodate. Restrictive polling is more difficult. The arbitration of polling response is reserved for DTE. This allows flexibility. For example, it allows polling to be restricted on the basis of the received Fax ID, or a password sent in an NSF frame, or other means. Examples FAX A.7 and FAX A.8 illustrate a pair of difficult sessions, simple sending and receiving, with every T.30 session message experiencing errors.

Page retransmission is handled by setting a retry count in the DCE to a non-zero value. The host must be ready to re-send any given page based on the value of the retry count and the confirmation value received from the remote end. There is ample time to reset for the last page because the DCE will go through training again. The retry count is necessary to assure no delay in response to the RTN or RTP signal sent from the receiver.

FAX A.1

© Copyright IBM Corp. 1996

Table 12. Send two pages, 1-D data, no errors

DTE commands	**DCE responses**	**local DCE action**	**Remote Station Action**
AT+FCLASS=2	OK	Set Class 2	
AT+FLID="<local ID>"	OK	Set local ID	
ATD<dial string>	+FCON (+FCSI:"<csi.") +FDIS:<dis codes. OK	off hook, dial, send cng detect flags (get CSI) get DIS	answer, send ([CED], V.21 flags, [CSI], DIS
AT+FDT <1st page data> <DLE><ETX>	+FDCS:<dcs codes> CONNECT <XON> OK	[send TSI] send DCS send TCF get CFR send carrier send page data	(get TSI) get DCS get TCF send CFR receive carrier receive page data
AT+FET=0	+FPTS:1 OK	send RTC send MPS get MCF	get RTC get MPS send MCF
AT+FDT <2nd page data> <DLE><ETX>	CONNECT <XON> OK	send carrier send page data	receive carrier receive page data
AT+FET=2	+FPTS:1 +FHNG:0 OK	send RTC send EOP get MCF send DCN hangup	get RTC get EOP send MCF get DCN hangup

FAX A.2

Table 13. Receive two pages, 1-D data, no errors

DTE commands	DCE responses	local DCE action	Remote Station Action
AT+FCR=1	OK	Enable Reception	
AT+FLID"<local ID>"	OK	Set local ID	
	RING <-	Detect ring<-	Dials[,send CNG]
ATA		off hook, send CED, send CSI, send DIS,	get CED, get CSI, get DIS,
	+FCON [+FCSI"<tsi>"] +FDIS:<dis codes. OK	detect flags, [get TSI] get DIS begin TCF recv	send V.21 flags, [send TSI], send DIS, start TCF
AT+FDR		accept TCF	finish FCT
	+FCFR +FDCS:<dcs codes> CONNECT	send CFR	get CFR
		get page carrier	send page carrier
<DC2>		get page data	send page data
	<page data stream> <DLE><ETX> <- +FPTS:1,<lc> +FET:0 <- OK	detect RTC <- get MPS <-	send RTC drop carrier, send MPS
AT+FDR		send MCF	get MCF
	CONNECT	get page carrier get page data	send page carrier send page data
<DC2>			
	<page data stream> <DLE><ETX> <- +FPTS:1,<lc> +FET:2 <- OK	detect RTC <- get EOP <-	send RTC drop carrier, send EOP
AT+FDR		send MCF get DCN <-	get MCF, send DCN
	+FHNG:0 <- OK		

FAX A.3

Table 14. Polling: Dial, Send and Poll Receive

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
AT+FSPL=1	OK	Enable polling		
AT+FCIG="<poll ID>"	OK	save polling ID		
ATD<dial string>	+FCON [+FCSI:"<csi>"] +FDIS:<dis codes> +FPOLL OK	off hook,dial send CNG detect flags [get CSI] get DIS	answer, send [CED], V.21 flags, [CSI], DIS	remote has doc to poll
AT+FDT <1st page data> <DLE><ETX>	+FDCS:<dcs codes> CONNECT <XON> OK	[send TSI], DCS send TCF get CFR send carrier send page data	[GET TSI], DCS get TCF send CFR receive carrier receive page data	AT+FDT starts send session; AT+FDR starts polling
AT+FET=1	+FPTS:1 OK	send RTC send EOM get MCF	get RTC get EOM send MCF	EOM means go toPhase B.
AT+FDR (FSPL=1) <DC2>	+FCFR +FTSI:"<tsi>" +FDCS:<dcs codes> CONNECT <page data stream> <DLE><ETX> +FPTS:1,<lc>,0,0 +FET:2 OK	ignore CSI & DIS send CIG & DTC get TSI/DCS/TCF send CFR get page carrier get page data get RTC get EOP	send CSI & DIS get CIG & DTC send TSI/DCS/TCF get CFR send page carrier send page data send RTC send EOP	AT+FDR starts polling
AT+FDR	+FHNG:0<- OK	send MCF get DCN<-	get MCF, send DCN	

FAX A.4

Table 15. Answer, Receive and Poll Send

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
AT+FLPL=1	OK	Set DIS bit 9		doc to poll
	RING<-	Detect ring<-	Dials[, send CNG]	
ATA	+FCON [+FTSI:"<tsi>"] +FDCS:<dis codes> OK	off hook, send CED, send CSI & DIS detect flags, [get TSI] get DCS begin TCF recv	get CED, get CSI & DIS, send V.21 flags, [send TSI], send DCS, start TCF	
AT+FDR <DC2>	+FCFR [+FDCS:<dcs codes.] CONNECT <page data stream> <DLE><ETX><- +FPTS:1,<lc> +FET:1<- OK	accept TCF send CFR get page carrier get page data detect RTC<- get EOM<-	finish TCF get CFR send page carrier send page data send RTC, drop carrier, send EOM	
AT+FDR	[+FCIG:"<cig>"] +FDTC:<dtc codes> OK	send MCF send CSI & DIS get [CIG &] DTC	get MCF ignore CSI & DIS send (CIG &) DTC	DCE restarts Phase B calling station starts polling
AD+FDT <page data> <DLE><ETX>	+FDCS:<dcs codes> CONNECT <XON> OK	send [TSI &] DCS send TCF get CFR send carrier send page data	get [TSI &] DCS get TCF send CFR receive carrier receive page data	
AT+FET=2	+FPTS:1 +FHNG:0 OK	send RTC send EOP get MCF send DCN hangup	get RTC get EOP send MCF get DCN hangup	

FAX A.5

Table 16 (Page 1 of 2). Send one page with Line Errors & Retransmission

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
ATD<dial string>	+FCON	off hook, dial, detect flags get bad DIS <-/- ...wait...	answer, CED, V.21 flags, send DIS wait for DCS resend DIS	
	+FDIS:<dis codes> OK	get good DIS <-		
AT+FDT		send DCS-/-> send TCF-?-> get DIS<- repeat DCS-> repeat TCF -/-> get FTT<- send new DCS -> send slower TCF- get bad CFR <-/- repeat new DCS -> repeat new TCF -> get good CFR <- send carrier	get bad DCS ignore TCF resend DIS get good DCS get bad TCF send FTT get new DCS get slower TCF send CFR get DCS again get good TCF repeat CFR receive carrier	DCE responds to FTT by stepping down to 7200.
	+FDCS:<dcs codes> CONNECT <XON>			
<page data stream> <DLE><ETX>		send page data-/->	receive page data	errors in page
AT+FET=2	+FPTS:2 OK	send RTC send EOP-> get RNT<-	get RTC get EOP send RTN	remote station rejects page; asks for a repetition.
[AT+FDIS=,1]	OK	[stepdown to 4800]		[DTE stepdown]
AT+FDT	CONNECT <XON>	send [new] DCS -> repeat TCF-> get CFR<-	get good DCS get good TCF send CFR receive carrier	RTN forces back to Phase B this time the remote gets the page w/o error.
<repeat page data> <DLE><ETX>	OK	send carrier-> send page data ->	receive page data	

Table 16 (Page 2 of 2). Send one page with Line Errors & Retransmission

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
AT+FET=2	 +FPTS:1 +FHNG:0 OK	send RTC ->\nsend EOP-/->\n..wait for PPM..\nrepeat EOP->\nget bad\nMCF<-/-\nrepeat EOP->\nget good\nMCF<-\nsend DCN-?->\nhangup\nhangup	get RTC\nget bad EOP get good EOP\nsend MCF\nget EOP again\nrepeat MCF\nget DCN (?)\n(timeout ?)	

