User's Guide

Microcom®

Managed Modem Module

Microcom Part Number 24-0000889-003

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Contents

Chapter 1
Overview 1-1
Features 1-1
K56flex (56Kbps) Technology 1-2
V.34 (Including 33.6) 1-2
MNP 10 EC 1-3
Background 1-3
Advantages of MNP 10EC Modems 1-3
Class 2.0 (EIA / TIA 592) FAX 1-4
Background 1-4
Advantage of Class 2.0 Fax Modems 1-4
Setting Up Class 2.0 Modems 1-4
Equipment Needed to Use MMMs 1-4
Conventions and Terminology 1-5

Chapter 2
Installation 2-1
Configuring MMM Engines 2-1
MMM Faceplates 2-2
Modem LEDs 2-3
Hex MMM LEDs 2-3
MMM24 LEDs 2-3
Cabling MMMs 2-4
ISDN Support 2-5

Chapter 3
Commands and Registers 3-1
The Command Set 3-1
Preparing the Modems to Accept Commands 3-1
Entering Commands 3-1
Command State and Connect State 3-1
Command Syntax 3-1
Combining Commands on a Single Command Line 3-1
Issuing AT Commands at any Speed 3-2
Functional Group Tables 3-2
Commands 3-9
Dial Modifiers 3-12
Registers 3-36
Commands to Change or Read Registers 3-37
Change the Value of a Register 3-37
Change the Value of the Last Referenced Register 3-37
Display the Value of the Last Referenced Register 3-37
Point to New Register 3-37
Read All Registers 3-37
Read Configuration Register 3-37
Register Descriptions 3-37
Cellular Commands 3-48

Appendix A

Error Correction and Data Compression A-1
MNP Classes A-1
MNP Class 10 ..... A-1
ITU-T V.42 Error Correction A-2
Data Compression A-2
How Data Compression Works A-2
How To Use MNP Data Compression A-2

Appendix B

Diagnostics B-1
Local Analog Loopback with Self-Test B-1
Using Commands to Perform a Local Analog Loopback with Self-Test B-1
Local Analog Loopback B-1
Using Commands to Perform a Local Analog Loopback B-1
Remote Digital Loopback with Self-Test B-1
Remote Digital Loopback B-2
Using Commands to Perform a Remote Digital Loopback B-2
Using Circuits to Perform a Remote Digital Loopback B-2
Local Digital Loopback B-2
Using Commands to Perform a Local Digital Loopback B-2
Respond to Remote Digital Loopback B-3
Automatically Terminating a Test: Register S18 ..... B-3

Appendix C

Specifications, Switches and Jumpers C-1
Specifications for the Managed Modem Module C-1
Memory C-1
Protocols C-1
Microprocessors C-1
Power Requirements C-1
Operating Environment C-1
Physical Dimensions C-1
Modem Status LEDs C-1
Interfaces C-1
DIP Switches and Jumpers C-3

Appendix D

Result Codes and Modulation Protocols D-1
Connection Result Code Tables D-1
Differences in Modulation Protocols D-6
Protocol Configuration Command Settings D-6
Speed and Protocol Connection Matrices D-7

Appendix E

Regulatory Requirements E-1
Telephone Company and FCC Requirements E-1
Information Requested by the Telephone Company E-1
Statements Required by the FCC E-1
Canadian Department of Communications Requirements E-2
Canadian EMI Limits E-2

Index Index-1

Chapter 1

Overview

Managed Modem Modules (MMMs) are members of the high-speed V.34 and K56flex Microcom family of modems, designed for installation in the Microcom Access Integrator System. MMMs are available with analog or digital engines.

An analog MMM contains two engines (or hex modems), each of which holds six modems, for a total of 12 modems in each chassis slot. Each of the modems provide full V.34bis compliance and all of Microcom's enhancements. MNP Class 10EC modems offer:

- Multiple connection attempts during auto-reliable link negotiation
- Negotiated speed upshifts
- Aggressive adaptive packet assembly
- Dynamic speed upshifts and downshifts

All digital MMM24s provide 24 modems in each chassis slot. They offer all the features of the hex modems, except analog phone-cable jacks. In addition, MMM24s include K56flex technology.

Features

Microcom's MMMs support:

- V.34bis speeds of 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800 and 2400 bps with other V.34bis modems
- V.Fast speeds of 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, and 14,400 bps with V.Fast modems
- ITU-T V.32bis and V.32 connections at speeds of 14,400, 12,000, 9600, 7200, and 4800 bps with other V.32bis and V.32 modems
- ITU-T V.22bis (2400 bps)
- ITU-T V.22 (600 and 1200 bps)
- Bell 212A (1200 bps)
- Bell 103 (300 bps)
- Serial port speeds of up to 115,200 bps
- ITU-T V.42 error correction, including LAPM and MNP Classes 2 through 4
- MNP Class 10EC Enhanced Cellular
- MNP Class 10 Adverse Channel Enhancements (ACE)
- MNP Class 5 data compression
- V.42bis data compression
- Modem firmware upgrades from the Modem Network Controller via modem flash memory
- Hot-pluggable modem cards
- Easy pull-out carrier replacement for service and maintenance
- Password Connection Security for MNP reliable and normal connections between modems set up with the same password
- Dynamic Transmit Level Adjustment to compensate automatically for cellular phone signal distortion
- Universal Link Negotiation for automatic connections at the highest speed and MNP class common to both modems

- Multi-protocol auto-answering for incoming calls using various modulation protocols
- Hewlett Packard ENQ/ACK
- Automatic power-up diagnostics

In addition, MMM24 modems support K56flex speeds of 32,000, 34,000, 36,000, 38,000, 40,000, 42,000, 44,000, 46,000, 48,000, 50,000, 52,000, 54,000, and 56,000.

Note: This technology is designed only to allow faster downloads from K56flex compliant sources. Maximum achievable download transmission rates currently do not reach 56kbps and will vary with line conditions.

K56flex (56Kbps) Technology

Microcom modems now incorporate K56flex technology, which enables your modem to download data at speeds up to 56Kbps, almost twice as fast as 33.6K modems.

You don't need new phone lines or equipment to use the new K56flex technology. It works over existing analog phone lines and is transparent to the phone company's equipment. Just install your modem and attach it to the phone network. It already defaults to the 56K speeds.

K56flex is in addition to the current V.34 standard. When the two modems negotiate the initial connection, they connect at the highest possible speed — 56K for digital connections or V.34 33.6K for analog connections. Of course, these Microcom modems continue to connect with lower speed modems.

The new K56flex technology is not an extension of V.34 28.8K/33.6K bps. Existing analog modems, using modulations such as V.34, use the Public Service Telephone Network (PSTN) as an *analog* transmission medium (even though the signals are digitized for communications throughout most of the network), while K56flex uses the PSTN as a *digital* transmission medium.

K56flex technology is used primarily for faster World Wide Web browsing and Internet access, and for faster remote access to corporate LANs that digitally connect to the PSTN. If you are using a V.34 modem, this new technology can almost double your download speed from the Internet, reducing your wait for information by approximately 50 percent.

To achieve 56K speeds, both end users and Internet Service Providers (ISPs) or corporate LANs must use modems that incorporate this technology, and on phone lines with good line conditions (not noisy). In addition, there can be only one analog-to-digital conversion over the entire connection (normally the analog local loop from the central office to your house). This means your ISP or corporate LAN must be connected to the PSTN over a digital line such as PRI or T1. Otherwise, connections will be made at V.34 speeds.

The K56flex technology is one of several competing 56K solutions. To connect at 56K, both your modem and the central site modem must support the same 56K solution. Because Rockwell International's modem chipsets are used in more than 70 percent of modems worldwide, your modem can successfully communicate with most other modems. An international standard is expected to be reached in 1998.

K56flex only works downstream from your ISP to your modem, not the other way. However, upstream transmissions from your modem to your ISP are mostly keystrokes and mouse commands that require less bandwidth, so they'll continue to flow quickly at a rate of 31.2K. Also, if the modem cannot connect at 56K, it will downshift in 2K increments until it connects. If it reaches 32K, the modem switches over to using the highest V.34 speed supported by current line conditions.

V.34 (Including 33.6)

Your MMMs support the V.34 and Annex 12 standards that provide for connection speeds of 31,200 and 33,600 bps. V.34 formalizes the V.Fast (V.FC) protocol. The new standard, "Annex 12" or simply "33.6," is a V.34 enhancement.

MMM modems will attempt to connect automatically at 33,600 bps. You need not change any modem commands or settings. Poor phone-line quality or the other modem's capabilities may prevent connecting at this speed. If the other modem does not support the 33.6 standard, the connection will be at the highest possible speed.

Because it is an enhancement to the V.34 standard, Annex 12 maintains the improvements introduced by V.34, such as the V.8 handshake between V.34 modems that minimizes the time to make a connection. If line conditions require fallback or permit fall-forward, your modem can perform either when you are connected to another V.34 modem. If the other modem does not have V.34 capability, your MMM uses earlier negotiation protocols.

Not all V.34 modems support V.FC connections, but Microcom's do. You can expect continued high-speed connections to over 1 million V.FC modems from over 120 vendors. By default, your modem starts a negotiation at V.34 and then tries V.FC, V.32bis and V.32 in that order — permitting the highest speed connections with other modems.

In most cases, you don't have to change anything to obtain the benefits of V.34 with Annex 12. However, if you have altered a modem's default settings, or if a modem uses custom commands, look over the remaining sections of this addendum to see whether it affects your modem.

MNP 10 EC

This section describes MNP 10EC (Microcom Networking Protocol Class 10 Enhanced Cellular) and explains how to configure your modem for improved cellular operation.

Background

MNP 10EC is an enhancement to MNP 10 that improves modem-to-modem connection rates and the data throughput over cellular networks.

Land-line modems are designed to operate over local loops that are fixed and relatively stable. Because the signal-to-noise ratio and distortion characteristics of individual loops are fairly constant, two land-line modems can establish the data rate and communications parameters for a session during the initial negotiation phase. The two modems can usually adjust to minor variations in media quality without dropping the call.

Cellular transmissions add new layers of interruptions, distortions, and level changes that land-line modems are not designed to handle. Some of the interruptions and distortions are caused by the nature of cellular transmission itself: a continuous negotiation takes place between the mobile phone unit and the transmission site to which it is currently assigned. The communications involve instructions for handoffs from one cell site to the next and adjustments to a signal level that is constantly changing. The interruptions, called blanking, are often too brief to be heard during a voice call.

In a data transmission, however, the constant blanking appears as a series of hits, and the modem designed solely for land-line use will generally overreact to them, resulting in failures to connect, multiple re-transmissions of data packets, and dropped calls.

Advantages of MNP 10EC Modems

The MNP 10EC solution to this new level of adversity involves enhancements at both the hardware and protocol levels:

- At the hardware level, the modem's data pump recognizes the frequent interruptions as normal and temporary characteristics of the transmission media. Additionally, it recognizes sudden bursts of RF noise and adapts to signal fading. It quickly recovers a lost signal.
- At the protocol level, MNP 10EC compensates for cellular's adverse environment by identifying and correcting errors. It optimizes throughput by making speed and packet size adjustments based on the actual frequency of blanking interruptions, as well as on the signal quality and overall error performance.

Because it is fully compatible with all MNP 10 modems, MNP 10EC can be implemented on just the remote side of a cellular link and it will markedly improve performance. In major installations that frequently support cellular transmissions, MNP 10EC modems should be used on both the cell side and the land side to ensure optimum performance.

Class 2.0 (EIA/TIA 592) FAX

The MMMs support *inbound* Class 1, Class 2, and Class 2.0 fax capability at speeds up to 14.4 kbps. This release of the MMM does not support outbound faxing.

Background

Stand-alone fax machines control all phases of the fax transmission, from preparation of the image, negotiation with the receiving machine, exchange of data, and, when receiving a fax, image reconstruction. When a PC controls a fax modem, these tasks are divided between the modem and the PC. A Class 1 modem must be supervised by a software application running on the PC from the beginning of the transmission to the end.

Class 2.0 and the earlier Class 2 fax modems are more intelligent than Class 1 fax modems. They auto-dial, negotiate transmission protocols, establish communications, and transport the image data without supervision. This relieves the PC of most of the management responsibilities: with a Class 2.0 fax modem, the PC has only to encode or decode the message, and tell the modem where to send it.

Advantage of Class 2.0 Fax Modems

A Class 2.0 fax modem can receive faxes in the *background* while you work with other applications. Also, propagation delays and other network limitations have no effect on Class 2.0 operations. This means that in a network environment, a modem pool can include several Class 2.0 fax modems that can be accessed via the network with software that is designed to operate in a networked environment. Users on the network can receive faxes just as though modems connected directly to their PCs. The modem pool concept reduces initial cost, installation time, and maintenance tasks.

Setting Up Class 2.0 Modems

Class 2.0 operations are completely transparent to the user and require no special setup. Most fax software detects Class 2.0 capability during installation and configures itself accordingly.

Equipment Needed to Use MMMs

Your MMMs are part of a system that requires the following essential components:

1. The Microcom Access Integrator system, with its switching hub and power modules.
2. MMMs in carrier modules — two hex modem engines (12 modems) per carrier, or one MMM24 (24 modems) per carrier.
3. A Microcom Modem Network Controller (MNC) for management of all the modems in a chassis.

Note: For full access to all the modem's capabilities, you need to send commands from an attached DTE device (typically, a laptop, PC, or terminal), or through the MNC's command line.

4. Microcom 60-pin data cables. (For Microcom Access Servers and communication servers only.)
5. For Digital MMM24s, Dual T1/E1/or PRI engines.

   For hex modems, RJ11 compatible cables (not supplied) to connect the modems to your telephone jacks.

Conventions and Terminology

This guide uses the conventions list in Table 1-1.

Table 1-1. Guide Conventions

When You See...	***It Means...***
■	The start of a main section.
➥	An Important note or Warning message.
Enter	Press the Enter (Return) key.
Ctrl-*n*	Press key *n* while holding down the Control (Ctrl) key.
when *Xn* is set	When the AT command or register mentioned has that value. This can be the default, a value you have stored or a command you enter.
raise DTR	Most data communications software raises (turns on) DTR when it loads. Refer to your software manual to verify this for your application.
bold type	bold type indicates one of the following: • the default value in a command description, • what you type at the keyboard, or • what you see on the screen.

Chapter 2

Installation

Before you install any MMMs, set up your system using the Configuration Wizard as described in the *Getting Started Guide*. For complete MMM cabling diagrams, please see the *Reference Guide.*

Configuring MMM Engines

Digital and analog MMM engines are configured through software. We strongly recommend using the Wizard, which performs many of the configuration tasks for your system. After installation, you can manage and fine tune MMMs using *express*WATCH. For complete information about using the Wizard and *express*WATCH, see the *Getting Started Guide* and the *express*WATCH on-line help.

You can build command sequence files—ASCII text files that contain strings of AT commands—and send them to a specific modem, or they can be sent to a modem automatically when it starts up. Refer to Chapter 3 in the *Microcom Network Controller User's Guide* for information about canned sequence files.

The digital board is equipped with DIP switches and jumpers that are only used for bench testing. Verify that all switches and jumpers are in their default positions before installing the MMM. The factory default settings are shown in Figure 2-1. for reference only.

Note: There are no DIP switches on an analog MMM engine. The jumpers are identical to those on the digital engine and must be in their default positions before installation.

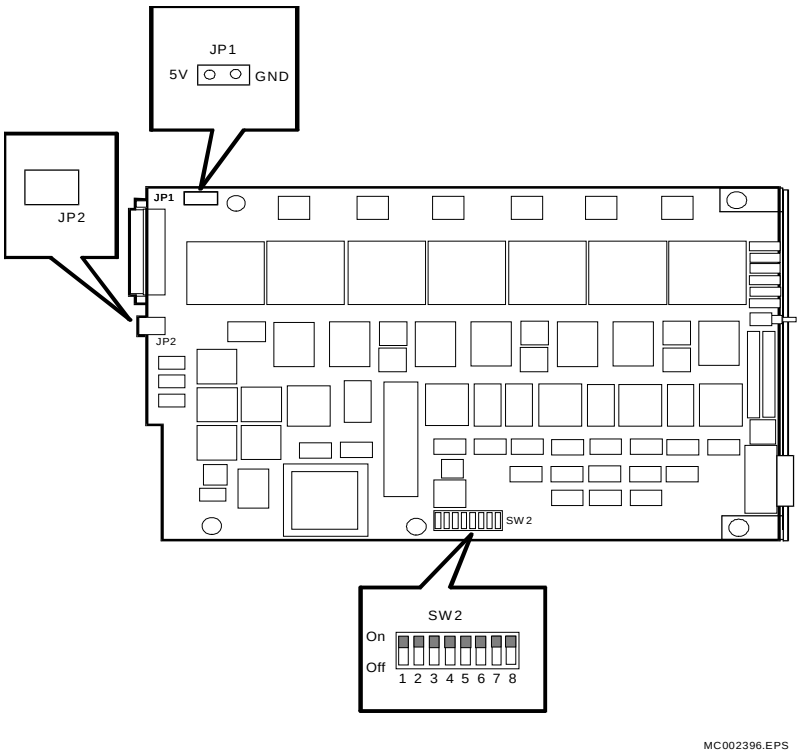

Figure 2-1. Factory Default Switch and Jumper Settings on a Digital MMM Engine

MMM Faceplates

Analog and digital MMMs, LIUs, PRIs, and network servers are part of a high-density communication system that provides extreme port density in a small space. The faceplates of both an analog and a digital MMM engine appear below in figure Figure 2-2.. For the older digital Hex MMM faceplates and description, see Appendix D, *Engine Faceplates and LEDs*, in the *Reference Manual*.

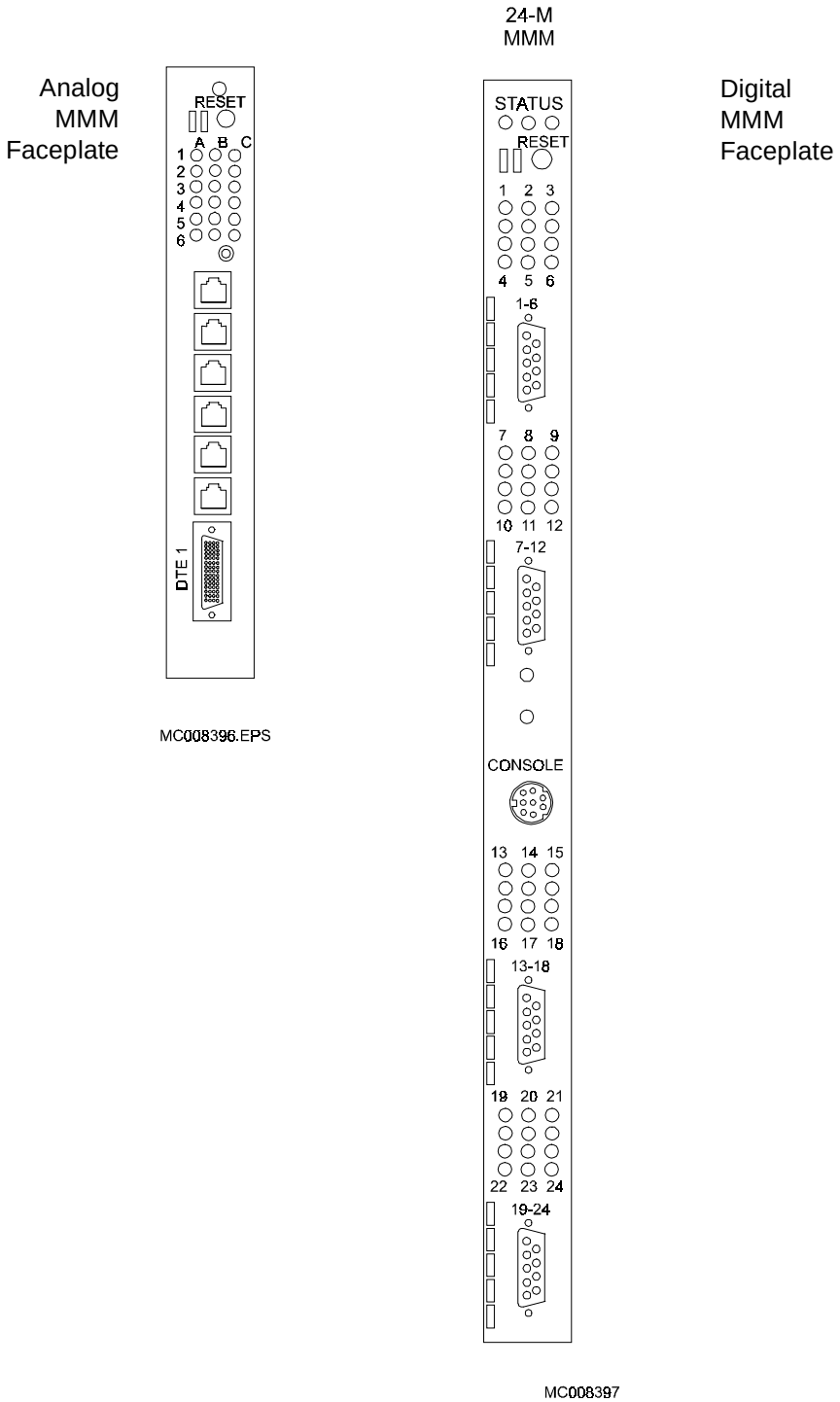

Figure 2-2. Analog and Digital MMM Engine Faceplates

Modem LEDs

The faceplates of Hex MMM engines have 19 LEDs that give a visual indication of the operating mode of the engine and each of its modems. The LEDs are shown in the left side of Figure 2-3.

The faceplates of MMM24s have four sets of modem LEDs, one set each for modems 1-6, 7-12, 13-17, and 18-24. Each set is arranged the same. The LEDs for the top set appear on the right side of Figure 2-3.

