



Quad Modem

Network Application Card
Product Reference

Part No. 1.024.1865-00
Version Number 6.0/6.1





Quad Modem

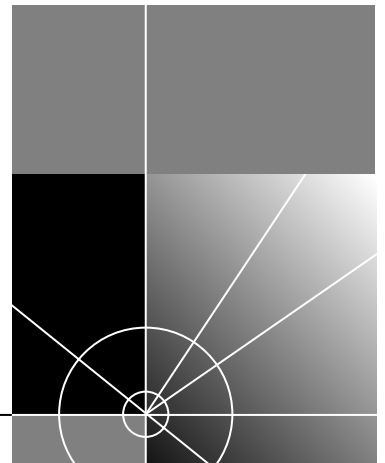
Network Application Card

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Version 6.0/6.1

<http://www.3com.com/>

Part No. 1.024.1865-00



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ABOUT THIS REFERENCE

About This Reference provides an overview of this reference, tells where to look for specific information, how to contact 3Com, and provides document conventions.

This book serves as a reference for the operation of the Quad Modem. Installation instructions, technical specifications, warranty, and regulatory information for the Quad Modem Card Set can be found in the *Quad Modem Getting Started Guides* and on the Total Control Enterprise Network System Documentation CD.



If the information in the release notes shipped with the product differs from the information in this reference, follow the instructions in the release notes.

Finding Specific Information in This Reference

This table shows the location of specific information in this reference.





If you are looking for	Turn to
An overview of the Total Control Enterprise Network System and the Quad Modem Card set.	Chapter 1
Information on what is New This Release, Quad Modem Compatibility, Supported Modem Standards, and x2 / V.90 Technology.	Chapter 2
Information regarding: Standard Analog and Digital Features, T1 and Cellular Features, Hardware Features, Configuration Utilities, Compatibility, and Viewing Help displays.	Chapter 3
Information regarding: Structuring AT Commands, Sending AT Commands to a modem, Issuing commands while online, and Using AT commands to dial, answer, and disconnect calls.	Chapter 4

(continued)

If you are looking for:	Turn to
Information regarding: Inquiry Commands, Monitoring calls, Link Diagnostic Results, Dialed number Identification Service, Automatic Number Identification, and Caller Access Codes.	Chapter 5
Information regarding: Enabling Result Codes, Result Code Groups, Extended Connect Message Indicators, and Additional Options.	Chapter 6
Information on Nonvolatile Random Access Memory and Configuration Templates.	Chapter 7
Information regarding: Remote Access and Link Security features.	Chapter 8
Information including an overview of MNP10 and ETC, using Cellular Templates, and using MNP10 and ETC Cellular Protocols.	Chapter 9
Information covering Fax and Data modes, and how to change them and general Fax guidelines.	Chapter 10
Information on how to check the current software version, how to obtain new operating software, and how to send the new software to the Quad Modem.	Chapter 11
How to change the call control settings using AT Commands.	Chapter 12
How to change the DTE Interface Settings using AT commands and S-Registers.	Chapter 13
Data format requirements and how to change and control link speeds.	Chapter 14
An overview of hardware and software flow control and an explanation of how to change the flow control.	Chapter 15
Information on error control standards and how to change the error control settings.	Chapter 16
Information on data compression and how to enable/disable it.	Chapter 17
Information on how to test the Quad Modem using &T and Register S16, and an explanation of leased line operations.	Chapter 18
Trouble clearing information including possible problems before, during, and after a client connects, as well as information on what to do in the event problems still exist.	Chapter 19
Information on synchronous operation and its requirements.	Appendix A
A listing of Result Codes.	Appendix B
A listing of S-Registers.	Appendix C
A listing of AT Commands (Alphabetically).	Appendix D

Conventions

These tables list conventions used throughout this guide.

Icon	Notice Type	Description
	Information note	Information containing important features or instructions.
	Caution	Information to alert you to potential damage to a program, system, or device.
	Warning	Information to alert you to potential personal injury or fatality. May also alert you to potential electrical hazard.
	ElectroStatic Discharge (ESD)	Information to alert you to take proper grounding precautions before handling a product.

Convention	Description
Commands	<p>The word “command” means you must enter the command exactly as shown in text and press the Return or Enter key. Example:</p> <p>To remove the IP address, enter the following command:</p> <p>SETDefault !0 -IP NETaddr = 0.0.0.0</p> <p><i>This guide always gives the full form of a command in uppercase and lowercase letters. However, you can abbreviate commands by entering only the uppercase letters and the appropriate value. Commands are not case-sensitive.</i></p>
Syntax	<p>The word “syntax” means you must evaluate the syntax provided and supply the appropriate values. Place holders for values you must supply appear in angle brackets. Example: Enable RIPIP by using the following syntax:</p> <p>SETDefault !<port> -RIPIP CONTROL = Listen</p> <p>In this example, you must supply a port number for <port>.</p>
Screen displays	This typeface represents information as it appears on the screen.
Menu commands and buttons	Menu commands or button names appear in italics. Example: From the <i>Help</i> menu, select <i>Contents</i> .
Words in <i>italicized</i> type	Italics emphasize a point or denote new terms at the place where they are defined in the text.
Words in boldface type	Bold text denotes key features.

Contacting 3Com

Call the appropriate toll free number listed below for technical support.



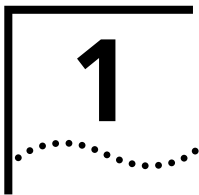
For European countries that do not have a toll free number listed, call +31 30 602 9900.