FAX A.6

Table 17 (Page 1 of 2). Receive one page with Line Errors & Retransmission

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
	RING<-	Detect ring<-	Dials	
ATA	 +FCON +FDCS:<dis codes> OK	off hook,\nCED->\nsend DIS-/->\n..wait for DCS..\nrepeat DIS->\nget bad\nDCS<-/-\nignore TCF<-?-\nrepeat DIS->\nget good\nDCS<-\nbegin TCF\nRX<-/-	get CED,\nget bad DIS\n...wait...\nget good DIS\nsend DCS,\nstart TCF\nget DIS again\nrepeat DCS,\nsend TCF	

Table 17 (Page 2 of 2). Receive one page with Line Errors & Retransmission

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
AT+FDR		reject TCF	finish TCF	DCE and remote repeat until TCF is good.
		send FTT->	get FTT	
		get new DCS<-	send new DCS	
	+FCFR	get slower	send slower	
		TCF<-	TCF	
		send CFR-/->	get bad CFR	DCE rereports
		get DCS again<-	repeat new DCS	+FDCS:<dcs> when Phase B
	+FDCS:<dcs codes>	get good TCF<-	repeat new TCF	done, because of changes.
<DC2>	CONNECT	send CFR->	get good CFR	
	<page data stream>	get page carrier	send page carrier	
	<DLE><ETX>		send page data	There are b line errors in this page.
	+FPTS:1<lc>,b,c	get page data		
	+FET:2<-	<-detect RTC<-		
	OK		send RTC, drop carrier, send EOP	
		get EOP <-		
AT+FDR		send RTN->	get RTN	the remote could stepdown
		repeat DIS->	get DIS again	
		get DCS & TCF<-	send DCS & TCF	to 4800.
	+FDCS:<dcs codes>	send CFR ->		
	CONNECT	get page carrier		
	<page data stream>	get page data	send page carrier	this time the page is OK.
<DC2>	<DLE><ETX>		send page data	
	<-	detect RTC <-		
	+FPTS:1,<lc>		send RTC, drop carrier, send EOP	
		get bad EOP<-/-		
	+FET:2 <-	...wait...		
	OK	get good EOP <-	repeat EOP	
AT+FDR		send MCF-/->	get bad MCF, repeat EOP again	
		get EOP again <-	get good MCF	
		repeat MCF->	send DCN	
	+FHNG:70 <-	get DCN<-/-	hangup	
	OK	timeout waiting for new frame		

FAX A.7

Table 18. Send two documents with procedure interrupts

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
ATD<dial string>	+FCON [+FCSI:"<csi>"] +FDIS:<dis codes> OK	off hook, dial, detect flags [get CSI] get DIS	answer, CED send [CSI &] DIS	
AT+FDT <1st document> <DLE><ETX>	 +FDCS:<dcs codes> CONNECT <XON> OK	send [TSI &] DCS send TCF get CFR send carrier send page data	get [TSI &] DCS get TCF send CFR receive carrier receive page data	
AT+FET=5	+FPTS:5 +FVOICE OK	send RTC send PRI-EOM get PIP -release line to local operator-	get RTC get PRI-EOM send PIP -release line to remote operator-	
ATD	+FCON [+FCSI:"<csi>"] +FDIS:<dis codes> OK	off hook again detect flags [get CSI] get DIS	off hook, [CED] [CIS &] DCS	DTE restarts session.
AT+FDT <2nd document> <DLE><ETX>	CONNECT <XON> OK	send carrier send page data	receive carrier receive page data	
AT+FET=2	+FPTS:5 OK	send RTC send EOP get PIP	get RTC get EOP send PIP	remote wants another procedure interrupt.
AT+FET=6	+FVOICE OK	send PRI-EOP -release line to local operator-	get PRI-EOP -release line to remote operator-	

FAX A.8

Table 19 (Page 1 of 2). Receive two documents with procedure interrupts

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
	RING<-	Detect ring<-	Dials	
ATA	send [CSI &] DIS +FCON [+FTSI:"<tsi>"] +FDCS:<dis codes> OK	off hook, CED, get [CSI &] DIS, detect flags, get [TSI &] DCS begin TCF RX	get CED, send V.21 flags, send [TSI &] DCS start TCF	
AT+FDR <DC2>	+FCFR CONNECT <page data stream> <DLE><ETX> <- FPTS:1,<lc> +FET:0 <- OK	accept TCF send CFR get page carrier get page data detect RTC <- get MPS <-	finish TCF get CFR send page carrier send page data send RTC, drop carrier, send MPS	
AT+FPTS=5	OK	make PIP frame		DTE wants PRI
AT+FDR	+FET:4 +FVOICE OK	send PIP get PRI-MPS -release line to local operator-	get PIP end PRI-MPS -released line to remote operator-	remote accepts PRI.
ATA	 +FCON [+FTSI:"<tsi>"] +FDCS:<dcs codes> OK	off hook, CED send [CSI &] DIS get [TSI &] DCS begin TCF RX	get CED get [CSI &] DIS send [TSI &] DCS send TCF	restart session, repeat Phase B
AT+FDR	 CONNECT <page data stream> DLE><ETX> <- +FPTS:1,<lc> +FET:6 <- OK	accept TCF send CFR get page carrier get page data get RTC get PRI-EOP	finish TCF get CFR send page carrier send page data send RTC, drop carrier, send PRI-EOP	 remote station wants procedure interrupt.
AT+FPTS=5	OK	make PIP frame		accept PRI-EOP

Table 19 (Page 2 of 2). Receive two documents with procedure interrupts

DTE commands	DCE responses	local DCE action	Remote Station Action	Notes
AT+FDR	+FVOICE OK	send PIP -release line to local operator-	get PIP -release line to remote operator-	

FAX Appendix B

Alphabetic Index of Commands, Parameters and Responses

Command	Page #	Description
+FCLASS=<value>	2-4	Service Class ID

Name	Page #	Description
A	2-7	Answer Command
D<string>	2-8	Originate Command
+FAA=	2-44	Auto Answer Mode parameter
+FAXERR=	2-39	Fax Error Value parameter
+FBADLIN=	2-38	Number of consecutive bad lines for a bad page parameter
+FBADMUL=	2-38	Error Threshold Multiplier
+FBOR=	2-40	Phase C Data Bit Order parameter
+FBUF?	2-44	Buffer Size, read only parameter
+FBUG=	2-36	Session Message Reporting parameter
+FCIG:	2-22	Report remote ID response, CIG
+FCFR	2-38	Confirmation to Receive prompt
+FCON	2-20	Facsimile Connection Response
+FCQ=	2-37	Copy Quality capabilities parameter
+FCR=	2-35	Capability to Receive parameter
+FCSI:	2-22	Report remote ID response, CSI
+FCIG=	2-34	Local polling ID String parameter
+FDCS:	2-20	Report session parameters response
+FDCS=	2-30	Current Session results
+FDFFC=	2-42	Data Compression Format Conversion parameter
+FDCC=	2-30	DCE capabilities parameters
+FDIS:	2-20	Report Remote capabilities response
+FDIS=	2-30	Current Session negotiation parameters
+FDR	2-15	Receive Phase C Data Command
+FDT[=]	2-9	Transmit Phase C data command
+FCTCRTY		CTC Retry Valve
+FDTC:	2-20	Report Remote capabilities response
+FET:	2-24	Post Page Message response
+FET=	2-13	End the page or document command
+FHNG:	2-25	Call termination status response
+FHR:	2-46	Report received HDLC frame response
+FHT:	2-46	Report transmitted HDLC frame response
+FK	2-19	Orderly fax abort command

© Copyright IBM Corp. 1996

Name	Page #	Description
+FLID=	2-34	Local ID String parameter, TSI/CSI
+FLNFC=	2-42	Page Length Format Conversion parameter
+FLPL=	2-34	Document for polling parameter
+FMDL?	2-5	Request DCE Model
+FMFR?	2-5	Request DCE Manufacturer
+FMINSP=	2-40	Minimum Phase C Speed parameter
+FNSC:	2-22	Report NSC frame response
+FNSF:	2-22	Report NSF frame response
+FNSS:	2-22	Report NSS frame response
+FPHCTO=	2-39	Phase C Time-out parameter
+FPOLL	2-21	Remote Polling Indication
+FPTS:	2-25	TX Page Transfer Status Response
+FPTS=	2-36	Page Transfer Status parameter
+FREV?	2-5	Request DCE Revision
+FREL=	2-41	Phase C EOL alignment parameter
+FSPL=	2-35	Enable polling parameter
+FTSI:	2-22	Report remote ID response, TSI
+FVOICE	2-25	Transition to Voice Response
+FVRFC=	2-41	Vertical Resolution Format Conversion parameter
+FWDFC=	2-43	Page Width Format Conversion parameter
+FTBC		Phase C Transmit Byte Count
+FRBC		Phase C Receive Byte Count