Figure 2-3. Modem LEDs (Hex MMM left; MMM24 right)

Hex MMM LEDs

The green LED above the RESET button is the engine's status indicator. It lights when you power up the engine. It goes out during initiation procedures. Then it remains on as long as the engine receives power.

The bank of 18 amber LEDs below the RESET button have row labels 1 through 6 for the engine's six modems. The columns A, B, and C show the status of each modem.

- LEDs in column A are Ring Indicators. An LED blinks when its modem is receiving an incoming Ring. After it establishes a connection, it indicates speed in the following ranges:
  - 2400 bps and below — LED is off
  - 4800 bps through 12,000 bps — LED is on
  - 14,400 bps through 33,600 bps — LED blinks off and on
- LEDs in column B are Off-Hook Indicators. An LED remains lit when its modem is off hook. It blinks when the modem is busied out.
- LEDs in Column C are DTR Indicators. An LED is on when its modem's DTR is high and off when it is low.

MMM24 LEDs

The three STATUS LEDs at the top of the MMM24 faceplate (see Figure 2-4) indicate three different module states. The right one is a green power indicator and should remain lit when the chassis is on. The middle flashes in response to LAN traffic. The left one flashes when the module receives MNC communications.

The four sets of modem LEDs display each modem's status and speed. Next to the modem's number, the upper LED indicates DTR and speed. The lower LED displays DTR status. See Table 2-1.

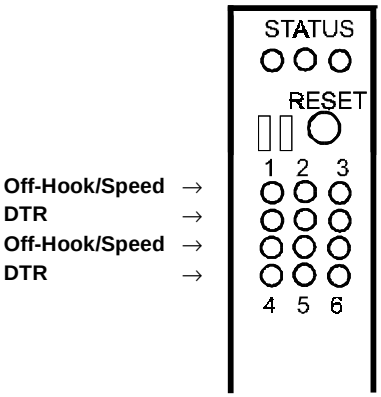

Figure 2-4. MMM24 Modem LEDs

Table 2-1. MMM24 Modem LED States

	Upper (Off-Hook)	*Lower (DTR)*
On solid	Off-hook	Data Terminal Ready
Off	On-hook	Data Terminal Not Ready
Flash	Ring detected	—
Blinking	Connection (see speeds below)	Busied out
2/10-second blink	50Kbps or above connection	—
4/10-second blink	40Kbps to 48Kbps connection	—
6/10-second blink	30Kbps to 38Kbps connection	—
8/10-second	21.6Kbps to 28.8Kbps connection	—
1-second	19.2Kbps or below connection	—

Cabling MMMs

LIUs and PRIs communicate with digital MMMs over the chassis backplane. The Access Servers let you communicate with all six modems in a digital MMM over a single cable. Each Access Server can direct the communications of up to 16 ports, so that three can be used to direct the 48 ports provided by two MMM24s.

Analog MMMs do not interface with LIUs or PRIs, but rather connect directly to analog telephone lines through RJ11 connectors on their face plates. A single Access Server can direct the communications of up to 16 analog modem ports.

For cabling diagrams and instructions for setting up standard Microcom Access Integrator configurations, see the *Reference Guide*.

For cableless operation, the MMM can communicate with AccessBuilders over the chassis backplane.

Note: The CONSOLE port on the digital MMM faceplate is for Microcom diagnostics use only.

ISDN Support

The modem can insert itself dynamically onto a TDM highway on a specific span and DS0 time slot to provide support for an analog call coming in over the PRI (Primary Rate ISDN) interface. You can enable this two ways, depending on the configuration of your MAI chassis:

- Cableless support using PPTP (Point to Point Tunneling Protocol) tunnels to either a 3COM AccessBuilder in the chassis or an external Windows NT server.
- Cabled support by EIA / TIA-232 interface on the MMM faceplate for dial-in access (this product release does not support dial-out access).

Software controls PCM encoding (μ-law, A-law).

Chapter 3

Commands and Registers

The Command Set

The MMM supports a superset of Smartmodem commands, enhanced to incorporate advanced Microcom functionality. Added commands use the prefixes ^, #, $, %,), *, -, :, @, and \. Default parameter settings appear in boldface in the commands description in this chapter.

Note: Type ^^ to enter a caret in a command sequence.

Preparing the Modems to Accept Commands

After you have initially set up your modem, you should:

1. Type **A** repeatedly until it is echoed on your screen. Do **NOT** press Enter.
2. Type **T** once. The **AT** characters cause the modems to match the speed and parity of the DTE devices automatically. They do not automatically match space parity, but use no parity instead.
3. Press Enter. The **OK** response should display. If not, reset the modem.

Entering Commands

Command State and Connect State

The modem accepts commands in *command state*. Your screen displays OK when the modem is in command state and result codes are enabled. The modem can exchange data with the remote system in *connect state*, but does not accept commands outside of a direct connect session initiated by the MNC.

To exit connect state and enter command state without breaking the connection, type the escape code sequence: +++ (three pluses). Do not press Enter; do not pause between pluses. To return to connect state, type: ATO Enter

Command Syntax

Each command line begins with AT (the ATtention code). Both characters must be either upper or lower case: AT or at.

Commands contain one or more upper or lower-case characters. Spaces are ignored. Enter commands after the OK response. If you make a mistake, use the Backspace key or press Ctrl -H, and enter the correct character.

Some commands require a numeric argument. If you leave out the numeric argument, the modem assumes it to be zero.

To make the command take effect, follow the command line with Enter.

Combining Commands on a Single Command Line

A single command line may contain up to 98 characters, excluding the AT and spaces. You can combine commands in one line.

Type AT at the beginning of the line. Then enter the commands in sequence, without spaces or any other characters. When the command line is complete, enter a carriage return following the last command. For example, to follow the AT&F command with the AT&W command, type:

AT&F&W Enter.

Issuing AT Commands at any Speed

When you turn on your modem, you can type an AT command at any supported serial port speed up to 115,200 bps. Your modem automatically adjusts to the connection and command speeds (autobauds) up to 19,200 bps. After you enter an AT at any speed up to 19,200 bps, you can enter commands at a new serial port speed at any time. If you enter a command at 38,400, 57,600 or 115,200 bps, the serial port locks at that speed. The serial port default speed is 38,400 bps.

To unlock the serial port speed and change to another other speed:

- enter an AT$B*n* command (where *n is any* supported serial port speed), ***OR***
- type AT%U [Enter] to unlock the serial port speed, then enter an AT at the new speed, ***OR***
- turn the modem off then on, and then enter an AT at the new speed.

The following serial port speeds and parity can be matched in AT mode:

speed: 300, 600, 1200, 2400, 4800, 9600, 19,200, 38400, 57600, 115,200 bps
parity: 7 odd, 7 even, 7 mark, 8 none, 8 even, 8 odd

Note: Space parity is not supported; the modem uses no parity and 7 data bits instead.

Functional Group Tables

The following tables list AT commands and registers by functional group. Some commands and registers apply to more than one group.

Table 3-1. Answering

AT	*Function*	*Default*	*Page*
A	Answer	none	3-9
&G*n*	Guard Tone	0	3-18
H*n*	Hang Up	none	3-19
%I*n*	Connection Security Password	none	3-20
%L*n*	Speed Matching	1	3-23
@U*n*	Minimum Connection Speed	300	3-32
-W*n*	Reverse Answer	0	3-34
-*Yn*	Call Abort Disable	0	3-35
S0=*n*	Auto-Answer; Ring to Auto-Answer On	1	3-37
S9=*n*	Carrier Detect Response Time	6	3-39
S10=*n*	Delay for Hang Up After Carrier Loss	60	3-39
:T13=*n*	Automode Timer	15	3-45
:T17=*n*	V.32/V.32bis Connection Training Timer	0	3-46

Table 3-2. Asynchronous Network Management

AT	*Function*	*Default*	*Page*
@E	Display Local Real-Time Statistics	none	3-16

Table 3-3. Asynchronous V.24 Signal Control

AT	*Function*	*Default*	*Page*
&C*n*	Serial Port CD Control	1	3-11
@C*n*	CTR, DSR, and CD Connect Message Control	0	3-11
&D*n*	DTR Control	2	3-14
:D*n*	Manual Dial	0	3-14
\D*n*	Serial Port DSR/CTS Control	0	3-15
%H*n*	Pin 25 Local Test Mode Control	0	3-19
\R*n*	Serial Port Ring Indicator	1	3-30
*Y*n*	Busy Out	0	3-36
S9=*n*	Carrier Detect Response Time	6	3-39
S10=*n*	Delay for Hang Up After Carrier Loss	60	3-39
S25=*n*	Delay to DTR	5	3-43

Table 3-4. Cellular Operation

AT	*Function*	*Default*	*Page*
*H*n*	Link Negotiation Speed	0	3-19
)M*n*	Power Level	0	3-25
@M*n*	Initial Transmit Level	0	3-25

Table 3-5. Default Operation

AT	*Function*	*Default*	*Page*
&F	Restore Command Defaults	none	3-17
&W*n*	Pulse Digit Command	0	3-34
*W	Store Complete Configuration	none	3-34
Z	Reset	none	3-36

Table 3-6. Dialing

AT	*Function*	*Default*	*Page*
D<*dial*>	Dial	none	3-11
D/*n*	Dial a Stored Telephone Number	none	3-13
-D	Repeat Dial	none	3-14
:D	Manual Dial	0	3-14
\F	Display Stored Phone Numbers	none	3-17
&G*n*	Guard Tone	0	3-18
H*n*	Hang Up	none	3-19
%I*n*	Connection Security Password	none	3-20
-J*n*	Detect Phase	1	3-21
P	Pulse Dial	none	3-28
$P	Logon Sequence Password	none	3-29
&P*n*	Dial Pulse Ratio	0	3-28

Table 3-6. Dialing *(Continued)*

AT	*Function*	*Default*	*Page*
\P*n*<*dial*>	Write a Stored Telephone Number	none	3-29
T	Tone Dial	T	3-31
#T*n*	T1 Signalling	none	3-32
@U*n*	Minimum Connection Speed	300	3-32
-W*n*	Reverse Answer	0	3-34
-*Yn*	Call Abort Disable	0	3-35
&Z*n*<*dial*>	Store Telephone Number	none	3-36
S6=*n*	Wait Before Dialing	2	3-38
S7=*n*	Wait for Carrier After Dial	60	3-39
S8=*n*	Pause Time for Dial Delay	2	3-39
S9=*n*	Carrier Detect Response Time	6	3-39
S10=*n*	Delay for Hang Up After Carrier Loss	60	3-39
:T14=*n*	Connect Message Delay Timer	0	3-45
:T17=*n*	V.32/V.32bis Connection Training Timer	0	3-46

Table 3-7. Dial Modifiers

AT	*Function*	*Default*	*Page*
A	Link Negotiation at 4800bps (same as *H2)	none	3-12
J	Link Negotiation at 1200bps	none	3-12
K	Cellular Power Level (current connection only)	none	3-12
L	Redial Last Number	none	3-12
M	Dial in LAPM Mode	none	3-12
N*n*	Dial an Alternate Stored Number	none	3-12
P	Pulse Dial	none	3-12
Q	Dial in LAPM Mode with Fallback to Normal	none	3-12
R	Dial a Number in Answer Mode	none	3-12
S	Dial First Stored Telephone Number	none	3-12
T	Tone Dial	none	3-12
U	Dial in Direct Mode	none	3-13
V	Dial in LAPM Mode with Fallback to MNP	none	3-13
W	Wait for Dial Tone Before Dialing	none	3-13
X	Dial in Auto-Reliable Mode	none	3-13
Y	Dial in MNP Reliable Mode	none	3-13
Z	Dial in Normal Mode	none	3-13
!	Flash	none	3-13
, (comma)	Pause During Dial	none	3-13
; (semicolon)	Return to Command State After Dialing	none	3-13
@	Wait for Quiet Answer Before Dialing	none	3-13

Table 3-8. MNP Commands

AT	*Function*	*Default*	*Page*
%A*n*	Auto-Reliable Fallback Character	0	3-9
\A*n*	Maximum MNP Block Size	3	3-9
%C*n*	Compression Control	3	3-10
\C*n*	Auto-Reliable Buffer	0	3-11
*H*n*	Link Negotiation Speed	0	3-19
\H*n*	Hewlett Packard ENQ/ACK	0	3-20
-K*n*	MNP Extended Services	1	3-22
\N*n*	Operating Mode	3	3-26
-Q*n*	Fallback Modulation Speed	0	3-29

Table 3-9. On-Line

AT	*Function*	*Default*	*Page*
\B*n*	Transmit Break	3	3-10
%D*n*	Disconnect Buffer Delay	0	3-13
%E*n*	Auto-Retrain	1	3-16
:E*n*	Compromise Equalizer	1	3-16
H*n*	Hang Up	none	3-19
\K*n*	Break Control	5	3-22
O*n*	Enter Connect State	1	3-27
S2=*n*	Escape Code Character	43	3-38
S9=*n*	Carrier Detect Response Time	6	3-39
S10=*n*	Delay for Hang Up After Carrier Loss	60	3-39
\T	Inactivity Timer	0	3-32
Y*n*	Long Space Disconnect	0	3-35

Table 3-10. Port Control

AT	*Function*	*Default*	*Page*
B*n*	ITU-T/Bell Mode	1	3-10
$B*n*	Change Serial Port Speed	38400	3-10
%B*n*	Modem Port Bps Rate	33600	3-10
&D*n*	DTR Control	2	3-14
@D*n*	Monitor Host DTR	0	3-14
%G*n*	Independent Serial Port/Modem Port Speed	0	3-17
\G*n*	Modem Port Flow Control	0	3-18
-H*n*	Dumb Mode	0	3-20
\H*n*	Hewlett Packard ENQ/ACK	0	3-20
-J*n*	Detect Phase	1	3-21

Table 3-10. Port Control *(Continued)*

AT	*Function*	*Default*	*Page*
\J*n*	Bps Rate Adjust	1	3-21
\K*n*	Break Control	5	3-22
%L*n*	Speed Matching	1	3-23
-O*n*	Serial Port Parity	4	3-27
-P*n*	Check Parity	0	3-28
\Q*n*	Serial Port Flow Control	3	3-30
%U*n*	Clear Serial Port Speed	0	3-32
\W*n*	Split Serial Port Speed	0	3-34
\X*n*	XON/XOFF Pass-Through	0	3-35

Table 3-11. Registers

AT	*Function*	*Default*	*Page*
=*x*	Change Value of Last Referenced Register	none	3-37
?	Display Value of Last Referenced Register	none	3-37
%R*n*	Read All Registers	none	3-37
S*n*	Point to New Register	none	3-37
S*n*?	Read Configuration Register	none	3-37
S*n*=*x*	Change Value of a Register	none	3-37
S0=*n*	Ring to Auto-Answer On	1	3-37
S1=*n*	Ring Counter	0	3-38
S2=*n*	Escape Code Character	43	3-38
S3=*n*	Carriage Return Character	13	3-38
S4=*n*	Line Feed Character	10	3-38
S5=*n*	Back Space Character	8	3-38
S6=*n*	Wait Before Dialing	2	3-38
S7=*n*	Wait for Carrier After Dial	60	3-39
S8=*n*	Pause Time for Dial Delay	2	3-39
S9=*n*	Carrier Detect Response Time	6	3-39
S10=*n*	Delay for Hang Up After Carrier Loss	60	3-39
S11=*n*	DTMF Tone Dialing Speed	75	3-39
S12=*n*	Escape Code Guard Time	50	3-40
S14=*n*	Bit Mapped Register	10	3-40
S16=*n*	Bit Mapped Register	0	3-40
S18=*n*	Test Timer	0	3-41
S21=*n*	Bit Mapped Register	48	3-41
S22=*n*	Bit Mapped Register	118	3-42
S23=*n*	Bit Mapped Register	30	3-42
S25=*n*	Delay to DTR	5	3-43
S27=*n*	Bit Mapped Register	64	3-43

Table 3-11. Registers *(Continued)*

AT	*Function*	*Default*	*Page*
:T0=*n*	Timer for V.22bis, V.22, and V.32 Modes	40	3-43
:T1=*n*	Timer for V.23 Split-Speed Mode	30	3-43
:T2=*n*	Timer for V.21 Mode	0	3-43
:T3=*n*	Timer for V.21 and V.23 Answer Tone Duration	33	3-44
:T4=*n*	Timer for Line Turnaround Delay - Carrier On	20	3-44
:T5=*n*	Timer for V.23 Half-Duplex Intercharacter Delay	7	3-44
:T6=*n*	Timer for DCD Turn On Delay	200	3-44
:T7=*n*	Timer for False Answer Abort	60	3-44
:T9=*n*	Primary XON Flow Control Character	17	3-45
:T10=*n*	Primary XOFF Flow Control Character	19	3-45
:T11=*n*	Secondary XON Flow Control Character	249	3-45
:T12=*n*	Secondary XOFF Flow Control Character	251	3-45
:T13=*n*	Automode Timer	15	3-45
:T14=*n*	Connect Message Delay Timer	0	3-45
:T15=*n*	V.24 Control Register	5	3-46
:T16=*n*	CTS Turn On Delay Timer	0	3-46
:T17=*n*	V.32/V.32bis Connection Training Timer	0	3-46
:T18=*n*	Busy-Out When DTR is Low Timer	0	3-46
:T19=*n*	MNP Link Control	1	3-47
:T22=*n*	DSR Timer	34	3-47
:T26=*n*	Bit Mapped Register	0	3-47
:T42=*n*	V.fast Connection Speed Selection	0	3-47

Table 3-12. Remote Access

AT	*Function*	*Default*	*Page*
*A	Request Remote Access	none	3-9
$P*n*	Security Database Password	none	3-29
*S	Remote Access Attention Character	42	3-31

Table 3-13. Test

AT	*Function*	*Default*	*Page*
%H	Pin 25 Local Test Mode Control	0	3-19
I	Identification	none	3-20
&T0	End Test in Progress	none	3-31
&T1	Local Analog Loopback	none	3-31
&T3	Local Digital Loopback	none	3-31
&T4	Respond to Remote Digital Loopback	none	3-31
&T5	Do Not Respond to Remote Digital Loopback	none	3-31
&T6	Initiate Remote Digital Loopback	none	3-31

Table 3-13. Test *(Continued)*

AT	*Function*	*Default*	*Page*
&T7	Initiate Remote Digital Loopback with Self-Test	none	3-32
&T8	Local Analog Loopback with Self-Test	none	3-32
%V	Display Modem Firmware Version	0	3-33
S18=*n*	Test Timer	0	3-41

Table 3-14. V.23 Operation

AT	*Function*	*Default*	*Page*
%F*n*	V.23 Mode	0	3-17
%O*n*	V.23 Equalizer Control	1	3-28
\W*n*	Split Serial Port Speed	0	3-34
:T1=*n*	Timer for V.23 Split-Speed Mode During Multi-Protocol Answer	30	3-43
:T2=*n*	Timer for V.21 Mode During Multi-Protocol Answer	0	3-43
:T3=*n*	Timer for V.21 and V.23 Answer Tone Duration	33	3-44
:T4=*n*	Timer for Line Turnaround Delay - Carrier On	20	3-44
:T5=*n*	Timer for V.23 Half-Duplex Intercharacter Delay	7	3-44
:T6=*n*	Timer for DCD Turn On Delay	200	3-44
:T7=*n*	Timer for False Answer Abort	60	3-44

Table 3-15. V.42 Operation

AT	*Function*	*Default*	*Page*
%C*n*	Compression Control	3	3-10
-J*n*	Detect Phase	1	3-21
-K*n*	MNP Extended Services	1	3-22
\N*n*	Operating Mode	3	3-26
\V*n*	Error-Correction Result Code Form	2	3-33

Table 3-16. Visual Display

AT	*Function*	*Default*	*Page*
E*n*	Command Echo	1	3-16
\E*n*	Data Echo	0	3-16
@E	Display Local Real-Time Statistics	none	3-16
\F	Read Stored Phone Numbers	none	3-17
I	Identification	none	3-20
-M*n*	MNP Class Connect Messages	0	3-24
Q*n*	Quiet	0	3-29
%R*n*	Read All Registers	none	3-30
S*n*?	Read Configuration Register	none	3-31
\S	Read Online Status	none	3-31
V*n*	Result Code Form	1	3-32

Table 3-16. Visual Display *(Continued)*

AT	*Function*	*Default*	*Page*
%V	Display Modem Firmware Version	none	3-33
\V*n*	Error-Correction Result Code Form	2	3-33
X*n*	Extended Result Codes	4	3-35
?	Display Value of Last Referenced Register	none	3-37

Commands

This section lists all the modem commands in alphabetical order. A command parameter in bold type indicates the default setting.

A/ Repeat Last Command

This command is not preceded by "AT" and not followed by Enter.

A Answer

Forces the modem to go off hook in answer mode, regardless of the value of register S0.

If result codes are enabled, your computer or terminal displays RING (long form) or 2 (short form) when it receives an incoming call.

%A*n* Auto-Reliable Fallback Character

Where *n* is an integer between 0 and 127 indicating an ASCII character (Default=0, the auto-reliable fallback character is disabled)

Sets the ASCII character recognized as the auto-reliable fallback character on the **answering** modem. In auto-reliable mode, when the modem encounters an incoming auto-reliable fallback character, it automatically switches to normal mode and passes the character to the serial port. Auto-reliable fallback character recognition stops if the modem receives a SYN character (decimal 22).

WARNING: The settings *n*=63 or *n*=126 interfere with V.42.

Note: With this command, **\N3\C2** must also be set.

*A Request Remote Access

Requests remote access. A hex modem can request remote access, but cannot be remotely accessed by another modem. The hex modem waits 10 seconds for a response from the answering modem. If remote access is denied, the hex modem displays the error message **REMOTE ACCESS FAILED** (numeric 40) and returns to command state.