Appendix A: ASCII Character Code/Hex/Decimal

© Copyright IBM Corp. 1996

Table 20. ASCII Character Code/Hex/Decimal Conversion Chart

CTRL	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	DEC
@	NUL	00	0	SP	20	32	@	40	64		60	96
A	SOH	01	1	!	21	33	A	41	65	a	61	97
B	STX	02	2	"	22	34	B	42	66	b	62	98
C	ETX	03	3	#	23	35	C	43	67	c	63	99
D	EOT	04	4	$	24	36	D	44	68	d	64	100
E	ENQ	05	5	%	25	37	E	45	69	e	65	101
F	ACK	06	6	&	26	38	F	46	70	f	66	102
G	BEL	07	7	'	27	39	G	47	71	g	67	103
H	BS	08	8	(	28	40	H	48	72	h	68	104
I	HT	09	9	)	29	41	I	49	73	i	69	105
J	LF	0A	10	*	2A	42	J	4A	74	j	6A	106
K	VT	0B	11	=	2B	43	K	4B	75	k	6B	107
L	FF	0C	12	,	2C	44	L	4C	76	l	6C	108
M	CR	0D	13	-	2D	45	M	4D	77	m	6D	109
N	SO	0E	14	.	2E	46	N	4E	78	n	6E	110
O	SI	0F	15	/	2F	47	O	4F	79	o	6F	111
P	DLE	10	16	0	30	48	P	50	80	p	70	112
Q	DC1	11	17	1	31	49	Q	51	81	q	71	113
R	DC2	12	18	2	32	50	R	52	82	r	72	114
S	DC3	13	19	3	33	51	S	53	83	s	73	115
T	DC4	14	20	4	34	52	T	54	84	t	74	116
U	NAK	15	21	5	35	53	U	55	85	u	75	117
V	SYN	16	22	6	36	54	V	56	86	v	76	118
W	ETB	17	23	7	37	55	W	57	87	w	77	119
X	CAN	18	24	8	38	56	X	58	88	x	78	120
Y	EM	19	25	9	39	57	Y	59	89	y	79	121
Z	SUB	1A	26	:	3A	58	Z	5A	90	z	7A	122
[	ESC	1B	27	;	3B	59	[	5B	91	{	7B	123
\	FS	1C	28	<	3C	60	\	5C	92	|	7C	124
]	GS	1D	29	=	3D	61	]	5D	93	}	7D	125
	RS	1E	30	>	3E	62	¬	5E	94	-	7E	126
-	US	1F	31	?	3F	63	_	5F	95	DEL	7F	127

NUL	Null, or all zeros	DC1	Device Control 1	SI	Shift In
SOH	Start of Header	DC2	Device Control 2	SO	Shift Out
STX	Start of Text	DC3	Device Control 3	SYN	Sync.
ETX	End of Text	DC4	Device Control 4	LF	Line Feed
EOT	End of Transmission	CAN	Cancel	FF	Form Feed
ACK	Acknowledge	EM	End of Medium	ENQ	Enquiry
BEL	Bell or Alarm	SUB	Substitute	ESC	Escape
BS	Backspace	FS	File Separator	DLE	Data Link Escape
HT	Horizontal Tab	GS	Group Separator	NAK	Negative Acknow- ledge
VT	Vertical Tab	RS	Record Separator	CR	Carriage Return
ETB	End Transmission Block	DEL	Delete		

Appendix B:

Command Summary

Table 21. Command Summary

COMMAND	VALUES	DESCRIPTION
AT		Attention Code that precedes most command strings except A/, A: and Escape Codes.
RETURN		Pressing RETURN key executes most commands.
$		This symbol placed in dialing string enables the modem to detect AT&T's "call card" tones for accessing user's calling card to originate an on-line connection.
A		Answer call, even if no ring present.
A/		Repeat last command. (Do not precede this command with AT. Do not hit RETURN to execute.)
****A:***		Continuous redial (10 redials in DOC units) of last number until answered. (Not used Internationally.)
$An	n = 0 or 1	$A0 discards data during auto-reliable *** time period. $A1 buffers data during auto-reliable time period.
#An	n = 0 thru 3	#A0 selects initial handshake at 33,600 *** to 31,200 to 28,800 to 24000 to 21,600 to 19,200 to 16,800 to 14,400 to 12,000 to 9600 to 4800 to 2400 to 1200 to 300 bps. #A1 selects initial handshake at 33,600 bps only. #A2 selects initial handshake at 33,600 to 31,200 to 28,800 to 24000 to 21600 to 19,200 to 16,800 19,200 to 14,400 to 9600 to 4800 bps. #A3 selects initial handshake at 2400 to 1200 to 300 bps.
****B***n	n = 0 or 1	B0 selects V.21 answer tone. *** B1 selects Bell answer tone.
&Bn	n = 0 or 1	&B0 means normal transmit buffer size. *** &B1 means reduced transmit buffer size.
&BSn	n = 0 or 1	&BS0 means maximum transmit block size of 64 characters. &BS1 means maximum transmit block size of *** 256 characters.

*** Factory Default setting

* Not applicable in model IBM 7852-4UK

© Copyright IBM Corp. 1996

Table 22. Command Summary

COMMAND	VALUES	DESCRIPTION
$BAn	n = 0 or 1	$BA0 means speed conversion is on. *** $BA1 means speed conversion is off.
&Cn	n = 0, 1, 2, or 4	&C0 forces Carrier Detect on. &C1 lets Carrier Detect act normally. *** &C2 lets Carrier Detect drop S24 time on disconnect. &C4 resets modem when Carrier Detect drops.
&CDn	n = 0 or 1	&CD0 execute cleardown on disconnect. *** &CD1 do not execute cleardown on disconnect.
Ds	s = phone #	Dial a telephone number "s," where s may include up to 60 digits or T, P, R, comma and ; characters.
Ds ***N***d	s = phone # d = 0 thru 9	Store telephone number. To store, phone number "s" is entered and followed by N and then Directory Number "d."
&Dn	n = 0 thru 3	&D0 DTR is ignored ** &D1 means modem returns to command mode. &D2 lets modem react to DTR normally. *** &D3 causes modem to reset to modem default parameters.
%DFn	n = 0 or 1	%DF0 Line Probe Data in Graph Format. *** %DF1 Line Probe Data in Table Format.
%DPn	n = 0 or 1	%DP0 do not read Line Probe Information from DSP during handshaking. *** %DP1 read Line Probe Information from DSP during handshaking.
$Dn	n = 0 or 1	$D0 disables DTR Dialing. *** $D1 enables DTR Dialing.
En	n = 0 or 1	E0 means do not echo Command Mode Character. E1 means do echo Command Mode *** characters.
&En	n = 0 thru 15	&E0 means no error correction. &E1 means V.42 Auto-reliable Mode. *** &E2 means V.42 Reliable Mode. &E3 means no modem-initiated flow control. &E4 means CTS modem-initiated flow *** control.

** Factory Default setting for IBM 7852-400-MAC

*** Factory Default setting

Table 23. Command Summary

COMMAND	VALUES	DESCRIPTION
&En		&E5 means Xon/Xoff modem-initiated flow control. &E6 means Xon/Xoff not passed through. *** &E7 means Xon/Xoff passed through. &E8 means Enq/Ack pacing off. *** &E9 means Enq/Ack pacing on. &E10 means Normal Mode flow control off. *** &E11 means Normal Mode flow control on. &E12 means Pacing off. &E13 means Pacing on. *** &E14 means data compression disabled. &E15 means data compression enabled. ***
$EBn	n = 0 or 1	$EB0 enables 10 bit mode. *** $EB1 enables 11 bit mode.
%En	n=0 thru 5	% E0 = Modem Won't Escape. % E1 = +++ Method (default setting). *** % E2 = Break Method. % E3 = Either +++ or Break Method. % E4 = No "OK" Response to +++ % E5 = "OK" Response to +++
#Fn	n = 0 thru 2	#F0 means no fallback when on-line. #F1 means fallback from 33600 to 4800 bps when on-line (increments of 2400 bps). #F2 means fallback to 4800 bps from 33.6K *** bps/fall forward if line improves (increments of 2400 bps).
&Fn	n = 0, 8 or 9	&F loads factory default values from ROM. &F8 reads factory default values and switch *** settings when &F is issued. &F9 reads parameters stored in non-volatile memory when &F is issued.
$Fn	n = 0 or 1	$F0 means do not fall back to normal connect if CR received. $F1 means fall back to normal connect if CR *** received.
****&G***n	n = 0, 1 or 2	&G0 turns off CCITT guard tones. *** &G1 turns on CCITT 550 Hz guard tone. &G2 turns on CCITT 1800 Hz guard tone.
Hn	n = 0 or 1	H0 means Hang Up (go on hook). H1 means Go Off Hook.
$Hn	n = 1 thru 3	$H1 brings up Help Screen #1. $H2 brings up Help Screen #2. $H3 brings up Help Screen #3.

***** Not applicable in model IBM 7852-4UK

Table 24. Command Summary

COMMAND	VALUES	DESCRIPTION
In	n = 0,1or 2	I0 requests modem ID #. I1 requests firmware revision #. I2 for MTS internal use.
I9	Read Only	Command enables display of Windows 95 Autodetect characteristics
L		Lists all stored telephone numbers in memory.
L5		L5 lists all current operating parameters.
L6		L6 lists all current S-Register values.
L7		L7 lists additional parameters.
L8		L8 lists On-Line Diagnostics
L9		L9 Displays Signal Strength Information.
L10		L10 Displays Signal Signal to Noise Ratio Information.
L11		L11 Displays Noise Information.
#Ln	n = 0 thru 3	#L0 means modems negotiate V.42 Mode. *** #L1 means MNP on and LAP-M off. #L2 means LAP-M on and MNP off. #L3 means no detection phase but go directly to LAP-M.
Mn	n = 0 thru 3	M0 means Monitor speaker always Off. M1 means Monitor speaker On until carrier *** detected M2 means Monitor speaker always On. M3 Monitor speaker on during dialing/off during handshaking.
$MBn	n = speed	$MB75 selects CCITT V.23 mode. $MB300 selects 300 bps on-line. $MB1200 selects 1200 bps on-line. $MB2400 selects 2400 bps on-line. $MB4800 selects 4800 bps on-line. $MB9600 selects 9600 bps on-line. $MB14400 selects 14400 bps on-line $MB19200 selects 19200 bps on-line $MB28800 selects 28800 bps on-line $MB33600 selects 33600 bps on-line ***
&Mn	n = 0 or 1	&M0 selects Async when on-line. *** &M1 selects Sync when on-line.

Table 25. Command Summary

COMMAND	VALUES	DESCRIPTION
Nd	d = 0 thru 9	Dial stored telephone number "d" (Do not include the letter D in this command.)
Nd ***N***e	d = 0 thru 9 e = any other number 0 thru 9	Number Linking. If first number dialed is busy, another stored number may be automatically dialed. In example, stored number d is dialed, and if busy, stored number e is dialed.
O		Exit Command Mode and go into On-Line Mode.
P		Modem will pulse-dial numbers following *** the P.
&Pn	n = 0 or 1	&P0 means 60-40 pulse ratio. *** &P1 means 67-33 pulse ratio.
Qn	n = 0, 1 or 2	Q0 means Result Codes sent. *** Q1 means Result Codes will be suppressed (quiet). Q2 means Dumb Answer Mode.
&Qn	n = 0 or 1	&Q0 selects Extended command set. *** &Q1 selects AT command set.
Rn	n = 0 or 1	R0 means modem will not reverse modes. *** R1 means modem will reverse modes.
&Rn	n = 0, 1 or 2	&R0 lets Clear to Send act normally. &R1 forces Clear to Send on. *** &R2 drops for 1 second on disconnect.
&RP		Command Initiates a Retrain that makes the processor read Line Probe Information (valid only in V.34 mode).
$Rn	n = 0 or 1	$R0 means disconnect after 12 retransmits. *** $R1 means do not disconnect after 12 retransmits.
&RFn	n = 0 or 1	&RF0 selects CTS follows RTS. &RF1 selects CTS to act independently ***
Sr=n	r = 0-11, 13, 15-19, 24-26, 29, 30 32, 34...	Sets value of Register "r" to value of "n", where "n" is entered in Decimal format.
Sr?	r = 0-11, 13, 15-19, 24 26, 30, 32 or 34...	Reads value of Register "r" and displays value in 3-digit Decimal format.

* Not applicable in model IBM 7852-4UK

***Factory Default setting

Table 26. Command Summary

COMMAND	VALUES	DESCRIPTION
$SBn	n = speed	$SB300 selects 300 bps at serial port. $SB1200 selects 1200 bps at serial port. $SB2400 selects 2400 bps at serial port. $SB4800 selects 4800 bps at serial port. $SB9600 selects 9600 bps at serial port. $SB19200 selects 19,200 bps at serial port. $SB38400 selects 38,400 bps at serial port $SB57600 selects 57600 bps at serial port. $SB115200 selects 115200 bps at serial port. ***
&SFn	n = 0 or 1	&SF0 selects DSR follows CD. *** &SF1 selects DSR independent.
&Sn	n = 0, 1 or 2	&S0 forces Data Set Ready On. &S1 lets Data Set Ready act normally. *** &S2 Data Set Ready drop is regulated by S24 on disconnect.
T		Modem will tone-dial numbers following the T.
&Tn	n = 4 or 5	&T4 means Enable Response to Request for Remote Digital Loopback. &T5 means Disable Response to Request for *** Remote Digital Loopback.
#Tn	n = 0 or 1	#T0 turns off Trellis Coded Modulation #T1 turns on Trellis Coded Modulation ***
Un	n = 0, 1, 2, or 3	U0 places modem in Analog Loop Originate Mode. U1 places modem in Analog Loop Answer Mode. U2 places modem in Remote Digital Loopback test mode. U3 places modem in Local Digital Loopback test mode.
$VDn	n= 0 or 1	$VD0 disables Voice/Data Dialing *** $VD1 enables Voice/Data Dialing
#Vn	n= 0 or 1	#V0 enables V.32terbo handshaking process. #V1 disables V.32terbo handshaking process. ***
Vn	n = 0 or 1	V0 means Result Codes sent as digits (terse response). V1 means Result Codes sent as words *** (verbose response).
W		Wait for new dial-tone.

***Factory Default setting

Table 27. Command Summary

COMMAND	VALUES	DESCRIPTION
&Wn	n = 0 or 1	&W0 causes modem to store its current parameters in non-volatile RAM, and modem will load these for future sessions instead of reading factory ROM defaults, unless &F command used. &W1 causes modem to not store parameters. ***
Xn	n = 0, 1, 2, 3 or 4	X0 selects Basic Result Codes *** (w/o CONNECT 1200, CONNECT 2400). X1 selects Extended Result Codes (w/CONNECT 1200, CONNECT 2400). X2 selects Standard AT Command set with NO DIAL TONE. X3 selects Standard AT Command set with BUSY. X4 selects Standard AT Command set with NO DIAL TONE and BUSY.
#Xn	n= 0 or 1	#X0 selects single XOFF character sent until *** XON level returns. #X1 selects multiple XOFF characters after buffer level is full.
Yn	n = 0 or 1	Y0 disables sending or responding to long *** space "break". Y1 enables sending or responding to long space "breaks".
Z		All configuration parameters are reset to default values.
,	in Dial command	Causes pause during dialing.
;	in Dial command	Causes return to Command Mode after dialing.
!	in Dial command	Causes modem to flash On-Hook.
@	in Dial command	Causes modem to wait for ringback, then 5 seconds of silence before processing next part of command.
+++AT<CR>		In-band Escape Sequence. Places modem in Command Mode while still remaining On-Line. Enter +++ followed by the letters A and T, up to ten command characters, and a RETURN.
BREAK AT<CR>		Out-of-band Escape Sequence. Places modem in Command mode while still remaining On- Line. Enter a BREAK signal, followed by the letters ***A***and ***T*** up to sixty command characters, and hit RETURN.