This command automatically sends the Remote Access Attention Character (set by *S). *S must be the same on both modems for a successful request.

Notes: Register S12 (guard time) should be set to the same value on both modems. If register S12 is set to a value greater than 127, the requesting modem waits up to 20 seconds for a response to a remote access request.

Remote access is available only during a normal connection or during an MNP reliable connection without data compression.

\A*n* Maximum MNP Block Size

\A0 Sets block size max 64 characters

\A1 Sets block size max 128 characters

\A2 Sets block size max 192 characters

\A3 Sets block size max 256 characters

Sets maximum block size for MNP stream link connections.

B*n* ITU-T/Bell Mode

B0 Uses ITU-T V.22 standard at 1200 and 300 bps

B1 Uses Bell 212A standard at 1200 and 300 bps

This command is ignored when the modem port is set to other speeds.

$B*n* Serial Port Bps Rate

Where *n* = 300, 600, 1200, 2400, 4800, 9600, 19200, **38400**, 57600, 115200, 230400 bps

Sets the serial port rate.

%B*n* Modem Port Bps Rate

%B*n* Where *n* = 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800, 31200, 32000, **33600**, 34000, 36000, 38000, 40000, 42000, 44000, 46000, 48000, 50000, 52000, 54000, 56000 bps

When entered locally, sets the modem port bps rate. Downshifting can still occur.

Notes: Set %G1 to disable autobaud before you use the %B*n* command. If %G1 is set, the modem speed changes only when an %B*n* command is entered.

If %G0 is set, **AT** [Enter] typed locally causes the modem port speed to match the serial port speed, regardless of any previous %B*n* setting.

See also the %U description when a %B*n* is used at a speed greater than 2400 bps.

\B*n* Transmit Break

Where *n* is an integer between 1 and 9 indicating the length of time (in increments of 100 milliseconds) to send the Break. (Default=300 milliseconds). During a reliable link, the Break always equals 300 milliseconds

Transmits a Break to the remote system from command state. To return to connect state, type: **ATO** [Enter]. (See also \K.)

%C*n* Compression Control

%C0 Disables data compression

%C1 Enables MNP Class 5 Data Compression only

%C2 Enables V.42bis compression only

%C3 Enables V.42bis compression and MNP Class 5 Data Compression. The MMM modem matches the capability of the remote modem.

Determines whether the modem attempts to use data compression during reliable connections. We recommend leaving this command at its default setting (%C3). This allows the modem to establish a reliable connection using V.42bis compression or MNP Class 5 Data Compression, depending on the capability of the remote modem.

If the remote modem does not support data compression or has data compression disabled, the modem can establish a non-compression connection, regardless of the modem's %C setting.

&C*n* Serial Port DCD Control

&C0 DCD always On

&C1 DCD follows the state of the carrier from the remote system; DCD turns On after the connect message

&C2 DCD On except momentarily at disconnect

Use this command if your computer or terminal requires DCD to be Off at certain times. See also \D.

@C*n* CTR, DSR, and DCD Connect Message Control

@C0 CTS, DSR, and DCD On before the connect message is sent

@C1 CTS, DSR, and DCD On after the connect message is sent

Specifies whether DSR, CTS, and DCD signals turn on before or after a connect message Use this command with :T14=*n*.

\C*n* Auto-Reliable Buffer

\C0 Does not buffer data during link negotiation. Switches to normal or direct mode if a SYN character is not detected within 3 seconds.

\C1 Buffers all data on the answering modem until either 200 non-SYN characters are received or a SYN character is detected within 3 seconds.

If 200 non-SYN characters are received, the modem switches to normal mode and passes the data through to the serial port. If the modem detects a SYN character within 3 seconds, it attempts to establish a reliable connection. Otherwise, the modem switches to normal mode.

\C2 Does not buffer data on the answering modem. Switches to normal mode upon receipt of a character defined by the %A command and passes that character to the serial port.

When the answering modem is set for auto-reliable auto-answer, determines the operation of the answering modem's buffer during the 3-second interval in which the modem attempts to make a reliable connection. When the modem receives calls both from modems that support MNP and modems that do not support MNP, set **\C2**. This allows the modem to switch to normal mode as soon as it detects a log-on character (defined by %A) from a non-MNP caller, eliminating the 3-second wait. (See the \N command for more information about auto-reliable and normal modes.)

For example, use **%A** to set the auto-reliable fallback character to ASCII 13 (carriage return). Then set **\C2** and **\N3**. Non-MNP callers who connect and press **Enter** to log on do not wait for the 3-second auto-reliable window to expire before data can pass.

When either \C1 or \C2 is set, reliable and normal connections may result independent of bps rate adjust. However, when \C0 is set, bps rate adjust affects the type of connection as follows:

- reliable and direct connections may result when bps rate adjust is On (\J1).
- reliable and normal connections may result when bps rate adjust is Off (\J0).

D<*dial*> Dial

Where <*dial*> is a string of up to 98 characters. Valid dial string characters are: 0-9, dial modifiers, and for tone dialing #, *. The modem ignores invalid characters. Dial strings longer than 98 characters return an error.

Dials a telephone number and attempts to establish a connection. The Dial command must be the last command on a command line. To cancel the Dial command, press any key or lower DTR (unless &D0 is set).

To dial the telephone number 1 617 555 1234, type: **ATD 16175551234** **Enter**

After disconnect, there is a five second delay before the modem may go off hook in originate mode.

Dial Modifiers

Dial modifiers add conditions to the telephone number you are dialing. You can use several dial modifiers within the same telephone number. Unless otherwise noted, dial modifiers can be placed anywhere in the dial string. Dial modifiers are:

A (Link Negotiation) Perform link negotiation at 4800 bps for the current connection only. (This dial modifier is equivalent to the *H2 command.)

J (Link Negotiation) Perform link negotiation at 1200 bps. (This dial modifier is equivalent to the *H1 command.)

K (Cellular Connection) Adjusts the power level for a single cellular connection.

L (Redial, the last dial command including the last telephone number dialed).

M (Dial in LAPM Mode) The modem overrides the current operating mode and dials in LAPM mode for that connection only.

Nn (Dial an Alternate Stored Number) Follows the last character in a dial string. If the modem fails to make a connection, the Nn modifier dials an alternate telephone number. n, a number between 1 and 4, indicates a telephone number stored in the directory with the &Z or \P command. For example: **ATD 55554321N3** Enter

If you do not enter a value for *n*, the modem dials the first stored entry.

The Nn modifier may also be stored at the end of the dial string. If you do not specify any value for n at the end of a stored phone number and the modem fails to make a connection, it dials the number in the next position, even if it is null. (Stored number 01 follows stored number 40). For example: **AT\P04 5551234N3** Enter

P (Pulse Dial) Causes the modem to pulse dial the number. For example: **ATD P12345** Enter

Pulse dial is the default setting. The last P or T dial modifier used remains in effect until you either use a dial command with a different P or T modifier or reset the modem. Also, you can combine P and T dial modifiers within a dial string. For example, to pulse dial a local telephone number and tone dial an access code and telephone number, type:

ATD P5552345 T335 6789 Enter

Q (Dial in LAPM Mode with Fallback to Normal) Causes the modem to override the current operating mode and dial in LAPM mode with fallback to normal mode for that connection only.

R (Dial a Number in Answer Mode) Must follow the last character in the dial string. Causes the modem to dial in answer mode when calling an originate-only modem. For example:

ATD 5552345R Enter

S (Dial the First Stored Telephone Number) Follows the Dial command. Causes the modem to dial the telephone number stored as entry 1 with the &Z or \P1 command. The telephone number is displayed as it is dialed. For example: **ATDS** Enter

This modifier cannot be stored in the first directory position.

T (Tone Dial) Causes the modem to tone dial the number. For example: **ATD T5552345** Enter

The last P or T dial modifier used remains in effect until you either use a dial command with a different P or T modifier or reset the modem. Also, you can combine P and T dial modifiers within a dial string. For example, to pulse dial a local telephone number and tone dial an access code and telephone number, type: **ATD P12345 T335 6789** Enter

U (Dial in Direct Mode) Causes the modem to override the current operating mode and dial in direct mode for that connection only. For example: **ATD 12345U** Enter

V (Dial in LAPM Mode with Fallback to MNP) Causes the modem to override the current operating mode and dial in LAPM mode with fallback to MNP for that connection only. For example: **ATD 12345V** Enter

W (Wait for Dial Tone Before Dialing) Inserted between digits in a dial string. Causes the modem to wait up to the register S7 time delay for a second dial tone before dialing the rest of the dial string. If the modem receives a dial tone before the register S7 time delay expires, it continues dialing. If no dial tone is received, the modem returns NO DIALTONE and hangs up. For example: **ATD 12345 W 67890** Enter

X (Dial in Auto-Reliable Mode) Causes the modem to override the current operating mode and dial in auto-reliable mode for that connection only. For example: **ATD 12345X** Enter

Y (Dial in MNP Reliable Mode) Causes the modem to override the current operating mode and dial in MNP reliable mode for that connection only. For example: **ATD 12345Y** Enter

Z (Dial in Normal Mode) Causes the modem to override the current operating mode and dial in normal mode for that connection only. For example: **ATD 12345Z** Enter

, (Pause During Dial) Causes the modem to pause for the register S8 time delay before dialing the next digit. Use more than one comma for a longer pause. For example, use the comma when you need to dial "9" and pause for another dial tone before dialing an outside line:

ATD 9,,5552345 Enter

@ (Wait for Quiet Answer Before Dialing) Inserted between characters in a dial string. Causes the modem to wait for the register S7 time delay, for at least one ring followed by five seconds of silence, before acting on the next character in the dial string. If the modem does not detect this sequence, it returns a NO ANSWER result code and hangs up. Use this modifier when the system you are calling does not provide a dial tone. For example: **ATD 12345 @ 43210** Enter

! (Flash) Inserted between characters in a dial string. Causes the modem to go on hook for 0.5 second and back off hook, as through you depressed the switch-hook button on your telephone.

; (Return to Command State After Dialing) Added to the end of a dial string. The modem remains in command state after it dials the digits preceding the semicolon. This allows you to type dial strings longer than 98 characters. After the final Dial command, it tries to establish a connection. To abort dialing when you have used the R dial modifier, use the Hang Up command (H). Each Dial command except the last one must end with a semicolon. For example:

ATD 9,12345; Enter
OK
ATD 78989 @ 12345 W 344 Enter

D/*n* Dial a Stored Telephone Number

Where *n* is an integer between 1 and 4 that specifies a telephone number stored in the directory with the &Z or \P command

Dials one of four telephone numbers stored in the directory with the &Z or \P command. The telephone number is displayed as it is dialed.

%D*n* Disconnect Buffer Delay

Where *n* is an integer from 0 to 255 representing seconds (Default = **0**)

Sets a delay during which the modem attempts to process data in its transmit or receive buffer before disconnecting. When DTR is lowered or a Hang Up (H) command is used, the modem attempts for *n* seconds to empty its transmit buffer before disconnecting. When carrier drops, the modem attempts for *n* seconds to empty its receive buffer before disconnecting. If its buffers are empty or if *n*=0, the modem disconnects without delay.

If a physical disconnect occurs (for example, the connection is lost), only the receive buffer can be processed. If the delay expires before the modem empties its buffers or if the modem is in command state at disconnect, data may be lost. The receive buffer may not empty prior to disconnect if auto-retrain is enabled (%E1) during normal mode connections at 2400 bps or higher.

&D*n* DTR Control

&D0 Ignores DTR. DTR is not needed for auto-answer

&D1 Enters command state on detecting On-to-Off transition of DTR; DTR is not needed for auto-answer.

&D2 Goes on hook upon detecting On-to-Off transition of DTR and prepares the serial port to accept an AT at any speed. DTR is needed for auto-answer.

&D3 Goes on hook and resets upon detecting On-to-Off transition of DTR and prepares the serial port to accept an AT at any speed. DTR is needed for auto-answer.

The On-to-Off transition of DTR must last as long as the value specified in register S25 (default=**0.05** second). Positive transitions of DTR (Off-to-On) that occur within five seconds after disconnect are ignored.

@D*n* Monitor Host DTR

Where *n* is a number of seconds.
Range = 0 to 255. Default = **0** (disabled)

This command orders the modem to monitor the host's DTR signal. If DTR is low for longer than *n* seconds, an alarm message is sent to the MNC for threshold processing.

-D<*dial*> Repeat Dial

Where <*dial*> is a string of up to 98 characters. Valid dial string characters are 0-9, dial modifiers, and for tone dial #, *. The modem ignores invalid characters

-D / *n* Where *n* is an integer between 1 and 4 that specifies a telephone number previously stored with \P

-DL Redials the last number dialed

-DS Dials the first entry stored in the directory.

Redials a telephone number until a connection is made (up to 10 tries). In reliable mode, if the remote system answers but fails to establish a reliable connection, the modem does not redial the number.

:D*n* Manual Dial

:D0 Modem does not go off hook when DTR is raised

:D1 Modem goes off hook in originate mode when DTR is raised. &D*n* (where *n*=1, 2, or 3) must also be set.

:D2 Modem goes off hook in originate mode and dials the first stored telephone number when DTR is raised. &D*n* (where *n*=1, 2, or 3) must also be set.

Determines whether the modem goes off hook in originate mode when DTR is raised.

Note: When :D1 or D2 are set, you must also set register :T18 to 0.

\D*n* Serial Port DSR/CTS Control

\D0 DSR and CTS always On

\D1 DSR and CTS follow CD. If &C1 is also set, DSR follows off hook

\D2 DSR and CTS both follow CD

\D3 DSR complies with ITU-T recommendations; CTS always On

\D4 DSR and CTS complies with ITU-T recommendations

Controls the Data Set Ready (DSR) and Clear To Send (CTS) signals on the serial port. Use this command when the central site computer requires the DSR and CTS signals to be Off at specific times.

Notes: Selecting hardware flow control for the serial port overrides the \D command. When hardware flow control is selected, the CTS line indicates the ability of the modem to receive data from your computer or terminal and the DSR action does not change. (See the \Q command.)

ITU-T recommends that DSR come On when establishing a connection and drop when the connection ends.

ITU-T recommends that CTS follow DTR while in command state; drop either when answer tone is detected when originating, when going off hook when answering, or when connection ends; and follow connection status during connection.

Use the following table when your computer requires DSR and CTS to be Off at certain times. This table shows &C and \D settings and the result of combining the two commands:

Table 3-17. &C and \D Command Results

&C	*\D*	*Result*
0	0	DCD On, DSR On, CTS On
0	1	DCD On, DSR On, CTS On
0	2	DCD On, DSR On, CTS On
0	3	DCD On, DSR complies with the ITU-T recommendations, CTS On
0	4	DCD On, CTS/DSR comply with the ITU-T recommendations
1	0	DCD follows modem carrier, DSR On, CTS On
1	1	DCD follows modem carrier, DSR follows off hook, CTS follows DCD
1	2	DCD follows modem carrier, DSR and CTS both follow DCD setting
1	3	DCD follows modem carrier, DSR complies with the ITU-T recommendations, CTS On
2	0	DCD On (Off for a few seconds at disconnect only), DSR On, CTS On
2	1	DCD, DSR, and CTS On (Off for a few seconds at disconnect)
2	2	DCD, DSR, and CTS On (Off for a few seconds at disconnect)
2	3	DCD Off at disconnect then On, DSR complies with the ITU-T recommendations, CTS On

$D Power-Up Diagnostics

Performs power-up diagnostics.

E*n* Command Echo

E0 Inhibits the echoing of commands to the local device

E1 Echoes commands to the local device

Controls whether the modem echoes commands to the local device. (See Appendix D, "Result Codes and Modulation Protocols," for a complete listing of all result codes.)

%E*n* Auto-Retrain

%E0 Disables the automatic retrain sequence

%E1 Enables the automatic retrain sequence (at 2400 bps or higher)

When **%**E1 is set and line quality is too poor to sustain communications, the modem tries up to three times to resynchronize the modems (for a total of up to six seconds) before hanging up. The modem only retrains when a connection is established at 2400 bps or higher.

Use O1 to force the retrain sequence when %E0 is set.

Note: The modem ignores %E0 during V.34, V.FC, V.32bis and V.32 connections.

:E*n* Compromise Equalizer

:E0 Disables the compromise equalizer only when the modem is in V.32 mode

:E1 Enables the compromise equalizer; use for outside line to outside line or PBX to outside line connections

Controls equalization operation when the modem connects in V.32 mode.

Note: Set :E0 only when you are performing back-to-back or PBX-to-PBX V.32 mode connections.

\E*n* Data Echo

\E0 Does not echo data sent by the local terminal or computer

\E1 Echoes data sent by the local terminal or computer

When in connect state, determines whether the modem echoes characters sent from the local terminal or computer. \E1 functions only during normal mode connections.

-E*n* Modem Port Data Length

-E0 Enables 10-bit data during normal mode connections

-E1 Enables 11-bit data during normal mode connections

Determines the number of data bits used on the modem port during normal mode connections (when \N0 is set) when the serial port is configured for asynchronous transmission of 11-bit characters. Both modems must be set to the same number of data bits.

Note: The modems will not be able to pass data when a reliable connection (\N3 or \N5 is set) falls back to a normal connection with 11-bit data characters enabled on both modems.

@E Display Local Real Time Statistics

This command delivers the real time statistics to the local terminal or computer, as a part of Asynchronous Network Management. Your screen shows the current value, average, and minimum or maximum values for the connection or since the last retrain for the following:

- Transmit Signal Level
- Eye Quality
- Far End Echo Delay
- Far End Echo Level

- Frequency Offset
- Phase Jitter

&F Restore Command Defaults

Restores the command default setting, but does not clear stored telephone numbers.

\F Display Stored Phone Numbers

Displays the telephone numbers currently stored in the telephone directory.

%F*n* V.23 Mode

%F0 Allows multi-protocol answering; disables V.23 mode on originate modem

%F1 75 bps transmit, 1200 bps receive (split speed) V.23 operation

%F2 1200 bps transmit, 75 bps receive (split speed) V.23 operation

%F3 1200 bps transmit, 1200 bps receive (half duplex) V.23 operation

Determines the V.23 mode used at 1200 bps.

Note: Typing **%F*n*** Enter (where *n*=1, 2, or 3) disables all protocols except V.23. Type **%B*n*** Enter to force the %F0 setting.

During normal split-speed connections:

- Set \J0 to operate at the speed of the serial port prior to the connection.
- Set \J1 for a 1200 bps constant speed.

During direct split-speed connections, the computer must be able to support split transmit and receive speeds.

When %F0 is set and the modem is at 1200 bps or higher, it can answer as a V.23 1200/75 bps modem or a V.23 1200/1200 bps half-duplex modem.

When **%F3** is set, the modem can only establish normal or direct 1200 bps half-duplex connections.

The \S command shows **MODEM BPS V.23 AT** when the modem establishes a V.23 connection.

Note: Set %G1 to disable autobaud first before setting %F*n*.

%G*n* Independent Serial Port/Modem Port Speed

%G0 Serial port speed determines modem port speed

%G1 %B command determines modem port speed

Determines whether the modem port speed is updated to match the serial port speed each time an AT is used. When %G1 is set, the modem port speed is not updated each time an AT is used, and may only be changed by issuing %B*n*.

If %G0 is set, the serial and modem port speeds are updated each time a command line is entered. If %G1 is set, the modem port speed is changed only when a %B*n* command is entered.

The tables that follow list the command strings needed to set modem port speed.

Table 3-18. Command Strings to Set Port Speed

Protocol (See Note)	***Use %G0:***	***Use %G1:***
V.21 (300 bps)	B0 at 300 bps	B0%B300
Bell 103 (300 bps)	B1 at 300 bps	B1%B300

Table 3-18. Command Strings to Set Port Speed *(Continued)*

Protocol (See Note)	***Use %G0:***	***Use %G1:***
V.22 (600 bps)	at 600 bps	%B600
V.22 (1200 bps)	B0 at 1200 bps	B0%B1200
Bell 212A (1200 bps)	B1 at 1200 bps	B1%B1200
V.34 / V.22bis (2400 bps)	at 2400 bps	%B2400
V.34 / V.32 (4800 bps)	at 4800 bps	%B4800
V.34 / V.32 (9600 bps)	at 9600 bps	%B9600
V.34 / V.FC / V.32bis (14,400 bps)	at 14,400 bps	%B14400
V.34 / V.FC (16800 bps)	at 16800 bps	%B16800
V.34 / V.FC (19200 bps)	at 19200 bps	%B19200
V.34 / V.FC (21600 bps)	at 21600 bps	%B21600
V.34 / V.FC (24000 bps)	at 24000 bps	%B24000
V.34 / V.FC (26400 bps)	at 26400 bps	%B26400
V.34 / V.FC (28800 bps)	at 28800 bps	%B28800
V.34 (31200 bps)	at 31200 bps	%B31200
V.34 (33600 bps)	at 33600 bps	%B33600
K56flex (32000 bps)	at 32000 bps	%B32000
K56flex (34000 bps)	at 34000 bps	%B34000
K56flex (36000 bps)	at 36000 bps	%B36000
K56flex (38000 bps)	at 38000 bps	%B38000
K56flex (40000 bps)	at 40000 bpm	%B40000
K56flex (42000 bps)	at 42000 bps	%B42000
K56flex (44000 bps)	at 44000 bps	%B44000
K56flex (46000 bps)	at 46000 bps	%B46000
K56flex (48000 bps)	at 48000 bps	%B48000
K56flex (50000 bps)	at 50000 bps	%B50000
K56flex (52000 bps)	at 52000 bps	%B52000
K56flex (54000 bps)	at 54000 bps	%B54000
K56flex (56000 bps)	at 56000 bps	%B56000

Note: For the modem to achieve the highest possible throughput available, set the modem port speed by issuing **AT%G1%B*n*** [Enter] (where *n* equals the desired speed).