Table 28. Callback Security/Remote Configuration Command Summary

COMMAND	DESCRIPTION
#DBn	**#DB0** disables Callback Security and answering Yes to the prompt turns off Callback Security and erases stored phone numbers and passwords. Answering No to the prompt aborts the command. **#DB1** activates remote and local password security. **#DB2** activates remote password security.
#CBNyyxxxxxx	Callback password with xxxxxx being callback password and yy being the memory location. Callback password xxxxxx must start with a non-numeric character and upper/lower case sensitive. Callback password xxxxxx must be a minimum of 6 and maximum of 10 characters. yy memory locations are from 0 to 29. Must specify P (pulse) or T (tone) dialing in string.
+ - Dxxxxxx???Nxx	Callback Phone Numbers xxxxxx with the + preceding the phone number indicating the callback modem phone number for the corresponding password at the same memory location. The (-) preceding the phone number enables direct entry when the caller uses the correct password without the callback modem having to return the call. The ??? entry at the end of the phone number represents an extension added to the main phone number. The Nxx is the memory location of the callback phone number and password.
#Pn	Parity of the prompt messages sent by the callback modem. **#P0** is no parity **#P1** is odd parity **#P2** is even parity
#RCBNxx	Erases the callback password stored at memory location xx. Memory locations are 0 to 29.
#RDNxx	Erases the callback phone number stored at memory location xx. Memory locations are 0 to 29.

Table 29. Password Command Summary

COMMAND	DESCRIPTION
#Ixxxxxxxxxx	Login Password is any keyboard characters (x) (upper/lower case sensitive), minimum 6 and maximum 10 characters. The default Login Password is **#IMULTITECH**
#Syyyyyyyyyy	Set-up Password is any keyboard characters (y) (upper/lower case sensitive), minimum 6 and maximum 10 characters. The default Set-up Password is **#SMODEMSETUP**.

Table 30. V.25bis Commands

COMMAND	DESCRIPTION
$Vn	**$V0** returns modem to AT command mode when in V.25bis mode. **$V1** enables V.25bis mode of operation. **$V2** allows modem to receive one V.25bis command while in AT command mode without leaving AT command mode. **$V5** DSR follows DTR in V.25bis mode. **$V6** DSR does not follow DTR in V.25bis mode.
CSPs Changes the serial bps rate. **CSP0300** - 300 bps **CSP1200** - 1200 bps **CSP2400** - 2400 bps **CSP4800** - 4800 bps **CSP9600** - 9600 bps **CSP19200** - 19200 bps **CSP38400** - 38400 bps **CSP57600** - 57600 bps **CSP115200** - 115200 bps	
CRNdd	Dials phone number dd where dd can be up to 20 characters (0 through 9, *, #, P, T and :). Phone number is checked against the Delayed and Forbidden Number lists before dialed.
CRIdd;nn	Dials dd same as CRN Command and ignores nn identification string.
DIC **or** **CIC**	The disregard or connect to incoming calls commands are used for auto-answer operations. **DIC** stops the modem from answering incoming calls. **CIC** causes the modem to answer incoming calls.

Appendix C:

S-Register Summary

Table 31. S-Register Summary

S-REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
S ***0***	1 ring	0-255	1	Sets number of rings before modem answers.
S***1***	1 ring	0-255	0	Counts rings which have occurred.
S***2***	ASCII	0-127	43	Sets Escape Code character (default is plus + sign).
S***3***	ASCII	0-127	13	Sets character recognized as RETURN (default is CTRL-M).
S***4***	ASCII	0-127	10	Sets character recognized as LINE FEED (default is CTRL-J).
S***5***	ASCII	0-32	8	Sets character recognized as 127 BACKSPACE (default is CTRL-H).
S***6***	1 second	2-255 4-255** 4-7***	2 4** 4***	Determines wait-time for dial tone.
S***7***	1 second	1-255 1-45 1-55*	45 55*	Determines how long modem waits for carrier before aborting call.
S***8***	1 second	0-255 4-255** 4-7***	2 4** 4***	Sets pause time caused by a comma character in a dial command.
S ***9***	100 mSec	1-255	6	Sets carrier detect response time.
S ***10***	100 mSec	1-255	7	Sets delay time between when carrier is lost and when modem disconnects.
S ***11***	1 mSec	1-255 80-255*	70 80*	Sets time duration of and spacing between tones in tone-dialing.
S ***13***	ASCII	0-127	37	Defines Remote Configuration Escape Character

*Values for International and DOC units only.

** International only. ***Model IBM 7852-4UK only.

© Copyright IBM Corp. 1996

S-REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
S **15**	Sec	10-255	20	Defines time delay for Callback attempts after initial passwords have exchanged.
S ***16***	1 Attempt	1-255 1-2***	4 2***	Defines the number of Callback attempts after initial passwords have exchanged between modems.
S ***17***	10 mSec	0-2.5	250 mSec	Defines length of break time (space) to PC.
S ***18***	30 min	10-255	30	Defines how often leased-line is checked and restoral attempted.
S ***19***	min	0-255	1	Timer used in dial back-up mode. Specifies time duration modem attempts to restore leased line connection.
S ***24***	50 mSec	0-255	20	Sets DSR/CTS/CD dropout time. Default (20) equals one second.
S ***25***	100 mSec	0-255	0	Sets DTR dropout time. 0 default equals 50 mSec.
S ***26***	1	0-255	0	Specifies number of failed password attempts allowed.
S ***29***	1	1-255	20	Specifies the amount of idle time can elapse between AT commands after the SETUP password has been entered
S ***30***	min	0-255	0	Inactivity timer used to disconnect modem.
S ***32***	100mSec	0-255	20	Sets time that modem waits for a <RETURN> to be entered during escape sequence execution.

*Values for International and DOC units only.

** International only. ***Model IBM 7852-4UK only.

S-REGISTER	UNIT	RANGE	DEFAULT	DESCRIPTION
S ***34***	ASCII	0-60	10	Buffer size for number of characters in AT command string after on-line escape sequence, before buffer is cleared and escape sequence aborted.
S ***36***	1 second	0-255	0	S36 sets the time between DTR inactive and the modem going off-hook (*busy-out*).
S ***37***	1 second	0-255	5	S37 sets the time allowed DTR active and the modem responding on-hook *(not busy)*.
S ***48***	N/A	33, 31, 28, 26, 24, 21, 19, 16, 14, 12, 96 and 48	0	S48 sets speed modem connects within scope of Enhanced V34 mode (e.g., S48 = 21 means maximum connect speed is 21.6K). This register is useful when line conditions will not support higher V34 speeds. The default value is 0, which indicates a connection attempt of 28.8K.

Appendix D:

Result Code Summary

Table 32. Result Code Summary

(TERSE) DIGIT	(VERBOSE) WORDS	EFFECT
0	OK	Command was executed without error; ready for next command.
1	CONNECT	Modem has detected carrier and gone on-line.
2	RING	Modem has detected ring caused by incoming call.
3	NO CARRIER	No carrier signal has been detected within allowed time.
4	ERROR	Error in Command line (too many, or invalid characters).
5	CONNECT 1200	Modem has detected carrier at 1200 bps and gone on-line.
6	NO DIAL TONE	No dial tone has been detected.
7	BUSY	A busy signal has been detected.
8	NO ANSWER	Remote system did not answer.
9	CONNECT 2400	Modem has detected carrier at 2400 bps and gone on-line.
11	CONNECT 4800	Modem has detected carrier at 4800 bps and gone on-line.
12	CONNECT 9600	Modem has detected carrier at 9600 bps and gone on-line.
13	CONNECT 14400	Modem has detected carrier at 14400 bps and gone on-line.
19	CONNECT 19200	Modem has detected carrier at 19200 bps and gone on-line.
21	CONNECT 21600	Modem has detected carrier at 21600 bps and gone on-line.
23	CONNECT 1275	Modem is connected in V.23 mode.
24	CONNECT 24000	Modem has detected carrier at 24000 bps and gone on-line.
26	CONNECT 26400	Modem has detected carrier at 26400 bps and gone on-line.
28	CONNECT 28800	Modem has detected carrier at 28800 bps and gone on-line.
31	CONNECT 31200	Modem has detected carrier at 31200 bps and gone on-line.
33	CONNECT 33600	Modem has detected carrier at 33600 bps and gone on-line.

Note: If IBM 7852-400 is used in MNP Reliable mode, the following responses change:

1R	CONNECT RELIABLE
5R	CONNECT 1200 RELIABLE
9R	CONNECT 2400 RELIABLE
11R	CONNECT 4800 RELIABLE
12R	CONNECT 9600 RELIABLE

© Copyright IBM Corp. 1996

13R	CONNECT 14400 RELIABLE
19R	CONNECT 19200 RELIABLE
21R	CONNECT 21600 RELIABLE
24R	CONNECT 24000 RELIABLE
26R	CONNECT 26400 RELIABLE
28R	CONNECT 28800 RELIABLE
31R	CONNECT 31200 RELIABLE
33R	CONNECT 33600 RELIABLE

Note: If IBM 7852-400 is used in LAP-M reliable mode, the following responses change:

1L	CONNECT LAPM
5L	CONNECT 1200 LAPM
9L	CONNECT 2400 LAPM
10L	CONNECT 4800 LAPM
12L	CONNECT 9600 LAPM
13L	CONNECT 14400 LAPM
19L	CONNECT 19200 LAPM
21L	CONNECT 21600 LAPM
24L	CONNECT 24000 LAPM
26L	CONNECT 26400 LAPM
28L	CONNECT 28800 LAPM
31L	CONNECT 31200 LAPM
33L	CONNECT 33600 LAPM

Note 1: If the IBM 7852-400 is used with data compression, the word *COMPRESSED* or the letter *C* is added to result codes.

Note 2: If the Standard AT Command Set 2400 responses are selected with the &Q command, the following responses change:

9	(not used)

10	CONNECT 2400 Modem has detected carrier at 2400 bps and gone on-line.

Appendix E:

V.25bis Operation

Chapter 5 described a set of commands which let the IBM 7852-400 dial, hang-up, and be configured for various applications. However, these commands, the AT command set, are only functional when the DTE transmits data asynchronously. That is, they cannot be used with synchronous equipment such as that found in Binary Synchronous Communications (*BSC or Bisync*) and Synchronous Data Link Control (*SDLC/HDLC*) environments.

The ITU V.25 *bis* commands provide you with an alternate set of commands and responses to those described in Chapter 5 for applications in which the DTE is synchronous. V.25 *bis* commands support dialing functions in asynchronous or synchronous mode according to the recommendations of the ITU; however, the AT commands are understood to reign in the asynchronous world, while the V.25bis commands are relegated to the synchronous world of datacomm. If you need to establish a datacomm link over Public Switched Telephone Network (*PSTN*) dial-up services, and your equipment outputs a synchronous data stream, V.25 *bis* commands are essential. V.25 *bis* mode AT commands do not include any modem configuration commands. You can execute normal AT commands in V.25 *bis* mode for modem configuration.

Delayed and Forbidden Numbers

V.25 *bis* provides the facility to delay failed call retry attempts by putting numbers that failed to connect on a special Delayed Number list. Subsequent dialing of these numbers will be delayed (time specified by a country regulation) and an appropriate message displayed. If the number is retried more than the maximum allowed number of times (number is also specified by country regulation), it is placed on the Forbidden Numbers list, and no further retries will be allowed. When the Forbidden Numbers list is full, no dialing is allowed and a CFIFF indication is given. The modem in AT command mode will respond with *NO CARRIER*. If country regulations require that the Forbidden Numbers list be checked in AT mode, then *NO CARRIER* will be the response to a dial attempt in AT mode. Numbers will also be put on the Forbidden Numbers list if the Delayed Numbers list is full and a new number fails for the first time. In that case, the new number will be added to the Delayed Number list and

© Copyright IBM Corp. 1996

the oldest existing number added to the Forbidden Numbers list. Numbers are removed from the Forbidden Numbers list by after a certain time has past (also by country regulation). Some country regulations have numbers remain on the Forbidden Numbers list permanently. The Delayed Number and Forbidden Numbers lists are eight numbers long (20 characters each).

V.25bis Operation

Operation in V.25 *bis* mode is similar to AT command mode in that certain DIP-Switch functions are important to its operation. V.25 *bis* does not include any speed detection for asynchronous mode, so when you are giving commands, you must stay in your initial speed (i.e., if you change your terminal speed while entering an AT command, you will get no responses). In synchronous mode, the modem supplies the clock, so the synchronous terminal "*knows*" the speed.

You must be in V.25 *bis* mode for the commands described here to function. Most AT commands will also function, except those associated with dialing such as *ATD*, *ATN*, *ATO*, and *ATU*. To get into V.25 *bis* mode, you type ***AT$V1***. At this point your modem does no more speed or parity detection (things associated with asynchronous operation). To get out of V.25 *bis* mode and back into AT command mode, enter ***AT$VO***. The***AT$V2*** command allows you to run one V.25 *bis* command from AT command mode without leaving AT command mode.

There is no command to select between asynchronous and synchronous V.25 *bis* operation. The position of DIP-Switch #12 selects between modes. For synchronous mode, DIP-Switch #12 must be UP, and the AT command mode enabled.

Another asynchronous mode concern is the problem of connecting at a different speed than the speed at which the serial port is set. If your modem port speed is different from the serial port speed, you must either:

1. Enable speed conversion and have flow control on, or

2. Enable connect responses (with the ***ATX1*** command) and change the serial baud rate after receiving a connect message.

DTR dialing is functional in V.25 *bis* mode, except the number dialed is from the V.25 *bis* mm memory location 01. Also, if the ***$VD1*** command is entered when in Auto-Answer mode, the modem answers immediately upon receiving the first ring.

There is no disconnect message (*NO CARRIER*) if a normal connection is made.

V.25bis Set-Up and Initialization

Before you operate your modem in the V.25 *bis* mode, you need to make sure it is set-up properly (various RS232 lines such as DSR and CTS act as specified in the V.25 *bis* standard). Set-up involves proper DIP-Switch settings and soft-switches (software controlled conditions).

V.25bis DIP-Switches (Defaults)

#1 - Unforced DTR

#2 - NA

#3 - NA

#4 - NA

#5 - Auto-Answer enabled

#6 - Async - Max throughput set

Sync - Slave Clocking

#7 - RTS unforced
#8 - Command Mode forced
#9 - Digital Loopback Off
#10 - Dial-Up
#11 - Async - AT/Extended Resp.
#12 - Async/Sync mode set per requirements

V.25bis Mode AT Commands

The following commands will either alter standard V.25 *bis* behavior (so you must be careful in their use) or they are not allowed, as indicated. All other commands can be used in V.25 *bis* operation.

A	Not Allowed
A/	Not Allowed
A:	Not Allowed
D	Not Allowed
D...N	Not Allowed
$D	Alters Operation ($D1 in V25 *bis* is direct call mode)

E	Alters Operation
&F	Alters Operation (removes modem from asynchronous V.42 *bis* mode)
N	Not Allowed
N...N	Not Allowed
O	Not Allowed
P	Not Allowed
T	Not Allowed
U	Not Allowed
W	Not Allowed
X	Alters Operation (X0 no connect message) (X1 connect message)
,	Not Allowed
;	Not Allowed
!	Not Allowed
@	Not Allowed
+++AT<CR>	Not Allowed

V.25bis Responses (Result Codes)

When in V.25 *bis* mode (the ***AT$V1*** command executed), your modem provides you with several responses which can help you follow the progress of V.25 *bis* operations. These are similar to the Result Codes associated with AT Command mode operation. The V.25 *bis* responses are in the form of three-character mnemonics as listed below:

INC	Incoming Call (same as RING indicator)
VAL	A valid V.25*bis* command has been attempted
DLC *t*	Call delayed for *t*minutes (number on Delayed list)
CFl *rr*	Call failure indicator where *rr*equals:
	et- Engaged tone (same as BUSY)
	nt - Call Answered but No Answer Tone

ab - Call Not Answered

fc - Number on Forbidden List

ns - Number not stored in memory

ua - User Abort

nd - No Dialtone

ff - Forbidden List full

LSN*mm;dd...dd* Phone number in V.25*bis* memory

LSD*mm;dd...dd* Phone number on the Delay list

LSF*mm;dd...dd* Phone number on the forbidden list

CON *ssss* Connection at ssss speed (if X1 in effect)

V.25bis AT Command

The AT commands associated with V.25*bis* mode are described as follows. Note that one command enables and disables V.25 *bis* mode and the rest are only operable in the V.25*bis* mode.

Enable/Disable V.25bis Mode ($V) Command

The function of the ***$V*** command is to select the V.25 *bis* mode in asynchronous mode. (Synchronous mode is set up with switches. For example, the modem could be in AT command mode, (***AT$V1***), and if synchronous mode is enabled with AT Command mode enabled, then V.25 *bis* mode is selected). Prior to executing this command, make sure that your modem is properly set up to perform the type of operation you will be performing. Refer to the initialization section of this appendix for information about modem set-up. When in V.25 *bis* mode, most normal AT commands will also function (except ***D***,***N***, *O* and ***U***). V.25 *bis* operates in asynchronous or synchronous modes (depending on the position of DIP-Switch #12), and does not check for terminal speed (so do not change speeds while in this mode) or parity. In synchronous mode, speed is not important since the internal clocks provide synchronization.