&G*n* Guard Tone

&G0 Disables guard tone

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

&G2 Sets guard tone on the answering modem to 1800 Hz

\G*n* Modem Port Flow Control

\G0 Disables modem port flow control

\G1 Sets modem port flow control to XON / XOFF

\G2 Sets modem port flow control to unidirectional XON / XOFF

Sets the flow control method used to pace data between modems during a normal mode connection. When \G1 is set, the modem sends an XOFF character to stop receiving data, and sends an XON character to resume reception of data. When \G2 is set, the modem sends XON and XOFF characters to the remote device but ignores XON and XOFF characters received from the remote device.

Note: The reliable link has its own method of flow control and ignores the \G setting. However, \Q*n* settings still determine DTE port flow control during a reliable link.

H*n* Hang Up

H Hangs up current connection

H1 Hangs up connection and busies out line by going off hook

Disconnects from the remote system and hangs up the telephone line. Ring signals and positive transitions of DTR are ignored for five seconds after disconnect.

Note: If %D (Disconnect Buffer Delay) is set to a value other than 0, hang up may be delayed until the modem has transmitted all the data in its transmit buffer.

%H*n* V.54 and Busy-out Control by Circuit

%H0 Disables V.54 control by circuit.

%H1 Enables busy out when pin 18 is high

%H2 Enables V.54 control by circuit (local analog loopback when pin 18 is high or remote digital loopback when pin 21 is high)

When %H0 is set, the modem ignores pins 18 and 21.

When %H1 is set and pin 18 goes high, the modem busies out the phone line by going off hook. If DTR is high, the modem also performs a local analog loopback test. It ignores pin 21.

When %H2 is set and pin 18 goes high, the modem performs a local analog loopback test. If a connection is in progress, the modem goes on hook and performs the test. If the modem is on hook when pin 18 is raised it remains on hook during the analog loopback test.

When %H2 is set and the modem connected, if pin 21 goes high, the modem performs a remote digital loopback test.

Pin 25 is used for Test Mode output and is On if the modem is in one of the loopback modes.

If you enter %H1 or %H2 with either pin 18 or 21 high, the modem does not perform the loopback test until a low-to-high transition occurs on either pin.

Note: For the modem to respond to remote request for a a Remote Digital Loopback test, set &T4. The default is &T5.

*H*n* Link Negotiation Speed

***H0** Link negotiation occurs at the highest supported speed

*H1 Link negotiation occurs at 1200 bps

*H2 Link negotiation occurs at 4800 bps

Sets link negotiation speeds for connections before the modems upshift. Use *H1 for cellular connections; use *H2 to facilitate non-cellular link negotiation over poor telephone lines.

If *H1 and @M1 are set, it is assumed that the modem is connected to a cellular phone. Once a 1200 bps connection is established, the modem attempts repeated upshifts to the highest supported speed. If unsuccessful, the modem downshifts to 1200 bps.

Note: Leave ***H0** set if you plan to answer calls from modems which do not support MNP Class 10 connections.

-H*n* Dumb Mode

-H0 Disables dumb mode (sets smart mode)

-H1 Enables dumb mode

Used to configure the modem to ignore commands on the DTE port and not send result codes. The modem is in smart mode when it recognizes commands. The modem can only recognize commands in dumb modem when they are sent via the MNC.

\H*n* Hewlett Packard ENQ/ACK

\H0 HP ENQ/ACK protocol disabled

\H1 HP ENQ/ACK protocol enabled during MNP reliable link; modem emulates terminal

\H2 HP ENQ/ACK protocol enabled during MNP reliable link; modem emulates host

HP ENQ/ACK support lets the modem emulate the ENQ/ACK protocol when an MNP reliable link is established. Flow control may be used in addition to the ENQ/ACK protocol if the host or terminal supports it. No data block should exceed 250 characters. To use the HP ENQ/ACK protocol:

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

Note: HP ENQ/ACK protocol is not supported during V.42 LAPM reliable connections.

^H Host Port Upgrade

Installs new firmware from computer file to modem's flash memory

I*n* Identification

I0 Displays the four-digit modem product code

I1 Performs a checksum on the firmware ROM; displays the three-digit result

I2 Performs a checksum on the firmware ROM; displays the checksum status

I3 Displays modem identification string

Note: There is no default setting for the Identification command.

%I*n* Connection Security Password

Edit Connection Security password *n*, where *n* = 0 to 49. (Default is no password)

Lets you set a new password or change the existing password. Passwords must contain exactly five alphanumeric characters. The modem ignores upper case or lower case and parity. Type a password at the **NEW PASSWORD:** prompt. Characters echo as you type the password.

You can protect the Connection Security Password by using the Security Database Password set by the $P command. If a Security Database Password exists and no one has entered it within the past two minutes, the modem prompts for this password before letting you edit a Connection Security Password. After you enter the Security Database Password at the **PASSWORD:** prompt, you can enter a Connection Security Password at the **NEW PASSWORD:** prompt.

You can verify passwords set by this command during link negotiation by using the $M command. If $M1 or $M2 is set, the originating modem sends its first Connection Security Password to the answering modem. The answering modem checks the Connection Security Password against its list of them 0 through 49. If it matches one of them, the connection proceeds. If it does not match and $M1 is set, the connection fails. If it does not match and $M2 is set, the modem uses Auto Logon Sequence 5 (see below) to prompt the originating modem for a password.

Default sequence 5 is: **D2A20' Connection Password:' P2 '^M^J'Z**

Where:

D2A20 'Connection Password:' P2	send the string **Connection Password:** to remote user and wait for a string containing user's password. Echo periods to remote user. If no string is received in 20 seconds, abort and disconnect.
'^M^J'	send a carriage return and a line feed.
Z	check the Connection Security Password database. If a match, the connection proceeds. If no match, retry the sequence up to two times more (for a total of three tries), then disconnect.

-J*n* Detect Phase

-J0 Disables the detect phase

-J1 Enables the detect phase

Indicates whether the originating modem sends a control sequence to the answering modem to determine the type of error correction enabled on the originating modem. The answering modem can have LAPM, MNP, or no error correction enabled. See the \N command description for information about the types of connections that can be established.

\J*n* Bps Rate Adjust

\J0 Disables the bps rate adjust feature

\J1 Enables the bps rate adjust feature

After establishing a connection with \J1 set, the modem automatically adjusts the speed of the serial port to match the speed of the connection until the connection terminates. If your computer does not automatically change to the adjusted bps rate, you must manually change the bps rate to the new setting. When \J0 is set, the serial port rate is independent of the rate of the connection.

When the modem establishes a reliable connection at 2400 bps or below, the serial port speed adjusts to the corresponding speed. When the modem establishes a reliable connection at speeds between 4800 bps and 16,800 bps, the serial port speed adjusts to 9600 bps.When the modem establishes a reliable connection at speeds between 19,200 bps and 33,600 bps, the serial port speed adjusts to 19,200 bps.

Notes: See the %U command for information about resetting the serial port bps rate. When **\J1\C0\N3** is set, the modem uses direct mode instead of normal mode if a reliable connection is not established.

To retain the highest throughput, we recommend that you turn off bps rate adjust (\J0) when data compression is used.

See the %F*n* description for details on \J*n* for V.23 connections.

-K*n* MNP Extended Services

-K0 Disables MNP Extended Services

-K1 Enables MNP Extended Services

-K2 Enables MNP Extended Services without MNP indication during the answer detect phase

MNP Extended Services allow two modems that support MNP Extended Services to use MNP data services that are not available when operating with LAPM. For example, two modems with MNP Extended Services enabled negotiate MNP Class 10 with V.42bis compression in preference to LAPM.

\K*n* Break Control

Where *n*, a number between 0 and 5, indicates the Break the modem transmits. Default is **5**.

Determines the type of Break the modem transmits when a Break enters the modem. The following table lists the effects of the *n* value when the modem receives or transmits the Break. The modem can buffer up to four Breaks on both the modem and serial ports.

Note: In the reliable link connect state, the sender's Break control setting determines how the receiver handles the Break.

Table 3-19. Effects of *n* When Modem Receives Or Transmits Break

Action	*Local DTE sends Break during reliable or normal connection*	*Local DTE sends \Bn; local modem in command mode, during reliable or normal connection*	*Local modem sends Break during direct connection*	*Remote modem sends Break during normal connection*
\K0	Enter command state; no Break to remote system*	Empty data buffers; send Break to remote system	Send Break to remote system; set modem to command state	Empty data buffers; send Break to serial port
\K1	Empty data buffers; send Break to remote system	Same as \K0	Send Break to remote system	Same as \K0
\K2	Same as \K0*	Immediately send Break to remote system	Same as \K0	Immediately send Break to serial port
\K3	Immediately send Break to remote system	Same as \K2	Same as \K1	Same as \K2
\K4	Same as \K0*	Send Break to remote system in sequence with any transmit data being buffered	Same as \K0	Send Break to serial port in sequence with receive data being buffered
\K5	Send Break to remote system in sequence with transmit data	Same as \K4	Same as \K1	Same as \K4

* Forces the modem to command state. To transmit a Break and enter connect state, type:
AT\BO ⏎

(See the \B command description for details.)

%L*n* Speed Matching

%L0 Provides partial speed matching

%L1 Enables speed matching (default)

%L2 Disables speed matching

%L3 Enables V.8 Automode with fallback to ITU-T Automode

%L4 Enables V.8 Automode only

Determines whether the modem uses speed matching to establish a connection. The following tables indicate connections possible when %L1 or %L3 is set.

Table 3-20. Connections Possible When %L1 or %L3 Is Set.

Mode Setting on Originating Modem	***Mode Setting on Answer Modem***	
	Bell212A	***Bell103***
K56flex (32000-56000)	V.22[a]	—
V.34 (2400-33600)	V.22[a]	—
V.FC (14,400-28800)	V.22[a]	—
V.32bis (4800-14400)	V.22[a]	—
V.32 (4800-9600)	V.22[a]	—
V.22bis (2400)	V.22[a]	—
V.22[a] (1200)	V.22[a]	—
V.22[b] (600)	—	—
Bell212A (1200)	Bell212A	Bell212A
Bell103 (300)	Bell103	Bell103

The following table indicates the connections that the modem can establish when %L4 is set.

Note: Both modems must support the V.8 protocol when using %L4 or they will not connect.

Table 3-21. Connections Possible When %L4 Is Set.

Mode Setting on Originating Modem	***Mode Setting: Answer Modem (V.8 only)***							
	V.22[b]	***V.22[a]***	***V.22bis***	***V.32***	***V.32bis***	***V.FC***	***V.34***	***K56flex***
K56flex (32000-56000)	—	V.22bis	V.22bis	V.32	V.32bis	V.FC	V.34	K.56flex
V.34 (2400-33600)	—	V.22[a]	V.22bis	V.32	V.32bis	V.Fc	V.34	—
V.FC (14400-28800)	—	V.22[a]	V.22bis	V.32	V.32bis	V.FC	V.FC	—
V.32bis (4800-14400)	—	V.22[a]	V.22bis	V.32	V.32bis	V.32bis	V.32bis	—
V.32 (4800-9600)	—	V.22[a]	V.22bis	V.32	V.32	V.32	V.32	—
V.22bis (2400)	—	V.22[a]	V.22bis	V.22bis	V.22bis	V.22bis	V.22bis	—
V.22[a] (1200)	—	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]	—
V.22[b] (600)	V.22[b]	—	—	—	—	—	—	—
Bell103 (300)	—	Bell103	Bell103	Bell103	Bell103	Bell103	Bell103	—

To restrict the possible connections that can result, set %L0 or %L2 on either the originating or answering modem as follows: (If %L2 is set, modem and connection speeds are identical.)

Table 3-22. Connections Possible When %L0 Is Set.

With %L0 set – Modem Speed	***Possible Connection Speed***
300	300
600	600
1200	1200
2400	1200, 2400
4800	4800
7200	4800, 7200
9600	4800, 7200, 9600
12,000	4800, 7200, 9600, 12,000
14,400	4800, 7200, 9600, 12,000, 14,400
16,800	14,400, 16,800
19,200	14,400, 16,800, 19,200
21,600	14,400, 16,800, 19,200, 21,600
24,000	14,400, 16,800, 19,200, 21,600, 24,000
26,400	14,400, 16,800, 19,200, 21,600, 24,000, 26,400
28,800	14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800
31,200	14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200
33,600	14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, 33,600
56000	32000, 33600, 34000, 36000, 38000, 40000, 42000, 44000, 46000, 48000, 50000, 52000, 54000, 56000

-M*n* MNP Class Connect Messages

-M0 Disables MNP Class connect messages

-M1 Enables MNP Class connect messages

Determines whether MNP Class connect messages are displayed. The -M1 setting overrides the \V command setting for long form connection result codes and the W command for serial port connect messages. The modem ignores this command with short-form result codes enabled by V0. Setting X0 will also override the -M setting by displaying only **CONNECT**.

When -M1 is set and an MNP connection established, the connect message is **CONNECT MNPn/x**, where n equals the MNP Class (from 1 to 10) and x equals the type of data compression used (V.42bis or MNP Class 5). If)M1 is set, the message is **CONNECT MNP*n*/y/*x*,** where *y* equals cellular. If the modems do not negotiate compression, the message is **CONNECT MNP*n*.**

During LAPM V.42bis connections when -M1 is set, the connect message is **CONNECT LAPM/V42BIS**. During LAPM connections with no compression active, the message is **CONNECT LAPM**.

When -M1 is set, the message during normal and direct connections is **CONNECT**.

)Mn Power Level Adjustment for Cellular Telephone Connections

)M0 For central site modems: Automatically adjusts power level of land-side modem if remote modem a) originates the call and b) is set to ***H1)M1**.

Use for MNP Class 10 modems that will connect to both MNP 10 non-cellular telephone site modems and to cellular modems that use only basic MNP 10 cellular operation instead of Enhanced Cellular operation.

)M1 For cell-side cellular modems: Forces adjustment of power level.

Adjusts the power levels during link negotiation for reliable connections to accommodate signaling requirements of cellular telephone equipment. This setting must be used for Method 2 MNP 10 Enhanced Cellular operation.

@Mn Select Transmit Level (Only for Cellular Connections)

Selects the initial transmit level for your connection. You can set levels from -10 dBm through -35 dBm. The command is structured as follows: From **@M10** through **@M35**, the level set is the variable expressed as -dBm. For example, **@M12** sets -12 dBm.

Microcom recommends that you use the default, **@M0**, when making cell-side cellular calls. You may need to adjust this level, depending on your cellular equipment.

@M0 Use an initial transmit level of -18 dBm

@M1 Use an initial transmit level of -30 dBm

@M2 Use an initial transmit level of -10 dBm

@M10 Use an initial transmit level of -10 dBm

@M35 Use an initial transmit level of -35 dBm

%M*n* Modulation Selection

%M0 Allows connections through V.32bis; disables V.FC and V.34

%M1 Allows connections through V.FC; disables V.34

%M2 Allows all modulations (default)

Controls the modem's top modulation speed.

%M*n* Modulation Selection

%M0 Disables V.34 modulation modes
%M2 Allows all modulation modes V.34 and below
%M3 Allows K56flex modulation mode (default)

This command controls the modem's top modulation speed.

$M*n* Connection Security Password Control

$M0 The originating modem does not send the Connection Security password; the answering modem does not verify the Connection Security password.

$M1 The originating modem sends the first Connection Security password; the answering modem verifies the Connection Security password for all connections. If the originator's password does not match one of the answerer's passwords 0 through 49, the connection fails.

$M2 The originating modem sends the first Connection Security password; the answering modem verifies the Connection Security password for all connections. If the originator's password does not match one of the answerer's passwords 0 through 49, the answerer uses Auto Logon Sequence 5 to prompt the remote user (up to three times) for a correct Connection Security password. If the Auto-Logon sequence fails, the connection fails

\N*n* Operating Mode

\N0 Sets normal mode

\N1 Sets direct mode

\N2 Sets MNP reliable mode

\N3 Sets auto-reliable mode

\N4 Sets LAPM reliable mode

\N5 Sets LAPM reliable mode with fallback to normal mode

\N6 Sets LAPM reliable mode with fallback to MNP reliable mode

Note: Dial modifiers can also be used to set the operating mode for a single call. See the Dial Modifiers descriptions earlier in this chapter for details.

\N0 Normal mode can be used to communicate with most modems. Error correction does not take place in normal mode.

\N1 Direct mode does not buffer data and ignores flow control. Also, in connect state the serial port always adjusts to the speed of the connection, regardless of the setting of \J*n*. Error correction does not take place in direct mode.

Note: The escape code sequence is disabled in direct mode if \J0 is set.

\N2 Reliable mode uses the MNP reliable link to provide error detection and automatic data retransmission if an error occurs. This provides error-free communications between your system and another that supports the MNP reliable link. With \N2 in effect, the modem disconnects if it fails to establish an MNP reliable link immediately after making a connection. During an MNP reliable link, both modems should use flow control on the serial port. When a transmission error is detected, data is buffered during retransmission.

Note: Some protocols are not timed to work with MNP, and can interfere with its effectiveness.

\N3 Auto-reliable mode lets the modem communicate with remote systems which do or do not support the MNP or LAPM reliable link. In auto-reliable mode, the answering modem looks for incoming MNP or LAPM protocol characters from the remote modem. If it detects them within approximately three seconds, it tries to establish a reliable link connection.
When the modem is set to auto-answer in auto-reliable mode, you can shorten this three-second period by using the %A command with the \C2 command.

Note: If both modems are set to auto-reliable mode, a normal connection or no connection could result due to noise on the telephone line.

\N4 LAPM reliable mode uses the LAPM reliable link to provide error detection and automatic data retransmission if an error occurs, ensuring error-free communications. The remote system must also handle a LAPM reliable link. The modem attempts to establish a LAPM reliable link immediately after making a connection. If the attempt fails, the modem disconnects.

\N5 LAPM reliable mode with fallback to normal mode attempts to establish a LAPM reliable connection. If the attempt fails, the modem falls back to a normal connection.

\N6 LAPM reliable mode with fallback to MNP reliable mode attempts to establish a LAPM reliable connection. If the LAPM connection attempt fails, the modem then tries to establish an MNP reliable connection.

The following table shows connections that can be established, depending on the operating mode enabled. NC indicates No Connection. When more than one operating mode is listed within a column, the first mode is for the originating modem and the second is for the answering modem.

Note: For MNP Extended Services connections where LAPM is indicated, if both the originate and answer modems have enabled MNP Extended Services for V.42 connections (-K1), the extended features of MNP are applied during the connection.

Table 3-23. MNP Extended Services Connections

Answering Modem	***Originating Modem***						
	\N0	***\N1***	***\N2***	***\N3***	***\N4***	***\N5***	***\N6***
\N0	normal	direct/ normal	NC	normal	NC	normal	NC
\N1	normal/ direct	direct	NC	normal/ direct	NC	normal/ direct	NC
\N2	NC	NC	MNP	MNP	NC	NC	MNP
\N3	normal	direct/ normal	MNP	LAPM	LAPM	LAPM	LAPM
\N4	NC	NC	NC	LAPM	LAPM	LAPM	LAPM
\N5	normal	direct/ normal	NC	LAPM	LAPM	LAPM	LAPM
\N6	NC	NC	MNP	LAPM	LAPM	LAPM	LAPM

* When the originating modem is set to **\N3-J1** and the answering modem is set to LAPM, a LAPM connection results. If the originating modem is set to **\N3-J0** instead, the modem establishes a normal connection.

Note: For the modem to establish a LAPM connection, **-K0** must be set.

$N List Connection Security Passwords

Displays the Connection Security Password database. (See %I and $P for details on setting these passwords.)

O*n* Enter Connect State

O0 Enters connect state

O1 Begins an equalizer retrain sequence when operating at 2400 bps or higher and then returns to connect state

Note: Type **ATO1** [Enter] to induce loss of equalization due to excessive bit error rates.

@O*n* DSR Low on Busy-Out

@O0 Disables DSR low on busy-out

@O1 Enables DSR low on busy-out, regardless of the &C and \D settings. Overrides the &C (Serial Port Control) and the \D (Serial Port DSR/CTS Control); commands.

-O*n* Serial Port Parity

-O0 Sets 7 data bits, odd parity

-O1 Sets 7 data bits, even parity

-O2 Sets 7 data bits, mark parity

-O3 Sets 7 data bits, space parity

-O4 Sets 8 data bits, no parity

-O5 Sets 8 data bits, odd parity

-O6 Sets 8 data bits, even parity

-O7 Sets 8 data bits, mark parity

Lets you change the serial port parity set by the AT sequence. You can also use the -O command to change the serial port parity while connected to a remote device. Use this command when the local device supports XON / XOFF flow control and detects parity. This command ensures that all modem-generated XON and XOFF characters have the correct parity.

Modem port parity cannot be changed after a connection is established. When the parity required for a connection is not the parity set by the sequence, the parity must be set at the same time the dial command is used and typed on the same command line. For example:

AT-O2D12345 Enter

Notes: The sequence cannot be used to match space parity; no parity is set instead. You must use -O3 to set space parity.

The AT sequence cannot be used to match 8 bit data, mark parity. You must set that with AT-07. Otherwise, the modem defaults to 8 bits, no parity.

%O*n* V.23 Equalizer Control

%O0 Disables equalizers in V.23 half-duplex mode

%O1 Enables equalizers in V.23 half-duplex mode

Determines if equalizers are set in V.23 half-duplex mode. To avoid transmission errors during V.23 half-duplex connections, equalizer settings must be the same on both modems.

P Pulse Dial

Changes the current dialing mode to pulse. Tone dial is the default.

&P*n* Dial Pulse Ratio

&P0 Make = 39%, Break = 61%, 10pps

&P1 Make = 33%, Break = 67%, 10pps

&P2 Make = 39%, Break = 61%, 20pps

&P3 Make = 33%, Break = 67%, 20pps

Controls the ratio of the off-hook (make) to on-hook (break) interval the modem uses for pulse dialing.

-P*n* Check Parity

-P0 Ignores parity for special characters.

-P1 Processes special characters received from the computer or terminal *only* if their parity matches that of the serial port.

-P2 Processes special characters *only* if their parity matches the parity of the serial port. Modem port flow control characters are recognized, however, regardless of whether their parity matches the serial port parity.

Controls checking of parity for XON and XOFF characters, the escape code sequence, and HP ACK characters. In command state, all command echoes and command responses from the modem are sent to the computer or terminal with parity that matches the serial port parity.

When -P1 is set, all received data is passed through to the computer or terminal at 8 data bits, no parity.

When -P0 or -P2 is set, all received data is passed through to the computer or terminal with parity corrected to match the serial port parity.

\P*n*<*dial*> Store a Telephone Number

Where *n* is an integer (1-4) and <*dial*> is a string of up to 98 characters. Valid dial string characters are: 0-9, dial modifiers, and for tone dialing #, *. Dial strings longer than 98 characters return **ERROR**. The modem ignores invalid characters.

Stores a telephone number in the modem's telephone directory.

$P Security Database Password

Lets you change the password needed to edit the auto-logon sequences, Dial Access and auto-logon commands, and Connection Security passwords. The default is that no password set.

The following table shows the prompts that appear when you use the $P command:

Table 3-24. Password Prompts

Prompt	*Response*
OLD PASSWORD:	Type the existing password for verification and press **Enter**; If no password has been set, just press **Enter**.
NEW PASSWORD:	Type a new password and press **Enter**.
NEW PASSWORD:	Type the new password and press **Enter** again for verification.

Passwords must contain exactly five alphanumeric characters. Upper case or lower case and parity are ignored. You must type the old password correctly in order to enter a new password. You must type the new password the same way both times for it to take effect. Periods are echoed as the password is entered.

Note: The password becomes valid 2 minutes after the last logon or Connection Security password was entered.

Q*n* Quiet

Q0 Enables output of result codes

Q1 Disables output of result codes

Q2 Disables Answer Mode Result Codes only; does not affect status report messages

Determines whether the modem sends result and status codes (OK, BUSY, RING, etc.) to your computer or terminal.

-Q*n* Fallback Modulation Speeds

-Q0 Disables fallback from a V.32bis or V.32 MNP reliable connection to an MNP reliable 2400 or 1200 bps connection

-Q1 Enables fallback from a V.32bis or V.32 MNP reliable connection to an MNP reliable 2400 bps connection

-Q2 Enables fallback from a V.32bis or V.32 MNP reliable connection to an MNP reliable 2400 or 1200 bps connection

Controls whether the modem can fall back from a V.32bis or V.32 MNP reliable connection to a V.22bis MNP reliable connection at 2400 bps or a V.22 MNP reliable connection at 1200 bps. Fallback may occur when poor telephone lines cause excessive MNP retransmissions.

Fallback from a V.32bis or V.32 MNP reliable connection to a 4800 bps V.32bis or V.32 MNP reliable connection is always enabled, regardless of the -Q setting. The modem always uses the V.22 standard when it falls back from a V.32bis or V.32 MNP reliable connection to a 1200 bps MNP reliable connection, regardless of the B setting.

\Q*n* Serial Port Flow Control

\Q0 Disables flow control

\Q1 Enables bidirectional XON/XOFF flow control.

Data transmission is stopped by an XOFF character, and restarted by an XON character. The modem generates XON and XOFF characters at the same parity used on the serial port. The serial port responds to XON and XOFF characters sent by the local computer or terminal in the same way.

\Q2 Enables unidirectional hardware flow control.

The modem turns CTS Off to signal the local computer or terminal to stop transmitting data, and turns CTS On to signal the local computer or terminal to resume transmitting data.

\Q3 Sets bidirectional hardware flow control using CTS and RTS.

The modem uses CTS to start and stop transmission from the local computer or terminal. When RTS is Off, the modem stops transmitting. When RTS is On the modem resumes transmission.

\Q4 Enables unidirectional XON/XOFF flow control.

The modem serial port generates, but does not respond to, XON/XOFF flow control characters. This setting allows for computers to transmit data that has XON and XOFF data characters. The computer can still be set to respond to XON/XOFF flow control characters sent to it from the modem during serial port flow control.

\Q5 Enables unidirectional hardware flow control; keeps CTS Off until a connection is established.

\Q6 Enables bidirectional hardware flow control as with \Q3, but also keeps CTS Off until a connection is established and ignores RTS while not connected.

Sets the type of flow control used on the serial port. If serial port speed is faster than modem port speed, data from the computer enter the modem faster than they leave. The modem holds characters in a buffer and sends them out at the slower modem port speed. When the buffer is full, flow control instructs your computer to stop transmitting data until the modem empties its buffer. Then flow control instructs the computer to resume transmitting data to the modem.

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

During direct mode connections, the modem does not use flow control and ignores the \Q*n* setting.

Notes: In direct mode connections the modem ignores the \Q command.

Hardware flow control overrides &C and \D settings for CTS operation.

%R*n* Read All Registers

%R0 Display the contents of all S registers in decimal and hexadecimal integers in tabular format

%R1 Display the contents of all :T registers in decimal and hexadecimal integers in tabular format

\R*n* Serial Port Ring Indicator

\R0 The ring indicator signal comes up on ring and remains On for the duration of the telephone call

\R1 The ring indicator signal comes up on ring and turns Off.

S*n*? Read Configuration Register

Where *n* is an integer from 0 to 27, indicating a register

Displays the contents in decimal form only of the register selected with *n*.

*S*n* Remote Access Attention Character

Where *n* is an integer between 0 and 126 indicating an ASCII character (Default=42, asterisk)

Defines the attention character used to request a remote access session. To request a remote access session using the remote access attention character, establish a connection and type the attention character four times in succession (do not press **Enter**). *A sends this sequence automatically.

In normal mode, register S12 sets the guard time that precedes and follows the attention character sequence. It should be set to the same value on both the originating and answering modems. Reliable mode uses its own timing and ignores register S12. During reliable connections, allow a short pause between typing each attention character, or use the *A command instead.

Note: Remote access is available only during a normal connection or during an MNP or LAPM reliable connection without data compression.

\S Read Online Status

Displays a list of modem commands and their current settings, the active connection type, as well as the elapsed connect time and the telephone number most recently dialed.

The \S command displays several screens. Press any key to move to the next screen. To cancel the display, use the line delete character **Ctrl** - X or send a Break.

T Tone Dial

Changes the current dialing mode to tone.

&T*n* Test and Diagnostics Commands

&T0 Ends a test in progress without terminating a connection, and returns the local and remote modems to normal operation. If a self-test is in progress, &T0 reports any errors. The &T0 command must be the last command on a command line. See also Appendix B, “Diagnostics.”

&T1 Performs local analog loopback. The modem should display the characters on your screen exactly as you type them. The modem must be in normal or direct mode and set to 1200 bps or higher. See also Appendix B, “Diagnostics.”

&T3 Performs local digital loopback. This allows a remote modem that does not support the V.54 standard to perform a remote digital loopback test with the MMM. The modem must be in normal or direct mode and set to 1200 bps or higher.

&T4 Allows the modem to respond to a remote caller’s request to enter remote digital loopback mode

&T5 Prevents the modem from responding to a remote digital loopback request. The modem can respond to requests for remote digital loopback. The default is not to respond. This command is available only when the modem is in normal or direct mode and set to 1200 bps. See also See also Appendix B, “Diagnostics.”

&T6 Initiates remote digital loopback. This instructs the remote modem to initiate a Remote Digital Loopback test. The modem must be in normal or direct mode and set to 1200 bps or above.

&T7 Initiate remote digital loopback with self-test. This instructs the remote modem to enter a Remote Digital Loopback with Self-Test. After the test is complete, the modem reports errors to the local device. The modem must be in normal or direct mode and set to 1200 bps or above.

&T8 Performs local analog loopback with self-test. The modem sends itself the ITU-T V.54 test pattern and verifies the characters to make sure they are received correctly. Upon completion of the test, the modem reports errors to the local device. This command is available only when the modem is in normal or direct mode and set to 1200 bps or above.

\T*n* Inactivity Timer

Where *n* is an integer between 0 and 90 specifying minutes (Default = 0)

Specifies the number of minutes the modem waits before automatically hanging up when data is not sent or received. \T0 (the default) disables the inactivity timer. The inactivity timer is only available during normal and reliable link connections; it is ignored in direct mode.

#T*n* T1 Mode Control

Sets the T1 signaling on MMM modems.

#T0 Analog signaling

#T1 Loop start signaling

#T2 DTMF E&M start signaling

#T3 DTMF Wink start timing

#T4 MF E&M start signaling

#T5 MF Wink start timing

%U*n* Clear Serial Port Speed

%U0 Allows the current serial port speed to be changed to any other speed. Not required for speeds below 4800 bps.

%U1 Always keep the current serial port speed. To change the serial port speed, you *must* enter **%U1** *each time* you change the serial port speed.

%U2 Allows the current serial port speed to be changed from any speed.

@U*n* Minimum Connection Speed

@U0 Where *n*=**300**, 600, 1200, 2400, 4800,7200,9600, 12000, 14400, 16800, 19200, 21600, 24000, 26400, 28800 bps

Controls minimum speed at which the modem will establish a connection in originating or answering. Use to exclude lower speed remote modems from connections to MMMs.

V*n* Result Code Form

V0 Sends short form result codes

V1 Sends long form result codes

Selects the form of result codes to your computer or terminal. The \V command modifies the connect messages to reflect a reliable link connection.

See Appendix D, "Result Codes and Modulation Protocols," for connect messages and result codes.

-V*n* Split Serial-Port Speed with Multi-Protocol Auto-Answer

-V0 Enables V.23 split serial-port speed connections within the multi-protocol auto-answer feature

-V1 Disables V.23 split serial-port speed connections within the multi-protocol auto-answer feature

Determines whether the serial port uses split transmit and receive speeds when using the multi-protocol auto-answer feature. **%F0** must also be set.

%V Display Modem Firmware Version

Displays the modem firmware version.

\V*n* Error Correction Result Code Form

\V0 Uses standard long form result codes: CONNECT <*speed*>

\V1 Adds /REL to long form error correction result codes: CONNECT <*speed*> /REL

\V2 Displays long form error correction protocol result codes: CONNECT <*speed*> /REL-MNP or CONNECT <*speed*>*/REL-LAPM or* CONNECT <*speed*>/REL-CELLULAR

\V3 Adds /REL to long form error correction result codes: CONNECT <*speed*> /REL Displays Hayes compatible short form result codes

\V4 Enables long form error correction result codes: CONNECT <*speed*> /REL-MNP or CONNECT <*speed*>*/REL-LAPM or* CONNECT <*speed*>/REL-CELLULAR

\V5 Displays as one of the following formats: **CONNECT <speed>/<modulation>/REL - CELLULAR**, **CONNECT <speed>/<modulation>/REL - LAPM**, or **CONNECT <speed> /<modulation>/REL - MNP**, with the modulation **/V.34**, **/V.FC**, **/V.32**, /**V.22**, or **/FSK.**

Determines whether result codes indicate a reliable link connection. The <speed> field content is determined by the W command setting. Setting -M1 changes the format of the long form connection result codes.

Use \V0 when the when the communications software you use does not expect a reliable link result code, even if a reliable connection is established.

Set V0\V3 if your c software requires Hayes compatible connection result codes. When V1 is set to select long form result codes, \V3 is equivalent to \V2.

Note: When either \V1 or \V2 is set, the message CONNECT 9600/REL also indicates 4800, 7200, and 12,000 bps reliable connections. When \V3 or \V4 is set, the actual modem bps rate displays.

^V Display Bootstrap Revision

Requests modem to display its current flash memory bootstrap revision

W*n* Connection Speed Reporting

W0 Displays serial port connect messages

W1 Displays serial port connect messages

W2 Displays modem port connect messages

When **W0** or **W1** is set, connect messages indicate the serial port speed.
When **W2** is set, connect messages indicate the modem port speed.
When **X0** is set, CONNECT displays, regardless of the **W*n*** setting.

See Appendix D, “Result Codes and Modulation Protocols,” for connect messages and result codes.

&W Store Current Configuration

Stores current user profile.

Stores the active commands and certain S-registers. You store telephone numbers independently with the \P*n* and &Z*n* commands. The &W command stores the serial port speed and parity and the modem port speed that are in effect when you enter &W.

The &W command does not store the following restricted S-registers: S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, and S12.

The modem saves the following command settings when you enter them. You do not need to enter &W or *W also.

%I Edit Connection Security Password

$P Security Database Password

***S** Remote Access Attention Character

See also the *W and Z commands.

%W*n* Pulse Digit Command

%W0 *n* pulse digits dialed for each number

%W1 *n*+1 pulse digits dialed for each number

%W2 10-*n* pulse digits dialed for each number

For pulse dialing, determines whether the modem dials each number in a dial string *n* pulses, *n*+1 pulses, or 10-*n* pulses. For example, when **%W0** is in effect, it dials 6 with 6 pulses. However, with **%W1**, it dials 6 with 7 pulses; with **%W2**, it dials 6 with 4 pulses.

Note: With **%W0** or **%W2** set, the modem dials digit 0 with 10 pulses. When **%W1** is set, digit 0 is dialed with 1 pulse.

*W Store Complete Configuration

Stores all active commands and registers that are stored with the &W command, and also stores the restricted S-registers not stored with &W. (See &W.)

Telephone numbers are saved with \P and &Z. *W saves the serial port speed and parity and the modem port speed that are in effect when *W is used.

Notes: The &W and *W commands share the same stored configuration area. Issuing one of these commands overrides the settings stored with the other command.

The &W command setting stores <u>default</u> settings for the restricted S-registers. If &W is used after issuing *W, the default settings for the restricted S-registers are stored. If you <u>change</u> the setting of one of the restricted S-registers and want to save it, use ***W**.

-W*n* Reverse Answer

-W0 Disables reserve answer

-W1 Enables reverse answer

To answer a call from a modem that has dialed with the R dial modifier (Dial a Number in Answer mode), set -W1 and turn on auto-answer. By default, auto-answer is enabled by S0=1; any S0 value other than 0 enables auto-answer. Modems set to reverse answer will go off-hook in originate mode after receiving a RING signal.

\W*n* Split Serial Port Speed

\W0 Disables split serial port speed

\W1 Enables split serial port speed

Determines whether the serial port uses split transmit and receive speed operation when either %F1 or %F2 is set to select V.23 mode.

X*n* Extended Result Codes

X0 Modem ignores dial tone and busy signals. Sends a CONNECT result code when a connection is established. Smartmodem 300 compatible

X1 Modem ignores dial tone and busy signals. Sends a connect result code reflecting bps rate when a connection is established

X2 Modem ignores busy signals. Sends NO DIALTONE result code if dial tone is not detected within 5 seconds of a dial attempt. Sends a connect result code reflecting bps rate when a connection is established

X3 Modem ignores dial tone. Sends BUSY result code if a busy signal is detected. Sends a connect result code reflecting bps rate when a connection is established

X4 Sends NO DIALTONE result code if dialtone is not detected within 5 seconds of dial attempt. Sends BUSY result code if a busy signal is detected. Sends a connect result code reflecting bps rate when a connection is established

Result codes are further controlled by the V*n* command. Result codes indicate MNP reliable mode only when either \V1, \V2, \V3, \V4, \V5 or -M1 is set. When the modem ignores dial tone, it waits for the register S6 time delay and dials regardless of dial tone presence.

Note: The "W" dial modifier causes a wait for dial tone regardless of the X setting.

\X*n* XON/XOFF Pass-Through

\X0 Processes XON / XOFF flow control characters

\X1 Processes XON / XOFF flow control characters and passes them through to the local or remote system so that the local or remote device also processes the XON and XOFF characters

Determines whether XON / XOFF flow control characters are sent to the remote or local modem. When XON / XOFF flow control is enabled on the serial port (\Q1) and pass through is enabled (\X1), the modem also transmits to the remote device any XON and XOFF characters sent to the serial port from the local device.

CAUTION: With \X0 set and XON / XOFF flow control enabled, local devices such as printers may send XON and XOFF characters to the modem serial port. If the modem is controlling the flow of data to the remote system, local flow control characters will not interfere with the connection. But, if \X1 is set, local flow control characters also pass through to the remote system. These characters may turn on the flow of data from the remote system before the modem is ready to receive, resulting in loss of data.

Y*n* Long Space Disconnect

Y0 Disables long space disconnect on receipt of H or DTR drop if &D2 or &D3 is set.

Y1 Enables long space disconnect on receipt of H or DTR drop if &D2 is set.

Sends a 4-second Break on receipt of H if &D3 is set.

Sends a Break for 4 seconds before disconnect in response to an H command, or if DTR drops and &D2 is set. If &D3 is set, also sends a 4 second Break before disconnect in response to H. If &D3 is set and DTR drops, the modem disconnects. If the answer modem sees the Break, it drops the connection.

Setting Y0 disables this feature.

Notes: This command is available during normal and direct connections only.

Y1 must be set on both modems in order for this command to take effect.

-Y*n* Call Abort Disable

-Y0 Disables call abort disable

-Y1 Enables call abort disable

By defalt, pressing any key aborts a connection attempt. With -Y1 set, the modem ignores keyboard input after going off-hook, whether originating or answering a call. With -Y1 set, you can abort a call by sending a break to the modem or lowering DTR if &D1, &D2 or &D3 is also set.

*Y*n* Busy Out

***Y0** Disables busy out of the modem

*Y1 Enables busy out of the modem

*Y2 Enables busy out of the modem when DTR is low

Busies out the modem so that it does not respond to ring or answer incoming calls. If the installation uses the MNC, we recommend issuing *Y1 immediately after entering a direct connect session, and setting *Y0 as the last command before the session ends. When using the MNC to configure multiple modems, you must set *Y1 as the first command, and *Y0 as the last command in a command sequence.

When the Busy Out command is set to 2, the modem busies out if DTR goes off:

- after initialization.
- while the modem is idle.
- 5 seconds after disconnect. If DTR goes off before the 5 second wait, the modem will not busy out and performs according to the DTR Control command setting.

Z Reset

Hangs up the telephone line, clears the modem and serial port buffers, and, when the next AT command is used, sets the parity and bps rate to match the local computer or terminal. Also restores commands and registers last saved with &W or *W or the factory defaults if an &W or *W command was not used.

To reset the modem, type: **ATZ** [Enter]**.** If the **OK** response does not appear, type **ATQ** [Enter] to enable result codes.

&Z*n*<*dial*>Store Telephone Number

Where *n* is a directory position from 01 through 40 and <*dial*> is a string of up to 98 characters. Valid dial string characters are: 0-9, dial modifiers, and for tone dialing #, *. Strings of more than 98 characters return an **ERROR** message. The modem ignores invalid characters.

Stores a number in position *n* of the modem's telephone directory. If you omit *n*, the number will store in the first postion of the directory. When storing a number with this command you can use any dial modifiers except the S modifier. The &Z command must be last on a command line.

Registers

The modem also stores configuration settings in a set of registers. The modem registers are similar to the Hayes Smartmodem 2400 registers; some have enhanced modem features. Some registers control a single function; to set the function, change the value of the register. Other registers display several functions; bit maps are provided for interpreting these registers.

Note: The modem factory defaults for commands and registers work with many installations; you may never need to change the default settings.

This section explains how to change register values and describes each register. Bit mapped registers are recommended for reading modem status only; we suggest you use commands or switches to change the modem's settings.

Commands to Change or Read Registers

Change the Value of a Register

ATSn=x

AT:Tn=x

Changes the value of register "n" to a new value "x."

Change the Value of the Last Referenced Register

AT=x

Changes the value of the last referenced register or the register pointed to with the ATS*n* command. For example, if the last register command used was ATS0=2, typing **AT=4** changes the value of register S0 from 2 to 4.

Display the Value of the Last Referenced Register

AT?

Displays the value of the last register referenced in a read, write, or point to command.

Point to New Register

ATS*n*

Range: an integer from 0 - 27

Instructs the modem to point to the register whose location is *n*. This becomes the last referenced register. For example, typing **ATS1** places the pointer at register S1 and returns the command prompt.

Read All Registers

AT%R*n*

%R0 Displays the contents of all S registers in decimal and hexadecimal integers in tabular format

%R1 Displays the contents of all :T registers in decimal and hexadecimal integers in tabular format

Read Configuration Register

ATSn?

Where *n* is an integer from 0 to 27 indicating an S register

AT:T*n*?

Where *n* is an integer from 0 to 27 indicating a :T register

Displays the contents of register "*n*" in decimal form only.

Register Descriptions

S0 Ring to Auto-Answer On

Range: 0 - 255 rings

Default: Auto-answer on 1 ring is factory default setting

Sets the number of rings required before the modem answers. **S0=0** disables auto-answer. Ring signals are ignored for five seconds after disconnect.

S1 Ring Counter

Range: 0 - 255 rings

Default: 0 rings

Keeps a running total of the number of rings which occur before the modem answers a call. If no ring occurs within eight seconds after the last ring, the ring counter resets to 0.

Ring signals are ignored for five seconds after disconnect.

S2 Escape Code Character

Range: 0 - 255, ASCII decimal

Default: 43 (+)

Sets the character used for the three-character escape code sequence. When the modem is in connect state and receives the escape code sequence, it enters command state. Setting register S2 to 0 disables the escape code character. See register S12 to set the guard time that brackets the escape code character.

Register S2 is not stored with &W; use *W to save this register setting.

S3 Carriage Return Character

Range: 0 - 127, ASCII decimal

Default: 13 (carriage return)

Sets the character recognized as a carriage return. The carriage return terminates command lines and result codes.