To place your modem in V.25 *bis* mode from asynchronous mode, enter the ***AT$V1*** command. To return to AT command mode, enter the ***AT$V0*** command. ***AT$V2*** allows you to run one V.25 *bis* command from AT command mode without leaving AT command mode (the V.25 *bis* command follows ***$V2*** on the command line).

Change Serial Baud Rate (CSP) Command

The ***CSP*** command will change the serial baud rate of your modem by entering **CSP *sssss*** where ***sssss*** can equal:

0300 = 300 bps

1200 = 1200 bps

2400 = 2400 bps

4800 = 4800 bps

9600 = 9600 bps

19200 = 19200 bps

38400 = 38400 bps

57600 = 57600 bps

115200 = 115200 bps

Dial Phone Number Provided (CRN) Command

The CRN command permits the dialing of the phone number immediately following it (from the command line). It is similar to the ***D*** command of the AT command set, except that the number is first checked against the Delayed Number and Forbidden Number list. If permitted, depending on the country regulations in effect, the number will then be dialed. For example, if you enter ***CRN7859875*** and hit RETURN, your modem will check the two lists. If the number is on the Delayed Numbers list, you can dial that number again after *t* minutes have passed. If the number is on the Forbidden list, a ***CFIFC*** message will be displayed.

You can use various commands from the AT command set within the CRN command line to facilitate the dialing process, such as ***P***, ***T***, or ***:*** for pulse dialing, tone dialing and wait for dial tone. V.25 *bis* supports "*smart*" dialing.

To dial a phone number, enter ***CRNdd...dd*** where ***dd...dd*** is the phone number, which can be up to 20 characters long using any character on the telephone pad (0 through 9, *, #, P, T, and :).

Some additional dialing characters may be available, based on country regulations.

Listing Delayed Phone Numbers (RLD) Command

When a phone number is dialed by a CRN command and a connection is not made, the number is entered in the modem's V.25 *bis* Delayed Number list along with the number of retry attempts. Any further dialing attempts will be delayed some amount of time (determined by the regulations of each country). While the delay is in progress, the modem will give a DLC indication. The list contains eight numbers. When filled, the next number failing "*bumps*" off the oldest number on the list onto the Forbidden Number list. Numbers on the Delayed Number list that succeed in a connect attempt are removed. If a certain number of failed attempts occur (the number of failed attempts is specified by each country), the number is entered into the V.25 *bis* Forbidden Phone Number List. Forbidden phone numbers cannot be dialed at all. To list the phone numbers on the V.25 *bis* Delayed Phone Number List, enter ***RLD*** and hit RETURN.

Listing Forbidden Phone Number (RLF) Command

Those phone numbers that have failed to connect the required number of times as specified by country regulations are removed from the Delayed Number list and entered onto the V.25 *bis* Forbidden Number list. Numbers on the Forbidden Number list cannot be dialed at all for some maximum amount of time, which is also specified by country regulations. In some countries, the time might be one hour, and in others the number may never be dialed again. The forbidden list is eight numbers long, with the newest number replacing the oldest if the memory is full. To list the numbers in the Forbidden list enter ***RLF*** and hit RETURN.

Disregard or Connect to Incoming Calls (DIC or CIC) Command

The Disregard or Connect to Incoming Calls commands are used for Auto-Answer operations. Depending on the country regulations, your modem will wait some amount of time or number of rings before answering the call. During that time, you can stop the modem from answering the call by entering the ***DIC*** (Disregard Incoming Calls) command. The ***CIC*** (Connect to Incoming Calls) command will cause your modem to answer the call (either reversing the effect of a DIC command or simply have your modem answer the call immediately without waiting the regulation time before answering).

DTR Dialing ($D) Command

DTR Dialing is an alternate method of causing the IBM 7852-400 to automatically dial a number. Data Terminal Ready (DTR) is a signal that comes into the modem from the terminal or computer to which it is connected via pin 20 of the RS232 interface. In DTR Dialing, the modem will automatically dial a stored number as soon as it receives a high DTR signal. The DTR Dialing method is popular when using the IBM 7852-400 in synchronous applications.

To enable DTR Dialing, enter the command **AT$D1** and hit Return. The modem will now dial the phone number you have stored as N0 when it receives a high DTR signal (see the ***D...N*** command in Chapter 5). DTR must remain high for the duration of the call, until disconnect. To disable DTR Dialing, enter the command **AT$D0** (or ***AT$D***) and hit RETURN.

When you use DTR Dialing, be sure that DIP-Switch #1 is in the UP position, so that DTR is not forced on.

In addition, when using DTR Dialing in a synchronous application, be sure that DIP-Switch **#8** is in the UP position to disable V.25 *bis* Command mode.

Appendix F:

RS232C Interface Specifications

The IBM 7852-400 RS232C interface circuits have been designed to meet the electrical specifications given in EIA (Electronic Industries Association) RS232C standards. All signals generated by the modem are approximately 10 volts when measured across a load of 3000 ohms or greater. The receiving circuits of the modem will accept signals in the 3 to 25 volt range. The voltage thresholds are:

Negative = voltage more negative than 3 volts with respect to signal

Positive = voltage more positive than +3 volts with respect to signal

SIGNAL INFORMATION:	NEGATIVE	POSITIVE
Binary State	One	Zero
Signal Condition	Mark	Space
Control and Timing Function	Off	On

The input impedances of all modem circuits which accept signals from the data processing terminal or CPU equipment have DC resistances of 4.7K. For more specific details, consult the EIA RS232C standard itself.

The following chart lists the EIA RS232C interface pins and circuits present on the IBM 7852-400's RS232C Interface connector. All other pins are unused.

PIN ASSIGNMENT	DESIGNATION	EIA CIRCUIT	CCITT CIRCUIT	SIGNAL SOURCE	FUNCTION
1	pg	--	101	--	Protective Ground
2	SD	BA	103	DTE	Transmitted Data
3	RD	BB	104	DCE	Received Data
4	RTS	CA	105	DTE	Request to Send
5	CTS	CB	106	DCE	Clear to Send
6	DSR	CC	107	DCE	Data Set Ready
7	SG	AB	102	--	Signal Ground
8	CD	CF	109	DCE	Carrier Detect
9**	+v	+v	--	DCE	Test Voltage
12	HS	--	--	DCE High Speed	
15***	TC	DB	114	DCE	Transmit Clock
17***	RC	DD	115	DCE	Receive Clock
20	TR****	CD	108/2	DTE	Terminal Ready
22	RI	CE	125	DCE	Ring Indicator
24	XTC	DA	113	DTE	External Transmit Clock
25	OOS	CN	142	DTE	Terminal Busy

**Pin 9 need not be present in your RS232C cable

© Copyright IBM Corp. 1996

***Pins 15 and 17 are necessary only for synchronous operation

****Also known as DTR (Data Terminal Ready)

The computer or terminal should be supplied with a cable terminated with a Cinch DB25P (or equivalent) connector mounted in a Cinch DB51226-1 (or equivalent) hood assembly as specified by the EIA RS232C standard.

FUNCTIONAL DESCRIPTION OF RS232C SIGNALS:

Transmitted Data - Pin 2, SD (BA)

Direction: to modem

Signals on this circuit are generated by the customer's terminal and transferred to the transmitter of the IBM 7852-400. A positive signal is a space (binary 0) and a negative signal is a mark (binary 1). The transmitting terminal should hold this line the marking state when no data is being transmitted, including intervals between characters or words. The TRANSMIT (XMT) LED indicates the status of this circuit.

Received Data - Pin 3, RD (BB)

Direction: from modem

The lead is the data output of the modem. Data signals received from the remote modem are presented on this line. When no carrier signal is being received (pin 8 negative), this line will be forced into a marking condition. The RECEIVE (RCV) LED indicates the status of this signal.

Request To Send - Pin 4, RTS (CA)

Direction: to modem

The RTS signal indicates to the modem that the computer or terminal has data that it wants to transmit.

Clear To Send - Pin 5, CTS (CB)

Direction: from modem

The CTS line indicates to the terminal that the IBM 7852-400 will transmit any data present on the Transmit Data line (pin 2).

Data Set Ready - Pin 6, DSR (CC)

Direction: from modem

DSR On indicates that the IBM 7852-400 is in the data mode and is connected to the communications channel. This signal will be on during analog-loop-test mode.

Signal Ground - Pin 7, SG (AB)

The SG lead is connected to signal ground of the modem. It establishes the common ground reference for all other interface signals.