Register S3 is not stored with &W; use *W to save this register setting.

S4 Line Feed Character

Range: 0 - 127, ASCII decimal

Default: 10 (linefeed)

Sets the character recognized as a line feed. The line feed character follows the carriage return at the end of command lines and result codes.

Register S4 is not stored with &W; use *W to save this register setting.

S5 Backspace Character

Range: 0 - 32, ASCII decimal

Default: 8 (backspace)

Sets the character recognized as a backspace.

Register S5 is not stored with &W; use *W to save this register setting.

S6 Wait Before Dialing

Range: 2 - 255 seconds

Default: 2 seconds

Sets the time to pause after off hook before the modem dials. The modem pauses for a minimum of two seconds, even if register S6 is set to a value less than 2.

Notes: Register S6 is valid only when either X0, X1, or X3 is set.

Register S6 is not stored with &W; use *W to save this register setting.

S7 Wait for Carrier After Dial

Range: 0 - 255 seconds

Default: 60 seconds

Sets the length of time that the modem waits for:

- a carrier from remote modem before hanging up (originate or answer mode)
- ringback (originate mode only, and only if either X3 or X4 is set)
- dial tone when the "W" dial modifier is encountered in a dial string
- quiet answer when the "@" dial modifier is encountered in a dial string

Note: Register S7 is not stored with &W; use *W to save this register setting.

S8 Pause Time for Dial Delay

Range: 0 - 255 seconds

Default: 2 seconds

Sets the length of time to pause when the modem encounters the pause (,) dial modifier.

Note: Register S8 is not stored with &W; use *W to save this register setting.

S9 Carrier Detect Response Time

Range: 0 - 255 tenths of a second

Default: 6 (0.6 seconds)

Determines how long a signal must be present before the modem recognizes it as a carrier.

Notes: Register S9 is not stored with &W; use *W to save this register setting.

Register S9 is only used in normal and direct modes.

S10 Delay for Hang Up After Carrier Loss

Range: 0 - 255 tenths of a second

Default: 60 (6 seconds)

Sets the length of time the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss. Both modems should have equal values in register S10. If the register S10 values are unequal, disconnect occurs when the lower value is reached. The modem always responds to loss of carrier, even if register S10 is set to 255 or &D0 is set.

When register S10 is set to 255, the modem stays off hook indefinitely after carrier loss.

After disconnecting, the modem waits for a minimum of five seconds before going off hook again in answer mode.

Notes: Register S10 is not stored with &W; use *W to save this register setting.

Register S10 is ignored during V.32 reliable connections.

S11 DTMF Tone Dialing Speed

Range: 50 - 100 milliseconds

Default: 75 milliseconds

Sets the length of time after the last tone was sent and before the next tone is sent when the modem is dialing over a touch tone line.

S12 Escape Code Guard Time and Remote Access Attention Sequence Guard Time

Range: 0 - 255 (fiftieths of a second)

Default: 50 (1 second)

Sets the minimum "quiet" time that must be present before and after entering the three-character escape code or the remote access attention sequence. The time delay between each character in the escape code or remote access attention sequence must be less than this guard time. If register S12 is set to 0, the time it takes to enter the escape code or remote access attention sequence does not affect recognition.

Notes: Register S12 is not stored with &W; use *W to save this register setting.

In normal mode, register S12 sets the guard time that precedes and follows the attention character sequence. It should be set to the same value on both the originating and answering modems. Reliable mode uses its own timing and register S12 is ignored.

S14 Bit Mapped Register

Default = 10.

Table 3-25. S14 Bits

Bit Position	*Function*	*Decimal Value*	
0	not used		
1	command echo	0	no echo
		1	echo
2	result codes	0	result codes
		1	no result codes
3	result type	0	short form
		1	long form
4	dumb mode	0	smart mode
		1	dumb mode
5	dial method	0	tone dial
		1	pulse dial
6	not used		
7	originate/answer	0	answer mode
		1	originate mode

S16 Bit Mapped Register, Test Options

Default = 0.

Table 3-26. S16 Bits

Bit Position	*Function*	*Decimal Value*	
0	Local Analog Loopback	0	disabled
		1	enabled
1	not used		
2	Local Digital Loopback	0	disabled
		1	enabled

Table 3-26. S16 Bits

Bit Position	*Function*	*Decimal Value*	
3	Remote Digital Loopbackstatus (initiated by the remote modem)	0	loopback Off
		1	loopback in progress
4	Initiate Remote Digital Loopback	0	disabled
		1	enabled
5	Initiate Remote Digital Loopback with Self-Test	0	disabled
		1	enabled
6	Initiate Local Analog Loopback with Self-Test	0	disabled
		1	enabled
7	not used		

Note: The modem does not support diagnostic tests in Bell 103, V.13, V.21, or V.23 modes. Register S16 is a read-only register that displays loopback test option status, and is available only when the modem is in normal or direct mode.

S18 Test Timer

Range: 0 - 255 seconds

Default: 0 seconds (disables timer)

Sets how long the modem conducts a loopback diagnostic test. Register S18 is available only when the modem is in normal or direct mode.

When register S18 is set to 0, enter the &T0 command to end a test.

Note: Register S18 is not supported for V.54 loopback test by circuit.

S21 Bit Mapped Register

Default = 48.

Table 3-27. S21 Bits

Bit Position	*Function*	*Decimal Value*	
0	Telco Jack	0	default
		1	not supported
1,2	not used		
3,4	DTR	0	Ignores DTR (&D0)
		1	On-to-Off DTR transition: modem enters command state (&D1)
		2	On-to-Off DTR transition: modem goes on hook (&D2)
		3	On-to-Off DTR transition: modem resets (&D3)
5	DCD	0	DCD always On
		1	DCD On indicates data carrier is present or DCD On except momentarily at disconnect
6	not used		
7	long space disconnect	0	off (Y0)
		1	on (Y1)

S22 Bit Mapped Register

Default = 118.

Table 3-28. S22 Bits

Bit Position	*Function*	*Decimal Value*	
0,1	not used		
2,3	not used		
4,5,6	result code options	0	same as X0
		4	same as X1
		5	same as X2
		6	same as X3
		7	same as X4
7	make/break ratio	0	39/61
		1	33/67

S23 Bit Mapped Register

Default = 30.

Table 3-29. S23 Bits

Bit Position	*Function*	*Decimal Value*	
0	respond to remote digital loopback	0	disabled
		1	enabled
1,2,3	serial-port bps	0	0 to 300 bps
		1	600 bps
		2	1200 bps
		3	2400 bps
		4	4800 bps
		5	9600 bps
		6	19200 bps
		7	38400, 57600 and 115200 bps
4,5	parity option	0	even
		1	space/none
		2	odd
		3	mark
6,7	guard tones	0	disabled
		1	550 Hz
		2	1800 Hz
		3	not used

The modem ignores the Respond to Remote Digital Loopback option during reliable connections.

Note: S23 changes the parity set automatically or by -O*n*, but the data and stop bits are retained.

S25 Delay to DTR

Range: 0 - 255 hundredths of a second

Default: 5 hundredths of a second (0.05 seconds)

With &M2 or &M3 set, the modem ignores an On-to-Off transition of DTR less than the S25 time delay.

S27 Bit Mapped Register

Default = 64

Table 3-30. S27 Bits

Bit Position	*Function*	*Decimal Value*
0	transmission mode	0 asynchronous mode
2-5	not used	
6	answer tone when at 1200 bps	0 ITU-T V.22bis / V.22 1 Bell 212A when supported
7	not used	

:T0=*n* Timer for V.22bis, V.22, and V.32 Modes During Multi-Protocol Answer

Where *n* is an integer from 0 to 255 representing tenths of a second
Default is 40 (4 seconds)

This command requires 1200 bps or higher operation with %F0%L1 set.

Determines how long the modem attempts to establish a V.32, V.22bis, or V.22 connection before attempting to establish a V.23 split speed or V.21 connection. During this period, the modem sends V.22bis or V.22 carrier.

:T1=*n* Timer for V.23 Split-Speed Mode During Multi-Protocol Answer

Where *n* is an integer from 0 to 255 representing tenths of a second.
Default is 30 (3 seconds)

This command requires 1200 bps or higher operation with %F0%L1 set.

When the modem is unable to establish a V.32, V.22bis, or V.22 connection, :T1 determines how long the modem attempts to establish a V.23 split-speed connection before attempting a V.21 or V.23 half-duplex connection. During this period, the modem sends a V.23 forward channel carrier.

Note: If :T1 is set to 0, the modem does not send a V.23 forward channel carrier during the multi-protocol answer sequence.

:T2=*n* Timer for V.21 Mode During Multi-Protocol Answer

Where *n* is an integer from 0 to 255 representing tenths of a second.
Default is 0 (V.23 half duplex disabled)

This command requires 1200 bps or higher operation with %F0%L1\N3 set.

When the modem is unable to establish a V.32, V.22bis, V.22, or V.23 split-speed connection, :T2 determines how long the modem attempts to establish a V.21 connection before attempting a V.23 half-duplex connection. During this period, the modem sends V.21 carrier.

Set :T2=20 (2 seconds) when including V.23 half duplex in the multi-protocol answer modem.

Note: If :T2 is set to 0, V.23 half-duplex connections are not attempted. The modem attempts to establish a connection for the length of time specified by register S7 before hanging up.

:T3=*n* Timer for V.21 and V.23 Answer Tone Duration

Where *n* is an integer from 0 to 33 representing tenths of a second.
Default is 33 (3.3 seconds)

This command requires either V.21 operation (%F0 is set and the modem speed is 300 bps) or V.23 operation (%Fn, where *n*=1, 2, or 3).

When the answering modem is set for V.21 or V.23 operation, :T3 determines the duration of the V.25 answer tone that is sent to the originating modem. When :T3 is set to 0, no answer tone is sent. All V.21 and V.23 answers begin with two seconds of silence unless :T3 is set to 0.

When the originating modem is set for V.21 or V.23 operation, :T3 determines how long the modem waits after detecting answer tone before proceeding with the connection. When :T3 is set to 0, the originating modem does not wait for answer tone.

:T4=*n* Timer for Line Turnaround Delay - Carrier On

Where *n* is an integer from 0 to 255 (in increments of 12.5 milliseconds).
Default is 20 (250 milliseconds)

This command takes effect only during normal mode V.23 half-duplex connections. After the modem turns carrier off, determines the minimum time the modem waits for the remote modem to respond before turning carrier back on again to resume sending data.

:T5=*n* Timer for V.23 Half-Duplex Intercharacter Delay

Where *n* is an integer from 0 to 255 (in increments of 12.5 milliseconds).
Default is 7 (87.5 milliseconds)

This command takes effect only during normal mode V.23 half-duplex connections.

Sets the length of time the modem waits after transmitting the last data character in the transmit buffer before turning carrier off. :T5 may need to be adjusted if the local computer intercharacter time causes excessive line turnarounds.

:T6=*n* Timer for DCD Turn On Delay

Where *n* is an integer from 0 to 255, representing milliseconds. Default is 200 milliseconds (2 tenths of a second)

This command takes effect during only normal mode V.23 half-duplex connections.

Sets how long the modem waits after carrier goes on before it starts looking for data. This command may be set to exclude the turn on noise that occurs when DCD turns On during V.23 half-duplex connections.

If :T6 is set to 0, the modem waits 256 milliseconds before looking for data.

:T7=*n* Timer for False Answer Abort

Where *n* is an integer from 0 to 255, representing seconds.
Default *n*=60 seconds. Setting :T7=0 disables this timer.

This command takes effect only when the modem falls back to a normal mode V.23 half-duplex connection.

Sets the amount of time the modem waits before hanging up when it receives no data from the local computer. If this command is set to a value greater than zero, the timer starts when the modem connects. If the modem does not receive data from the local computer in the specified time, it hangs up.

:T9=*n* Primary XON Flow Control Character

Where *n* is a decimal from 0 to 255, representing an 8-bit character.
Default *n*=11 hexadecimal (or 17 decimal) <DC1>

Defines the character used for primary XON flow control on the modem and serial ports. Enable primary flow control with \Q1, \Q4, \G1, or \G2.

Note: With modem port flow control, both modems must have the same primary flow control characters set during normal connections.

:T10=*n* Primary XOFF Flow Control Character

Where *n* is a decimal from 0 to 255, representing an 8-bit character.
Default is 13 hexadecimal (or 19 decimal) <DC3>

Defines the character used for primary XOFF flow control on the modem and serial ports. Enable primary flow control with \Q1, \Q4, \G1, or \G2.

Note: With modem port flow control, both modems must have the same primary flow control characters set during normal connections.

:T11=*n* Secondary XON Flow Control Character

Where *n* is a decimal from 0 to 255, representing an 8-bit character.
Default is F9 hexadecimal (or 249 decimal)

Defines the character used for secondary XON flow control on the modem's serial port. For secondary flow control to take effect, you must set either -F1\Q1 or -F1\Q4.

:T12=*n* Secondary XOFF Flow Control Character

Where *n* is a decimal from 0 to 255, representing an 8-bit character.
Default is FB hexadecimal (or 251 decimal)

Defines the character used for secondary XOFF flow control on the modem serial port. For secondary flow control to take effect, you must set either -F1\Q1 or -F1\Q4.

:T13=*n* Automode Timer

Where *n* is an integer from 0 to 255, representing tenths of a second.
Default is 15 (1.5 seconds)

Sets a timer to allow modems to connect in Automode. If the originating modem is set to 2400 bps or lower and has a problem connecting to your modem, we recommend increasing the value of this command to 40 (4 seconds) on the answering modem.

Note: Use :T13 *only* when **%L3** is in effect.

:T14=*n* Connect Message Delay Timer

Where *n* is an integer from 0 to 255, in 100 millisecond intervals.
Default is 0

Specifies how long to wait before or after a connect message before CTS, DSR, DCD go high. Use this command with **@C*n*** (where *n*=0 or 1).

:T15=*n* Bit Mapped Register, V.24 Control

Default = 5.

Specifies whether CTS is lowered during direct mode retrains, or during leased line restoral and dial backup operation indirect mode. This register is bit-mapped as follows:

Table 3-31. T15 Bits

Bit Position	*Function*	
0	0	CTS is not affected by direct mode retrains
	1	CTS is lowered during direct mode retrains
1-5		not used
6	0	CD follows link negotiation connection status
	1	CD always follows modem carrier when &C1 is set
7	0	V.32 answer tone without phase reversals
	1	V.32 answer tone with phase reversals

:T16=*n* CTS Turn On Delay Timer

Where *n* is an integer from 0 to 255 (in increments of 12.5 milliseconds)
Default is 0

After DCD and / or DSR have been turned On while connecting, determines how long the modem waits before turning On CTS.

:T17=*n* V.32/V.32bis Connection Training Timer

Where *n* is an integer from 0, 1, 5 to 32. (Default is 0, use dynamic training sequences — equivalent to a setting of 28)

This register controls the length of the training sequences exchanged when trying to establish V.32 and V.32bis connections.

Reduce the time required to establish a connection by setting :T17 to a value less than 28; this increases the modem's sensitivity to noise on the line.

Reduce the modem's sensitivity to noise by setting :T17 to a value greater than 28; this lengthens the time required to make a connection.

:T18=*n* Busy Out When DTR is Low Timer

Where *n* is an integer from 0 to 255 seconds. (Default is 0)

When DTR is low, the modem goes off hook and busies out the line after the time set by :T18 expires. When DTR is raised, the modem re-enters command state. &D*n* (where *n*=1, 2, or 3) must also be set.

Setting :T18=0 disables this feature.

Note: Manual Dial (:D*n*) cannot be used when :T18 is in effect. :D0 must be set when :T18 is set to a non-zero value.

:T19=*n* Bit Mapped Register

Where *n* is an integer from 0 to 255. (See below for other valid values for *n*.) (Default = 1.)

This command controls MNP link control and is used as follows:

Table 3-32. T19 Bits

Bit Position	*Function*	
0	0	Modem keeps a non-MNP10 1200 bps connection if no MNP link activity is received from the remote modem
	1	Modem disconnects a non-MNP10 1200 bps connection if no MNP link activity is received from the remote modem for two minutes

:T22 DSR Timer

Where *n* is an integer from 0 to 255 (in increments of 12.5 milliseconds)
Default is 34 (425 milliseconds)

After DCD and/or CTS drop, :T22 identifies how long the modem waits before DSR is dropped when disconnecting. For example, if \D2 and &C1 are set, when DCD and CTS drop, the modem then waits the amount of time specified by :T22 before dropping DSR.

:T26=*n* Bit Mapped Register

Default = 0.

Table 3-33. T26 Bits

Bit Position	*Function*	
0	0	Enables 2-second billing delay
	1	Disables 2-second billing delay. This bit decreases connection time, but may affect attaining connections
1	0	Normal answer tone length in V.32 mode
	1	Shortens answer tone length in V.32 mode

:T42=*n* V.34/V.FC Connection Speed Selection

0 Default V.34/V.FC connection speed selection

1 Highest V.34/V.FC connection speed selection (about 2 speeds above default)

2 Higher V.34/V.FC connection speed selection (about 1 speed above default)

3 V.34/V.FC connection speed selection

4 Lower V.34/V.FC connection speed (about 1 speed below default)

5 Lowest V.34/V.FC connection speed (about 2 speeds below default)

This register allows you to change the V.34/V.FC connection speed according to line quality. Microcom recommends that you leave this register at its default setting.

If you notice that your modem falls back during V.34/V.FC connections, or that you are seldom able to make 33.6 kbs connections, you can try the lower settings of this register.

:T51=*n* Set Switched-Line Transmit Level

where *n* = 0 to 15, indicating a transmit level.

This register allows you to set a transmit level for switched-line connections. For example, 0 = 0 dBm, 1 = -1 dBm, and so on to 15 = -15 dBm.
However, if your country has set specific minimum and maximum transmit level values, then the modem only allows values within that range. For example, if the maximum is -10 dBm and the minimum is -15 dBm, then setting this register to any value between 0 and 10 results in a -10 dBm value.

Note: The U.S. default is -10 dBm. See any country specific addendum for other defaults.

:T52=*n* Set Leased-Line Transmit Level Parallel-port packet size

where *n* = 0 to 15, indicating a transmit level.

This register allows you to set a transmit level for leased-line connections. For example, 0 = 0 dBm, 1 = -1 dBm, and so on to 15 = -15 dBm. However, if your country has set specific minimum and maximum transmit level values, then the modem only allows values within that range. For example, if the maximum is -10 dBm and the minimum is -15 dBm, then setting this register to any value between 0 and 10 results in a -10 dBm value.

Cellular Commands

Setting Up MNP 10EC Modems

Microcom modems can be set up in different ways to operate over a cellular telephone network. We recommend using setting AT%G1%B9600 along with AT*H1 on the cell side in most cellular environments. The following setups are typical.

Method 1: Universal V.32bis Setup

With Method 1, MNP10 EC operation is available with other EC-capable modems and with non-EC modems that support MNP 10 Cellular. Enhanced Cellular V.32bis operation is active at speeds between 1200 to 14,400 bps.

AT&F Land-side modem.

Sets the modem to factory defaults; allows the land-side modem to make data connections with both land-based and cellular-based modems without reducing maximum connection speeds. Connections over most land lines can reach 14,400 bps between V.32bis modems and 28,800 bps between V.34 modems. MNP 10 cellular connections occur at the highest speed the modems determine they can support depending on the characteristics of the cellular connection. If the land-side modem will make cellular connections only, Microcom recommends setting AT&F\N2)M1. Cell-side MNP/EC or MNP 10 Cellular modems require *H1 to make cellular connections.

AT&F\N2)M1*H1 Cell-side modem.

Allows the cell-side modem to make MNP 10EC connections with any other MNP 10EC or MNP 10 cellular modem. The modem makes the initial connection at 1200 bps, and then it attempts to upshift to the highest V.32bis speed that the modems can support given the characteristics of the cellular connection.

Method 2: V.32bis Cellular Quick Connect

Method 2 allows cellular connections to V.32bis modems at the highest mutually supported V.32bis speed for that cellular connection, up to 14,400 bps.

AT&F\N2)M1 Land-side modem.

Forces MNP connections to all modems and allows MNP 10 Cellular or Enhanced Cellular connections to capable MNP 10 modems.

AT&F\N2)M1*H2 Cell-side modem.

Uses the *H2 command to force the modem to connect more quickly than it would with *H1.

Note: In some cellular environments, Method 1 with ***H1** may be more robust. If you cannot connect, try ***H1** in the cellular command string instead of ***H2**.

Appendix A

Error Correction and Data Compression

MNP Classes

The MMM modem provides MNP Class 10, which includes data compression and error correction, and supports operation at speeds up to 115,200 bps.

MNP Class 10

MNP Class 10 provides:

- Adverse Channel Enhancements (ACE), which optimize performance under poor line conditions.
- Compatibility with non-MNP modems.
- Improved initial connection success rate by making multiple negotiation attempts when configured for auto-reliable mode.
- User configuration of the modem to negotiate the link at a low speed modulation, then upshift to a higher speed at the completion of link negotiation.
- Improved link performance during adverse channel conditions by aggressive adaptive packet assembly.
- Maximized throughput by continuously monitoring line quality and link performance, then dynamically upshifting or downshifting to optimum modulation speed.

The MMM modem is compatible with all Microcom MNP products, and its enhanced MNP service is completely transparent to the user.

The MMM also provides the MNP Classes listed below.

MNP Class 2: Class 2 service uses standard asynchronous framing techniques for data transmission and error correction. Because of protocol overhead, actual throughput is less than the bps rate of the modem.

MNP Class 3: Class 3 service uses synchronous framing techniques. Start and stop bits associated with each character are removed prior to transmission by MNP. This results in a 20% increase in performance over Class 2 service. Thus, actual throughput is greater than the bps rate of the modem.

MNP Class 4: Class 4 service uses synchronous framing techniques plus improvements developed by Microcom: Adaptive Packet Assembly and Optimized Data Phase. These enhancements improve performance for all types of connections.

- Adaptive Packet Assembly automatically adjusts the size of the data packets based on the quality of the telephone line. When line quality is good and there are few retransmissions, the packet size increases. When poor line quality causes frequent retransmissions, packet size decreases in order to maintain high throughput during error correction.
- Optimized Data Phase is the redesign of the MNP protocol header which reduces the number of overhead bytes per data packet. For example, modems operating at 2400 bps using Class 4 service transmit data at 2900 bps.

MNP Class 5: Class 5 service provides data compression which, combined with MNP Class 4, allows throughput of almost twice the connection speed. MNP Class 5 Data Compression dynamically adjusts to the type of data being transmitted for maximum compression efficiency.

ITU-T V.42 Error Correction

ITU-T V.42 incorporates two types of error-correction protocols: MNP and LAPM. The originating modem enters an optional **detect phase** where it sends a control sequence to the answering modem, to see whether the answering modem has MNP, LAPM, or no error correction protocol enabled. The AT\N command setting enabled *for each modem* determines the type of error correction used during the connection.

V.42 error correction is unavailable during 300 bps connections.

Data Compression

The MMM modem offers MNP Class 5 Data Compression for increased throughput during reliable connections with other modems that support MNP Class 5. The modem matches the capabilities of the remote modem, to establish MNP Class 5 or non-compression connections.

The MMM modem also offers ITU-T V.42bis compression, an international standard for data compression over modem links. The modem can achieve throughputs up to 115,200 bps using V.42bis compression. The modem supports the V.42bis compression algorithm when operating with MNP error correction, to combine the benefits of V.42bis compression with the benefits of MNP Class 10 and other MNP features. The modem also supports V.42bis in LAPM.

How Data Compression Works

Data compression is a technique used during reliable connections that lets a modem exchange more information per second than standard transmission techniques, thus increasing the modem's *throughput*. This increased throughput transfers data at an effective rate faster than the actual connection speed, saving time and connect charges.

Data compression combines duplicate characters so that runs of identical contiguous characters, such as spaces or tabs in a table, are sent as a shorter sequence. It also recodes characters based on the frequency with which they occur in the data being sent. For example, if the ASCII character "e" appears very frequently, it is recoded as a shorter character that uses fewer bits. Data is transmitted in compressed form, thus increasing throughput and decreasing transmission time. After it is received, compressed data is decompressed by the receiving modem.

Data compression can be used with any type of file, but it is most efficient for text files whose characters conform to a frequency pattern similar to natural language text.

How To Use MNP Data Compression

You do not need to change the modem's default settings to use MNP Data Compression. The modem is shipped from the factory with MNP Data Compression enabled, and automatically uses MNP Data Compression when it establishes a reliable connection with another MNP Class 5 modem.

You can leave data compression enabled, regardless of the data compression capabilities of the remote modem to which you plan to connect. When a reliable connection is established, MNP link negotiation determines and matches the class of data compression enabled on the remote modem. If the remote modem does not support data compression or has data compression disabled, an MNP reliable connection without data compression takes place.

Appendix B

Diagnostics

Use these tests to verify the modem's performance and to isolate the source of a communications problem. If a problem exists, test all components of the communications path, including the data cable and all connectors, in addition to using the loopback diagnostic commands. The modem must be in normal or direct mode to perform diagnostic loopback tests.

Local Analog Loopback with Self-Test

Local Analog Loopback with Self-Test tests the local serial port. When set to Local Analog Loopback with Self-Test, the modem sends itself a special test data sequence and then verifies the data to make sure that it is correctly received.

Using Commands to Perform a Local Analog Loopback with Self-Test

To initiate a Local Analog Loopback with Self-Test, at the command prompt type **AT&T8** Enter. When the test is complete, the screen displays a three-digit number that represents the number of errors. For example:

AT&T8 Enter
(no display during test)
(test ends)
000
OK

The test continues until the time set with register S18 runs out, or until you terminate the test by typing **AT&T0** Enter. You can also type **ATH** Enter to end the test and hang up.

Local Analog Loopback

Local Analog Loopback tests the local serial port and the local computer or terminal. This test requires you to type a sequence of characters at your computer or terminal. The modem then sends these characters back to your computer or terminal. The characters on your display should match exactly the characters you type.

Using Commands to Perform a Local Analog Loopback

To initiate a Local Analog Loopback:

1. At the command prompt type **AT&T1** Enter (must be the last command on the command line).
2. Type a sequence of characters.

This test mode continues until the time set with register S18 runs out, or until you manually terminate the test. To manually end the test, enter command state and at the command prompt type **AT&T0** Enter. You can also type **ATH** Enter to end the test and hang up.

Remote Digital Loopback with Self-Test

Remote Digital Loopback with Self-Test tests the remote modem port, the telephone line, and the local serial and modem ports. When the modem is set to Remote Digital Loopback with Self-Test, it sends the remote modem a special test data sequence, and the remote modem echoes this data back to your modem. The characters echoed on your display should match exactly the characters you typed.

To initiate a Remote Digital Loopback with Self-Test:

1. Dial the number of a remote system that has been configured to accept a Remote Digital Loopback request.
2. When a connection is established, return to command state and, at the command prompt, type: **AT&T7** Enter

When the test is complete, the screen displays a three-digit number that represents the number of errors.

The test continues until the time set with register S18 runs out, or until you terminate the test by typing **AT&T0** Enter. You can also type **ATH** Enter to end the test and hang up.

Remote Digital Loopback

Remote Digital Loopback tests the remote modem port, the telephone line, the local serial and modem ports, and the local computer or terminal. You type a sequence of characters at your computer or terminal. The modem then sends these characters to the remote modem, which echoes them back to your modem. The characters on your display should match exactly the characters you type.

Using Commands to Perform a Remote Digital Loopback

To initiate a Remote Digital Loopback:

1. Dial the number of a remote system that has been configured to accept a Remote Digital Loopback request.
2. When a connection is established, return to the command state and, at the command prompt, type **AT&T6** Enter (must be the last command on the command line).
3. Type a sequence of characters.

The test continues until the time set with register S18 runs out, or until you manually terminate the test. To manually end the test, enter command state and, at the command prompt, type **AT&T0** Enter. You can also type **ATH** Enter to end the test and hang up.

Using Circuits to Perform a Remote Digital Loopback

To initiate a Remote Digital Loopback using circuits:

1. Raise circuit 140 (pin 21).
2. Type a sequence of characters.

To end the test, lower circuit 140 (pin 21).

Local Digital Loopback

Local Digital Loopback allows any data received by the modem to be looped back and sent to the remote modem. It tests the remote computer or terminal, the remote modem and serial ports, the telephone line, and the local modem port.

Using Commands to Perform a Local Digital Loopback

To initiate a Local Digital Loopback:

1. Dial the number of a remote system.
2. When a connection is established, return to the command state and at the command prompt type: **AT&T3** Enter

The operator of the remote system now types a sequence of characters.

No characters display while your modem echoes the characters typed by the remote operator back to the remote computer or terminal. The test continues until the time set with register S18 runs out. If register S18 is not used, the operator of the remote modem must hang up or call you on another telephone line to tell you when the test is over. At this point, manually terminate the test by typing **AT&T0** Enter. You can also type **ATH** Enter to end the test and hang up.

Respond to Remote Digital Loopback

The Respond to Remote Digital Loopback command configures your modem to accept a request from a remote modem to engage in a Remote Digital Loopback or a Remote Digital Loopback with Self-Test. To configure the Dynamic Integrator modem to accept a remote digital loopback request, at the command prompt type:

AT&T4 Enter (factory default)

To configure the modem to ignore a remote digital loopback request, at the command prompt type:

AT&T5 Enter

Automatically Terminating a Test: Register S18

To configure the modem to automatically terminate a test after a specified period of time, change the value of register S18. Register S18 determines the duration of a diagnostic test. The factory default setting is 0 seconds, which disables the timer and allows tests to continue indefinitely until you cancel them. You can set this register to terminate tests after 1 to 255 seconds.

Appendix C

Specifications, Switches and Jumpers

Specifications for the Managed Modem Module

Memory

Four 512K x 8 Flash ROM per hex engine or MMM24 engine

Four 512K x 8 Fast Static RAM per hex engine; four 1Mx16 FPM DRAM per MMM24 engine

One 128K x 8 Flash ROM per engine per modem (6 per hex and 24 per MMM24)

One 128K x 8 Fast Static RAM per engine per modem (6 per hex and 24 per MMM24)

Protocols

MNP Class 10 reliable link with V.42bis operation and data compression for error-free communication with other MNP-equipped systems

Compatibility with the ITU-T V.34 protocol (2400 to 33,600 bps) modem port speeds, V.Fast, Bell 103 and Bell 212A, ITU-T V.22, V.22bis, V.32, and V.32bis functions for normal ASCII communications

Microprocessors

One Motorola MC68EN360 at 24.576 MHz clock per hex engine

Six Zilog Z80182 (one per modem) at 36.8640 MHz clock per hex engine

One Motorola MC68EN360 at 32.768MHz clock per MMM24

One Motorola MC68EC040 at 32.678MHz clock per MMM24

24 Zilog Z80182 (one per modem) at 29.576MHz clock per MMM24

Power Requirements

30 Volts RMS AC 50/60Hz supplied via the Microcom Access Integrator Chassis

Operating Environment

0-40 degrees Celsius (32-105 degrees Fahrenheit)

0-95% relative humidity

Physical Dimensions

14” x 10.375”

Modem Status LEDs

All hex MMM engines have three status LEDs per modem (18 per engine) on their exterior brackets.

Alll MMM24s have two status LEDs per modem (48 per cengine) on their exterior brackets.

Interfaces

Each analog engine has six RJ11 connectors with the following pin outs:

Table C-1. RJ11 Telephone Cable Connectors

Function	*Pin*
—	1
Tip	2
Ring	3
—	4

Each digital engine has six Codecs with Control Logic for the Time Division Multiplex (TDM) backplane interface.

The digital and analog hex engines each have one high-density, 60-pin EIA232 interface with the following pin outs. MMM24s have four high-density 60-pin EIA232 interfaces with the same pin outs..

Table C-2. EIA232 Interfaces

Pin Number	*Signal Name*	*Pin Number*	*Signal Name*
1	GND	31	A_CB1
2	TXD0	32	TXD4
3	DTR0	33	DTR4
4	RTS0	34	RTS4
5	CTS0	35	CTS4
6	DSR0	36	DSR4
7	RXD0	37	RXD4
8	RXG0	38	RXG4
9	TXD1	39	TXD5
10	DTR1	40	DTR5
11	RTS1	41	RTS5
12	CTS1	42	CTS5
13	DSR1	43	DSR5
14	RXD1	44	RXD5
15	RXG1	45	RXG5
16	GND	46	RXG7
17	RXG3	47	RXD7
18	RXD3	48	DSR7
19	DSR3	49	CTS7
20	CTS3	50	RTS7
21	RTS3	51	DTR7
22	DTR3	52	TXD7
23	TXD3	53	RXG6
24	RXG2	54	RXD6

Table C-2. EIA232 Interfaces (Continued)

Pin Number	*Signal Name*	*Pin Number*	*Signal Name*
25	RXD2	55	DSR6
26	DSR2	56	CTS6
27	CTS2	57	RTS6
28	RTS2	58	DTR6
29	DTR2	59	TXD6
30	TXD2	60	GND

DIP Switches and Jumpers

Digital modem boards have DIP switches that are only used during bench-test diagnostic procedures. The switches and jumpers must be set in their default positions before installation. The default setting for all 8 switches is in the OFF position. Modem configuration and IP address information is changed through software commands, using *express*WATCH or the MNC command line. Switch settings are identified below for reference only.

Table C-3. DIP Switches

Switch	*Position*		*Configuration*
SW2 1-2	1	2	
T1 Timeslot	OFF	OFF	DS0 1-6 (Default)
	ON	OFF	DS0 7-12
	OFF	ON	DS0 13-18
	ON	ON	DS0 19-24
E1 Timeslot	OFF	OFF	DS0 1-6 (Default)
	ON	OFF	DS0 7-12
	OFF	ON	DS0 13-15, 17-19*
	ON	ON	DS0 20-25
SW2 3 Line Type	OFF		T1 (Default)
	ON		E1
SW2 4 TDM Highway	OFF		Span 1 (Default)
	ON		Span 2
SW2 5 Configuration Control	OFF		Read *xprswtch.mmm* (default)
	ON		Set with switches
SW2 6 Startup Control	OFF		Start main mode (default)
	ON		Remain in boot mode
SW2 7	OFF		Reserved
SW2 8	OFF		Reserved

* DS0 16 is skipped in E1 mode. The E1 DS0's 26 through 31 cannot be configured by switch.

➥ **Important:** Analog MMS do not have DIP switches. All functions are software settable.

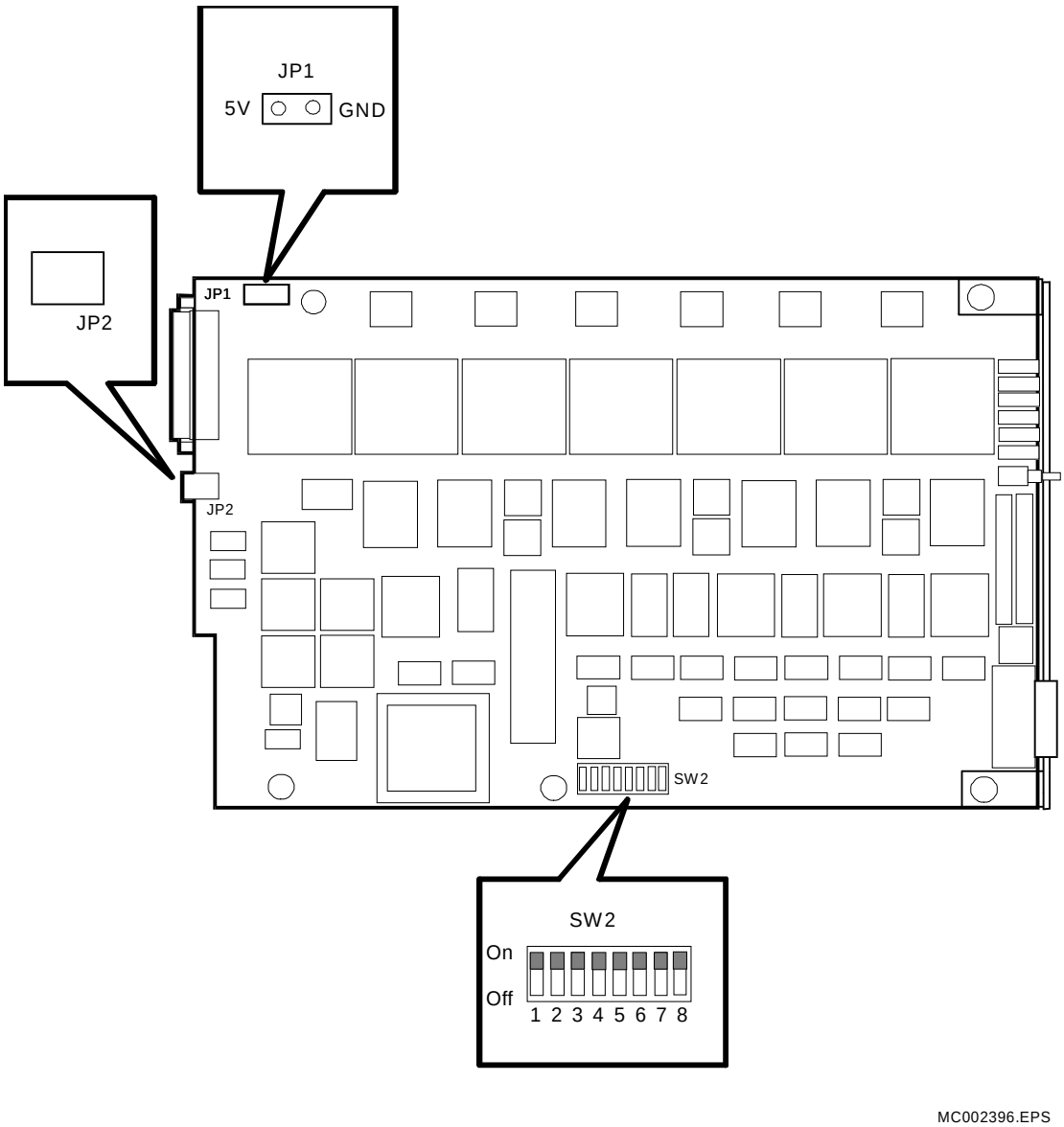

Figure C-1. Hex MMM DIP Switches

The digital and analog MMM have identical jumpers. These jumpers are not user configurable and must be in their default positions before installation. The default positions are shown above for reference purposes only.

Appendix D

Result Codes and Modulation Protocols

This appendix lists the result codes that can display when the modem attempts to establish a connection. See Chapter 3, *Commands and Registers*, for descriptions of the -M, V, \V, and W commands.

Connection Result Code Tables

The tables use the abbreviations: rel (reliable) and non-rel (non reliable).

Table D-1 shows the short and long form result codes, excluding connection result codes. The format of the connection result codes is dependent upon the \V, W, and -M commands.

Table D-1. Result Codes

Short Form	***Long Form***
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
6[1]	NO DIALTONE
7[1]	BUSY
8[1]	NO ANSWER
40	REMOTE ACCESS FAILED
51	NO PROMPT TONE

[1] Display of these call progress monitoring result codes depends on the setting of the X command.

Table D-2 and Table D-3 show the long form connection result codes.

Table D-2. Long Form ATV1-M0W0 or W1 Connect Speeds

Report DTE Speed		
DTE Speed	***non-rel \V0 rel***	***\V1 rel***[1] ***\V2 rel*** ***\V3 rel*** ***\V4 rel*** ***\V5 rel***[2]
75	75	75 / REL
300	300	300 / REL
600	600	600 / REL
1200	1200	1200 / REL
2400	2400	2400 / REL
4800	4800	4800 / REL
9600	9600	9600 / REL
19,200	19200	19200 / REL
38,400	38400	38400 / REL
57,600	57600	57600 / REL
115,200	115200	115200 / REL

1 If \V2 or \V4 is set and a reliable link is established, the message displays as one of the following formats:
CONNECT <speed>/REL - MNP or
CONNECT <speed>/REL - LAPM or
CONNECT <speed>/REL - CELLULAR or
CONNECT <speed>/REL - CELLULAR EC or
CONNECT <speed>/LAPM - CELLULAR EC.

2 If \V5 is set, the message displays in one of the following formats:
CONNECT < DCE speed >/< modulation >/REL-CELLULAR
CONNECT < DCE speed >/< modulation >/REL-LAPM
CONNECT < DCE speed >/< modulation >/REL-MNP
CONNECT < DCE speed >/< modulation >/REL-CELLULAR EC
CONNECT < DCE speed >/< modulation >/LAPM - CELLULAR EC
with the modulation **/V.34, /V.FC, /V.32, /V.22, or /FSK**

Table D-3. Long Form ATV1-M0W2 Modulation Speeds

ATV1-M0W2 Report Modulation Speed				
Modulation	***Speed***	***non-rel \V0 rel***	***\V1 rel \V2 rel[1]***	***\V3 rel \V4 rel[1] \V5 rel[4]***
V.21	300	—[2&3]	V.21 / REL	V.21 / REL
Bell 103	300	—[2]	103 / REL	103 / REL
V.23 half-duplex	1200	V.23 HDX[3]	—	—
V.23 split speed	75 / 1200	V.23[3]	—	—
V.22	600[3]	600	600 / REL	600 / REL
V.22 / Bell 212A	1200	1200	1200 / REL	1200 / REL
V.34 / V.22bis	2400	2400	2400 / REL	2400 / REL
V.34 / V.32	4800	4800	9600 / REL	4800 / REL
V.34 / V.32bis	7200	7200	9600 / REL	7200 / REL
V.34 / V.32bis	9600	9600	9600 / REL	9600 / REL
V.34 / V.32bis	12000	12000	9600 / REL	12000 / REL
V.34 / V.32bis	14400	14400	14400 / REL	14400 / REL
V.34 / V.FC	14400	14400	14400 / REL	14400 / REL
V.34 / V.FC	16800	16800	16800 / REL	16800 / REL
V.34 / V.FC	19200	19200	19200 / REL	19200 / REL
V.34 / V.FC	21600	21600	21600 / REL	21600 / REL
V.34 / V.FC	24000	24000	24000 / REL	24000 / REL
V.34 / V.FC	26400	26400	26400 / REL	26400 / REL
V.34 / V.FC	28800	28800	28800 / REL	28800 / REL
V.34	31200	31200	31200 / REL	31200 / REL
V.34	33600	33600	33600 / REL	33600 / REL
K56flex	32000	32000	32000 / REL	32000 / REL
K56flex	34000	34000	34000 / REL	34000 / REL
K56flex	36000	36000	36000 / REL	36000 / REL
K56flex	38000	38000	38000 / REL	38000 / REL
K56flex	40000	40000	40000 / REL	40000 / REL
K56flex	42000	42000	42000 / REL	42000 / REL
K56flex	44000	44000	44000 / REL	44000 / REL
K56flex	46000	46000	46000 / REL	46000 / REL
K56flex	48000	48000	48000 / REL	48000 / REL
K56flex	50000	50000	50000 / REL	50000 / REL
K56flex	52000	52000	52000 / REL	52000 / REL
K56flex	54000	54000	54000 / REL	54000 / REL
K56flex	56000	56000	56000 / REL	56000 / REL

[1] If \V2 or \V4 is set and a reliable link is established, the message displays as one of the following formats:
CONNECT <speed>/REL - MNP or
CONNECT <speed>/REL - LAPM or
CONNECT <speed>/REL - CELLULAR or
CONNECT <speed>/REL - CELLULAR EC or
CONNECT <speed>/LAPM - CELLULAR EC.