Data Carrier Detect - Pin 8, CD (CF)

Direction: from modem

DCD On (positive voltage) indicates that data carrier has been received from the other modem. This circuit will not normally turn on in the presence of message circuit noise or out-of-band signals. There is a one second delay between when the carrier tone has been detected and when the CD circuit is turned on.

This signal goes off if received data carrier falls below the receiver threshold for more than 37 mSec. When CD is off, the Received Data circuit (pin 3) is held to the marking state.

Test Voltage - Pin 9, XV

Direction: from modem

The XV lead has 330 ohms of resistance to +12 volts DC. This lead may be used to strap other signals high. For example, if the terminal does not supply a DTR (Data Terminal Ready) signal, Pin 9 may be jumpered to Pin 20 (DTR) on the RS232 connector or in the cable to force DTR on.

Transmit Clock - Pin 15, TC (DB)

Direction: from modem

The TC signal is provided only when the IBM 7852-400 is used in the synchronous mode. The clock is a square wave and is used to provide the computer or terminal with timing information for its Transmit Data circuit (pin 2). This clock will be provided the interface at all times when the modem is in Synchronous mode.

The first signal element of the Transmitted Data signal should be presented

by the terminal on the first positive (Off to On) transition of TC which occurs after the CTS circuit on pin 5 has turned on. The transmitted data is sampled by the modem on negative transition of TC.

Receive Clock - Pin 17, RC (DD)

Direction: from modem

The RC signal has the same characteristic of Transmit Clock, with the exception that it is used to provide the computer or terminal with timing information for its Receive Data (pin 3) circuit. The negative transition (On to Off) of RC indicates the enter of each signal element on the Received Data circuit.

Data Terminal Ready - Pin 20, TR or DTR (CD)

Direction: to modem

This signal (TR or DTR) provides a means for the terminal or computer to control the modem's connection to the communications channel. A high DTR signal is required by the modem to be able to communicate. Turning DTR off for more than 50 mSec will force the modem to disconnect.

The most common use of DTR is in automatic answer applications. A high DTR signal is required by the modem to answer a call. A frequently used method is to have the computer turn on DTR in response to RI (Ring Indicator), which allows the modem to answer. Later, DTR is turned off at the conclusion of the log off procedure, which forces the modem to disconnect, enabling it to receive another call. In non auto answer applications it is advisable to leave DTR on using the modem's DIP-switch option. This is the standard factory setting. An alternative is to provide a constant high DTR from the terminal or computer. The Data Terminal Ready (DTR) LED indicates the status of this signal.

Ring Indicator - Pin 22, RI (CE)

Direction: from modem

This signal will remain on for the duration of the ringing signal. When a ring signal is received by the modem, the modem will automatically answer after the first ring. The modem will answer after a specified number of rings which can be programmed in AT Command mode, but if none is specified, the modem will answer after the first ring.

External Transmit Clock - Pin 24, XTC

Direction: to modem

Supplies the same function as transmit clock on Pin 15.

Terminal Busy (Out of Service) - Pin 25, OOS

Direction: to modem

The Terminal Busy (OOS) circuit is not defined in the RS232C standard, but is used by us and most manufacturers to make the phone lines busy to incoming phone calls. Pin 25 is not normally connected to the RS232C interface when shipped from the factory; it can be ordered connected as an option. If pin 25 is connected and is brought high, the modem will be placed Off Hook, and busy to incoming calls.

Appendix G:

IBM 7852-400 SYSTEMS' ESCAPE METHODS

Introduction

You may find it necessary sometimes to issue AT commands to your modem while you are on-line with a remote modem, without disconnecting the call. If so, you will want to take advantage of Escape methods which allow you to change the modem's mode of operation from On-Line mode to Command mode, where you may issue AT commands, without disconnecting. While you may then return on-line, typically most users escape so that they may hang up a modem upon completion of a call.

Our modems offer two Escape Methods: in-band, and out-of-band. Both incorporate Time Independent Escape Sequence (TIES) methodology. An escape sequence is a pattern, or sequence, that the modem recognizes as its signal to shift from On-Line mode to Command mode. Time Independent means that the modem recognizes the escape sequence without a prefixed and/or suffixed delay.

In an in-band escape, the modem recognizes the escape sequence as a pattern sent to it as part of the data stream or band (hence its name).

In an out-of-band escape, the escape sequence is a pattern that cannot and does not occur in the data stream.

Our in-band escape method is : +++AT<CR>

Our out-of-band escape method is : <BREAK>AT<CR>. A BREAK signal cannot be sent as part of a data file; instead it is sent by a direct program command to the UART used by that computer.

BREAK is defined as either the transmission of binary 0 for a minimum of 10 bits; or as a minimum interval of 135 milliseconds as established in the CCITT X.28 standard. There are routines in high level languages, and keys on most computers that have been established to send BREAK for fixed intervals, but you may control the BREAK's duration by referring to your UART's specifications.

How to Select an Escape Method

© Copyright IBM Corp. 1996

If you want your modem to escape and then wait for you to issue a command before it will return to ON-LINE mode, then use +++<CR>. You might use this method if you find you need to review a help screen in the middle of a communications session.

If you wish to combine the escape with a command (or commands) and with an immediate return to ON-LINE mode, then use the <BREAK>AT<CR> method. You may also use this method to have the modem wait before it will return ON-LINE.

You may select your modem's escape method by using an AT%E command.

The AT commands used to select the modem's Escape Method are :

%E0 = ESCAPE DISABLED
%E1 = +++AT method (default)
%E2 = <BREAK>AT method
%E3 = BOTH methods enabled
%E4 = Disable OK response to +++
%E5 = Enable OK response to +++Escape
Method 1 : +++AT<CR>

In the following example, a user who is ON-LINE decides to set S-Register S0 to 1, to configure his/her modem to answer on the first ring.

1. The user enters the sequence +++AT<CR>. The sequence is sent to the modem.
2. The modem transmits the +++.
3. The modem buffers AT and starts the "Wait for CR timer ".
4. Upon receiving the <CR> the modem escapes to COMMAND mode.
5. The modem responds OK.
6. The user enters the command ATS0=1<CR>. This sequence is sent to the modem.
7. The modem buffers ATS0=1<CR> and identifies it as a valid command.
8. The modem executes the command, setting S0=1.
9. ATO<CR> is sent to the modem.
10.The modem returns to ON-LINE mode.

Escape Method 2 : <BREAK>AT<CR>

In the following example, a user who is ON-LINE decides to set S-Register S0 to 1, to configure his/her modem to answer on the first ring.

1. The <BREAK> signal is sent to the modem.
2. The modem buffers <BREAK>.

3. The modem starts the S32 wait for <CR> timer.
4. "ATS0=1<CR>" is sent to the modem.
5. The modem buffers "ATS0=1<CR>" and identifies it as a valid command.
6. The modem escapes to COMMAND mode.
7. The modem executes the command, setting S0=1.
8. The modem returns to ON-LINE mode.

S-Registers and Escape Sequences

There are two S-Registers that you may set to modify the functioning of your escape sequences. The first is S-Register S32, which establishes a value for how much time may elapse between the receipt of the beginning of the escape sequence, whether <BREAK>AT, or +++AT, and the receipt of a <CR>. This interval is known as Wait for <CR> Time, or BREAK passthru.

You may assign a value to S32 in increments of 100 milliseconds. The default value is 20, or 2 seconds.

In the +++AT<CR> method, the Wait for <CR> Time interval begins once the A in +++AT is received by the modem.

In the <BREAK>AT method, the Wait for <CR> Time interval begins once the modem has received the BREAK signal.

You may use S-Register S34 in conjunction with our in-band escape sequence, +++AT<CR>, to establish the maximum number of characters that your modem can buffer following an "AT", before a <CR> must be received. The default value is 10 characters. Do not confuse this buffer size with our regular COMMAND mode buffer length of 60 characters.

S-Register S34 does not affect our out-of-band escape sequence's buffer length, which is fixed at 60 characters.

Aborting an Escape Sequence

The +++AT<CR> escape will abort if you do not issue a <CR> before the Wait for <CR> interval expires.

The <BREAK>AT<CR> method will also abort if you do not issue a <CR> before the Wait for <CR> interval timer expires, and also if any of the following occurs :

1. An illegal sequence is detected, including :
a) A character other than A follows the <BREAK>;
b) A character other than T follows <BREAK>A;
c) Two BREAKs are received in succession;

2. The command buffer overflows before a <CR> occurs.

Part Number: 76H2773

Printed in U.S.A.