[2] In non-reliable V.21 or Bell 103 connections, message displays as: **CONNECT**

[3] Not supported in synchronous mode.

4 If \V5 is set, the message displays in one of the following formats:
CONNECT < DCE speed >/< modulation >/REL-CELLULAR
CONNECT < DCE speed >/< modulation >/REL-LAPM
CONNECT < DCE speed >/< modulation >/REL-MNP
CONNECT < DCE speed >/< modulation >/REL-CELLULAR EC
CONNECT < DCE speed >/< modulation >/LAPM - CELLULAR EC
with the modulation **/V.34, /V.FC, /V.32, /V.22, or /FSK**.

Table D-4. Short Form Connect Result Codes

ATV0W2 Report Modulation Speed					
Modulation	***Speed***	***\V0 \V1 non-rel \V2 non-rel \V4 non-rel \V5 non-rel***	***\V1 rel \V2 rel***	***\V3 rel***	***\V4 rel \V5 rel***
V.21 or Bell 103	300	1[1]	20	1[1]	20
V.23 half-duplex	1200	5[1]	—	5[1]	—
V.23 split speed	75/1200	11[1]	—	23[1]	—
V.22	600	9[1]	21	5[1]	21
V.22 or Bell 212A	1200	5	22	5	22
V.34/V.22bis	2400	10	23	10	23
V.34/V.32	4800	30	31	11	31
V.34/V.32bis	7200	40[2]	33	24	41
V.34/V.32	9600	32	33	12	33
V.34/V.32bis	12000	44[2]	33	25	45
V.34/V.FC/V.32bis	14400	34[2]	35	13	35
V.34/V.FC	16800	60	61	13	61
V.34/V.FC	19200	36	37	14	37
V.34/V.FC	21600	62	63	13	63
V.34/V.FC	24000	64	65	13	65
V.34/V.FC	26400	66	67	13	67
V.34/V.FC	28800	68	69	13	69
V.34	31200	70	71	13	94
V.34	33600	72	73	13	95
K56flex	32000	130	131	15	160
K56flex	34000	132	133	15	161
K56flex	36000	134	135	15	162
K56flex	38000	136	137	15	163
K56flex	40000	138	139	15	164
K56flex	42000	140	141	15	165
K56flex	44000	142	143	15	166
K56flex	46000	144	145	15	167
K56flex	48000	146	147	15	168
K56flex	50000	148	149	15	169
K56flex	52000	150	151	15	170
K56flex	54000	152	153	15	171
K56flex	56000	154	155	15	172

1. Not supported in synchronous mode.

2. In synchronous mode, or when **\V0** is set, the following numeric codes display: 14400 bps=**34**; 12000 bps=**44**; 7200 bps=**40**.

Differences in Modulation Protocols

Protocol Configuration Command Settings

When you send an AT string to the modem, it adjusts modem-port speed automatically to match the AT speed. Use %G1 to disable this feature. With %G1 set, you can change the modem speed with %B*n* (where *n* is the new modem speed) and %F*n*.

This section lists settings to configure the modem for each mode and protocol. Modem connection speeds are in parentheses.

Note: For the highest throughput, type **AT%G1%B*n*** **Enter** (where *n* equals the desired speed).

Table D-5. Configuration Settings When %F0 Is Set

Protocol	***Issue %G0:***	***Issue %G1:***
V.21 (75-300 bps)	B0 at 300 bps	B0%B300
Bell 103 (75-300 bps)	B1 at 300 bps	B1%B300
V.22 (600 bps)	at 600 bps	%B600
V.22 (1200 bps)	B0 at 1200 bps	B0%B1200
Bell 212A (1200 bps)	B1 at 1200 bps	B1%B1200
V.34 / V.22bis (2400 bps)	at 2400 bps	%B2400
V.34 / V.32 (4800 bps)	at 4800 bps	%B4800
V.34 / V.32 (9600 bps)	at 9600 bps	%B9600
V.34 / V.32 (12,000 bps)	at 12000 bps	%B12000
V.34 / V.FC / V.32bis (14,400 bps)	at 14400 bps	%B14400
V.34 / V.FC (16,800 bps)	at 16800 bps	%B16800
V.34 / V.FC (19200 bps)	at 19200 bps	%B19200
V.34 / V.FC (21,600 bps)	at 21600 bps	%B21600
V.34 / V.FC (24,000 bps)	at 24000 bps	%B24000
V.34 / V.FC (26,400 bps)	at 26400 bps	%B26400
V.34 / V.FC (28,800 bps)	at 28800 bps	%B28800
V.34 / V.FC (32,100 bps)	at 32100 bps	%B32100
V.34 / V.FC (33,600 bps)	at 33600 bps	%B33600
K56flex (32000 bps)	at 32000 bps	%B32000
K56flex (34000 bps)	at 34000 bps	%B34000
K56flex (36000 bps)	at 36000 bps	%B36000
K56flex (38000 bps)	at 38000 bps	%B38000
K56flex (40000 bps)	at 40000 bps	%B40000
K56flex (42000 bps)	at 42000 bps	%B42000
K56flex (44000 bps)	at 44000 bps	%B44000
K56flex (46000 bps)	at 46000 bps	%B46000
K56flex (48000 bps)	at 48000 bps	%B48000
K56flex (50000 bps)	at 50000 bps	%B50000
K56flex (52000 bps)	at 52000 bps	%B52000
K56flex (54000 bps)	at 54000 bps	%B54000
K56flex (56000 bps)	at 56000 bps	%B56000

Speed and Protocol Connection Matrices

The following tables show the possible speed and protocol combinations that can result in a connection to another modem. They also illustrate the action of an answer modem set up to use multi-mode answering.

Table D-6. Mode Settings on Originating and Answering Modems: Group 1

Originating Modem	***Answering Modem***					
	V.22[b]	***V.22[a]***	***V.22bis***	***V.32***	***V.32bis***	***V.34/V.FC***
V.34 / V.FC (14400-33600)	—		V.22bis	V.32	V.32bis	V.34 / V.FC
V.34 / V.32bis (4800-14400)	—	V.22[a]	V.22bis	V.32	V.32bis	V.34 / V.32bis
V.34 / V.32 (4800-9600)	—	V.22[a]	V.22bis	V.32	V.32	V.34 / V.32
V.34 / V.22bis (2400)	—	V.22[a]	V.22bis	V.22bis	V.22bis	V.34 / V.22bis

Table D-6. Mode Settings on Originating and Answering Modems: Group 1 (Continued)

V.22[a] (1200)	—	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
V.22[b] (600)	V.22[b]	—	—	—	—	—
V.23[a] (xmt 75)	—	V.23[b]	V.23[b]	V.23[b]	V.23[b]	V.23[b]
V.23[b] (xmt 1200)	—	—	—	—	—	—
V.23[c] (half-duplex)	—	V.23[c]	V.23[c]	V.23[c]	V.23[c]	V.23[c]
V.21(75-300)	—	V.21	V.21	V.21	V.21	V.21
Bell212A (1200)	—	V.22[a]	V.22[a]	V.22[a]	V.22[a]	V.22[a]
Bell103 (300)	—	Bell103	Bell103	Bell103	Bell103	Bell 103

Table D-7. Mode Settings on Originating and Answering Modems: Group 2

Originating Modem	***Answering Modem***					
	Bell103	***Bell212A***	***V.21***	***V.23[c]***	***V.23[b]***	***V.23[a]***
V.34 / V.FC (2400-33600)	Bell103	Bell212A	—	—	—	—
V.34 / V.32bis (4800-14400)	Bell103	Bell212A	—	—	—	—
V.34 / V.32 (4800-9600)	Bell103	Bell212A	—	—	—	—
V.34 / V.22bis (2400)	Bell103	Bell212A	—	—	—	—
V.22[a] (1200)	Bell103	Bell212A	—	—	—	—
V.22[b] (600)	—	—	—	—	—	—
V.23[a] (xmt 75)	—	—	—	—	V.23[b]	—
V.23[b] (xmt 1200)	—	—	—	—	—	V.23[a]
V.23[c] (half-duplex)	—	—	—	V.23[c]	—	—
V.21(75-300)	—	V.21	V.21	—	—	—
Bell212A (1200)	Bell212 A	Bell212A	—	—	—	—
Bell103 (300)	Bell103	Bell103	—	—	—	—

Note: For operations at V.22 600 bps, both modems must be set to 600.

Appendix E

Regulatory Requirements

Telephone Company and FCC Requirements

The following regulations apply to Microcom Access Integrator modems used within the United States and Canada.

FCC rules permit this device to be directly connected to the telephone network via standard jack. Do not use this equipment on a party or coin line.

Malfunctioning equipment may cause damage to the telephone network. If this device is not functioning properly, disconnect it until the problem has been determined and repaired. Otherwise, the telephone company may temporarily disconnect service.

Modem repair can only be carried out by Microcom, Inc. The user is responsible for reporting the need for service to Microcom or to an authorized agent. Service can be obtained by calling:

(781) 551-1313

See your Troubleshooting Guide for information about service.

If you have any problems with your telephone after installing any new device, disconnect the device to see if it is the source of the problem.

The telephone company may change its technical operations or procedures. If such changes affect the compatibility or use of this device, the telephone company is required to provide adequate notice of the changes.

Information Requested by the Telephone Company

If the telephone company requests information about the equipment connected to their lines, tell them:

- the telephone number to which the device is connected
- the ringer equivalence number (REN), found on the FCC sticker attached to the device. The REN determines the number of devices which may be connected to the same telephone number. In most areas, the sum of the RENs of all devices connected to the same line should not exceed five. If too many devices are attached, they may not ring properly.
- the USOC telephone jack required (RJ11, RJ41, or RJ45)
- the FCC registration number (on the FCC sticker attached to the device)

Statements Required by the FCC

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

Canadian Department of Communications Requirements

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

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

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

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

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

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

Canadian EMI Limits

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Index

Numerics

10-bit data characters 3-16
11-bit data characters 3-16

A

Adverse Channel Enhancements A-1
analog loopback 3-19
    local 3-31, 3-40, B-1
    with self-test 3-32, 3-40, B-1
answer
    command 3-9
    dial in mode 3-12
    interval 3-39
    mode 3-40
    modem, multi-protocol capability D-7
    tone register 3-43
answering calls
    manually 3-9
asynchronous mode register 3-43
asynchronous/synchronous time delay 3-43
AT command set 3-1
attention code 3-1
auto-answer 3-37
automatic
    fallback 3-23
    retrain sequence 3-16
    speed matching 3-23
automode timer 3-45
auto-reliable
    buffer 3-11
    fallback character 3-9
    mode 3-13, 3-26

B

backspace character 3-38
Bell 103 D-6
Bell 212A 3-41, D-6
bootstrap
    display 3-33
bps
    rate 3-10, 3-32
    rate adjust 3-21
break
    control 3-22
    ratio 3-28, 3-42
    ratio register 3-42
    transmit 3-10
buffer 3-22
busy-out 3-27
    control by circuit 3-19
    when DTR low timer 3-46

C

carriage return character 3-38
carrier 3-11, 3-32, 3-39, D-1
carrier detect 3-11, 3-15, 3-39, 3-42, 3-44
carrier detect register 3-42
carrier detect response time 3-39
CCITT
    V.21, C-1
    V.22 3-43, C-1
    V.22bis 3-43
    V.22bis, C-1
    V.32, C-1
    V.42 C-1
    V.54 3-31, 3-32, B-2
CCITT/Bell mode 3-10
CD 3-11, 3-15, 3-27, 3-39, 3-41, 3-42, 3-44
cellular connections 3-12, 3-48
changing
    serial port speed 3-17
    value of register 3-37
check parity 3-28
clear serial port speed 3-32
command
    state 3-14
command echo 3-16, 3-40
command line 3-1
command state 3-1, 3-13
commands
    grouped by function 3-2
    issuing 3-1
    prompt 3-1
    state 3-41
    syntax 3-1
    to change registers 3-37
    to read registers 3-37
compression
    control 3-10
    data 3-9, 3-10, 3-21, 3-31, A-1, A-2
compromise equalizer 3-16
configuration
    register 3-30, 3-31, 3-37
    restoring default 3-36
    restoring saved 3-17, 3-33
connect
    message 3-32, D-1
    message delay timer 3-45
    state 3-1, 3-16, 3-26, 3-27
    time 3-31
connection
    security password 3-20
    training timer 3-46
connection security password 3-25
conventions in manual 1-5
CTS 3-15, 3-27, 3-41
    turn on delay timer 3-46

D

data compression 3-9, 3-10, 3-21, 3-31, A-1, A-2
data echo 3-16
data length
    10-bit characters 3-16
    11-bit characters 3-16
DCD command table 3-15
default settings 3-9, 3-17, 3-36
delay for hang up after carrier loss 3-39
delay to DTR 3-43
detect phase 3-21
diagnostics 3-31, 3-32
    power-up 1-2, 3-15

dial tone
    wait for 3-13
dialing 3-11
    alternate stored number 3-12
    delay 3-13, 3-39
    first stored number 3-12, 3-13
    in answer mode 3-12
    in auto-reliable mode 3-13
    in direct mode 3-13
    in LAPM mode 3-12
    in LAPM with fallback to MNP 3-13
    in LAPM with fallback to normal 3-12
    in normal mode 3-13
    in reliable mode 3-13
    manually 3-11, 3-14
    modifiers 3-12, 3-13
    pause before 3-38
    pulse 3-12
    pulse ratio 3-28
    tone 3-12
digital loopback
    local 3-31, 3-40, B-2
    remote 3-31, 3-40, 3-42, B-2
direct mode 3-26, 3-30
directory 3-12, 3-13, 3-14, 3-17, 3-29, 3-36
disconnect buffer delay 3-13
displaying
    configuration register 3-31, 3-37
    stored telephone numbers 3-17
DSR 3-15, 3-27
DTR 3-11, 3-14, 3-41
    control 3-14
    delay to 3-43
    monitor host 3-14

E

echo
    command 3-40
    data 3-16
end test in progress 3-31
ENQ/ACK protocol 3-20
entering
    command state 3-1
    connect state 3-1, 3-27
equalizer
    compromise 3-16
error correction
    LAPM 3-21
    MNP 3-21
escape code
    character 3-38
    guard time 3-40
    sequence 3-1
exclamation point 3-13
extended result codes 3-35

F

factory default settings 3-9, 3-17, 3-36
fallback 3-25, 3-29
    modulation speeds 3-25, 3-29
FCC requirements E-1
firmware
    upload 3-20
    version 3-33
flash 3-13
    memory 3-20
flow control 3-20, 3-26, 3-30
    caution 3-35
    characters 3-45
    hardware 3-15, 3-30
    modem port 3-18
    primary XOFF character 3-45
    primary XON character 3-45
    secondary XOFF character 3-45
    secondary XON character 3-45
    serial port 3-30
    XON/XOFF 3-35
functional command groups 3-2

G

guard time escape code 3-40
guard tone 3-18, 3-42
    register 3-42

H

hang up
    delay 3-39
hardware flow control 3-15
Hewlett Packard ENQ/ACK protocol 3-20

I

identification 3-20
ITU-T
    automode 3-23
    V.21 3-23, 3-43, 3-44, D-6, D-7
    V.22 3-23, 3-41, 3-43, 3-44, D-6, D-7
    V.22bis 3-23, 3-41, 3-43, 3-44, D-6, D-7
    V.23 3-17, 3-43, 3-44
        half duplex 3-43, 3-44
        split speed 3-43
    V.23 half duplex 3-44
    V.32 3-23, 3-43, D-6
    V.32bis 3-23, D-6
    V.34 3-23

J

jack
    connector 3-41

L

LAPM
    connection 3-22
    reliable mode 3-26
leased line 3-43
    register 3-43
LEDs 2-3
line feed character 3-38
link negotiation 3-12
LIU
    LEDs 2-3
local analog loopback 3-31, 3-40, B-1
    by command B-1
local analog loopback with self-test 3-32, 3-40, B-1
    by command B-1
local digital loopback 3-31, 3-40, B-2
long space disconnect 3-41
loopback respond register 3-42
lost carrier to hang up delay 3-39

M

make/break ratio 3-28, 3-42
manual answering 3-9
manual dial command 3-14
manual dialing 3-11
maximum MNP block size 3-9
MNP 3-9, 3-22, 3-24, 3-26, A-1, A-2
    class connect messages 3-24
    result code form 3-33
    Turbo reliable mode 3-19
MNP Extended Services 3-22
modem port
    data length 3-16
    flow control 3-18
    speed 3-10
    testing B-1, B-2
modem registers 3-36

N

normal mode 3-26

O

originate mode 3-12, 3-40

P

parity 3-2
    check 3-28
    option register 3-42
password
    connection security 3-20
    log-on sequence 3-25, 3-27
    logon sequence 3-29
pause
    before dial 3-38
    during dial 3-13
    for dial delay 3-39
perform local digital loopback
    by command B-2
phone directory 3-12, 3-13, 3-14, 3-17, 3-29, 3-36
point to new register 3-37
port
    modem speed 3-10
    serial speed 3-10, 3-17
power level
    cellular 3-25
power-up diagnostics 1-2, 3-15
product code 3-20
prompt 3-1
protocol 3-26, A-1, C-1
    Bell 103 D-6
    Bell 212A D-6
    configuration settings D-6
    speed matrix D-7
    V.21 D-6, D-7
    V.22 D-6, D-7
    V.22bis D-6, D-7
    V.32 D-6
    V.32bis D-6
pulse dialing 3-12, 3-28, 3-34, 3-40

Q

quiet 3-29
quiet answer 3-13

R

reading
    configuration register 3-30, 3-31, 3-37
    modem status 3-31
    stored phone numbers 3-17
redial 3-14
    last telephone number 3-12
register
    change value of 3-37
    display value of 3-37
    read all 3-30, 3-37
    reading 3-31, 3-37
reliable
    connection 3-11, 3-22, 3-33, A-2
    link 3-22, 3-32, 3-33, D-1
    mode 3-26, 3-35
remote access
    request 3-9
remote digital loopback 3-19, 3-31, B-2
    by circuit B-2
    by command B-2
    respond to 3-42, B-3
    with self-test 3-31, B-1
repeat dial 3-14
repeat last command 3-9
request remote access 3-9
reset
    commands 3-36
respond
    to loopback register 3-42
    to remote digital loopback 3-42, B-3
restoring
    factory default settings 3-17, 3-36
    saved configuration settings 3-36
result code form 3-32
result codes
    extended 3-35
    long/short 3-9, 3-32
    MNP 3-33
    on/off 3-29, 3-40, 3-42
retrain 3-16
retrain sequence 3-27
returning
    to command state 3-13
    to connect state 3-1
ring
    counter 3-38
    indicator 3-30
    to auto-answer on 3-37
RTS 3-41

S

saved configuration settings 3-33, 3-36
security
    connection password 3-20
serial port
    CD control 3-11
    clear speed 3-32
    DSR/CTS control 3-15, 3-27
    flow control 3-26, 3-30
    parity 3-2, 3-27
    ring indicator 3-30
    speed 3-2, 3-21
    speed register 3-42
    testing B-1, B-2
single cellular connection 3-12

space parity 3-1
speed 3-2, 3-10, A-1
    protocol matrix D-7
    serial port 3-2, 3-17, 3-21, 3-32
speed matching 3-23
status
    read online 3-31
storing
    a telephone number 3-29, 3-36
    the first telephone number 3-36
synchronous mode register 3-43

T

telephone numbers
    dialing 3-13, 3-14
    dialing (begin range) 3-11
    reading stored 3-17
    storing 3-29, 3-36
test timer 3-41, B-3
timer
    automode 3-45
    busy out when DTR low 3-46
    connect message delay 3-45
    CTS turn on delay 3-46
    V.32/V.32bis 3-46
timer delay
    asynchronous/synchronous 3-43
    DTR 3-43
    false answer abort 3-44
    line turnaround 3-44
    turn CD on 3-44
    V.21 answertone 3-44
    V.21 fallback 3-43
    V.23 answertone 3-44
    V.23 half duplex intercharacter 3-44
    V.23 half-duplex fallback 3-43
    V.23 split speed fallback 3-43
tone dialing 3-12, 3-31, 3-40
transmission mode
    auto-reliable 3-26
    direct 3-26, 3-30
    LAPM 3-26
    normal 3-26
    register 3-43
    reliable 3-26, 3-35
transmit break 3-10
TST indicator 3-16

U

upload
    firmware 3-20
user profile
    store 3-33

V

V.21 3-23, 3-43, 3-44, C-1, D-6, D-7
V.22 3-23, 3-41, 3-43, 3-44, C-1, D-6, D-7
V.22bis 3-23, 3-41, 3-43, 3-44, C-1, D-6, D-7
V.23 3-17, 3-44
    equalizer control 3-28
    half duplex 3-28, 3-43, 3-44
    mode command 3-17
    split speed 3-43
V.24 control register 3-46, 3-47
V.32 3-23, 3-43, 3-46, C-1
V.32/V.32bis connection training timer 3-46
V.32bis 3-23, 3-46
V.34 3-23
V.42 A-2, C-1
V.42bis A-2, C-1
V.54 3-31, 3-32, B-2
V.8 automode 3-23
V.Fast speed command settings 3-18
V.FC 3-23

W

wait
    before dialing 3-13, 3-38
    for carrier after dial 3-39
    for dialtone before dialing 3-39
    for hang up after carrier loss 3-39
    for quiet answer 3-13
writing
    a stored telephone number 3-29, 3-36
    the first stored telephone number 3-36

X

XON/XOFF flow control 3-18, 3-20, 3-35
XON/XOFF pass-through 3-35