Country	Toll Free Number	Country	Toll Free Number
Austria	06 607468	Netherlands	0800 0227788
Belgium	0800 71429	Norway	800 11376
Canada	1800 2318770	Poland	00800 3111206
Denmark	800 17309	Portugal	0800 831416
Finland	0800 113153	South Africa	0800 995014
France	0800 917959	Spain	900 983125
Germany	0800 1821502	Sweden	020 795482
Hungary	00800 12813	Switzerland	0800 553072
Ireland	1800 553117	UK	0800 966197
Israel	0800 9453794	United States	1800 2318770
Italy	1678 79489	All Other Locations (Outside Europe)	1847 7976600

Refer to the Total Control Enterprise Network System Documentation CD-ROM for more information regarding product warranty.



For information about Customer Service, including support, training, contracts, and documentation, visit our website at
<http://totalservice.3com.com>



OVERVIEW

This chapter includes:

- Quad Modem Application and Card Set
- Quad Modem Network Application Card
- Quad Modem Network Interface Card
- Quad Modem Software

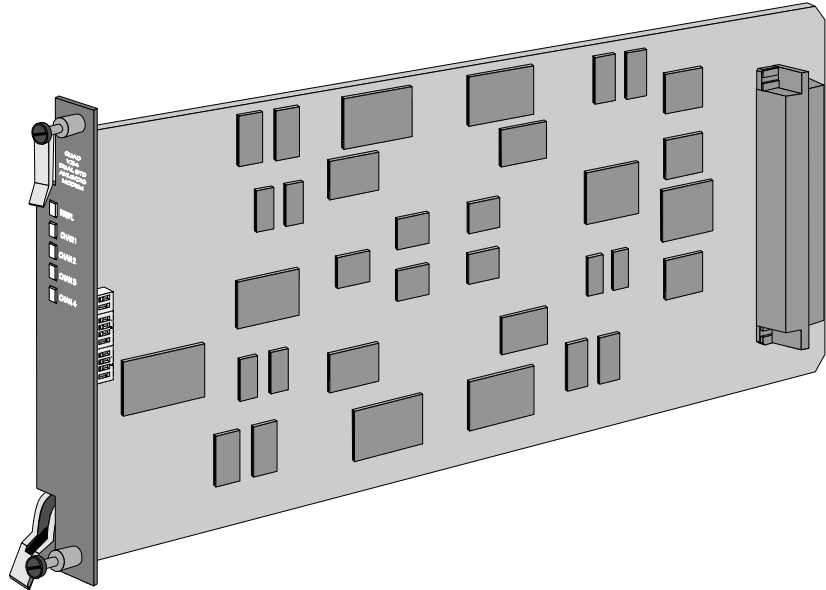
Quad Modem Application

The Quad Modem Card Set for the Total Control Enterprise Network System is designed for large-scale users in high-transaction, diversified data center environments where support for a combination of ISDN and analog remote access applications is required. This system routes ISDN or analog calls over Ethernet, Token Ring, or Frame Relay networks. Other applications include: Managed Remote Access, Dial-in Internet access, On-Demand Lan-to-Lan routing, and graphic and data intensive file transfer.

Quad Modems support connections to the Public Switched Telephone Network (PSTN) via analog lines or digitally through Dual T1, T1/PRI, and E1/PRI Application and Interface Cards. As an option, direct connections are made via the Quad Analog/RS-232 Network Interface Card (NIC). Quad Modems also work with EdgeServer, HiPer ARC, and NetServer Network Application Cards.

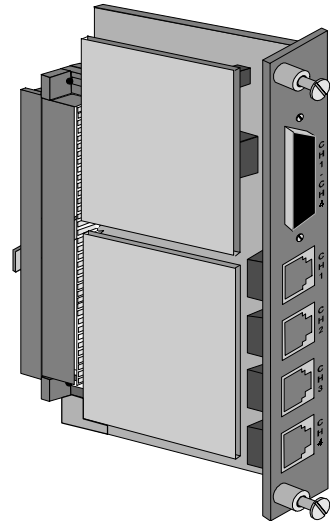
The Quad Modem allows network managers and developers to take full advantage of the versatility and many features offered through the use of Simple Network Management Protocol (SNMP) or other management software. As an integral part of the Enterprise Network System, the Quad Modem benefits from the system's reliable architecture.

Quad Modem Card Set



Features

- x2 / V.90 Technology
- 105 Dial-In Responder
- Programmable DSP Technology
- Quick Connect
- Fax and Cellular Capability
- Dial Security with Dialback
- Flash ROM Software Upgrades
- Feature Groups B and D when used with T1 NAC



**Quad Modem
Network
Application Card**

The Quad Modem Network Application Card (NAC) provides four dial-up modems on a single card. Each modem is capable of supporting V.34 modulation (33.6 Kbps connections possible with another V.34 modem), V.42/ V.42 *bis*, MNP 5 error correction and data compression, x2, V.90, V.110, V.120, X.75, and PPP ISDN and is backward compatible with all lower speed analog modulations.

You can manage the Quad Modems using Total Control Manager, or similar software such as a Management Information Base (MIB) Browser. Total Control Manager, is loaded on a PC (the Management Station) that connects to a particular chassis via a LAN connection.

The Quad Modem is available with three telephone network options:

- Digital only
- Analog only
- Analog/Digital

**Digital Modem
Function**

The Quad Digital and Analog/Digital in digital mode contain a common circuit that provides interfaces to the chassis midplane. The Quad Digital works with channelized T1, T1/PRI, E1/PRI, and E1/CAS NACs to connect to a local network and digital trunks. For example, digital phone line signals are sent directly from the T1 Card via the midplane. The modem can either send its digital signals to an external RS-232 port via a Quad Analog/RS-232 NIC, or can direct data to other application cards such as a Gateway card via the midplane.

The modem also uses Dialed Number Identification Service (DNIS) and Automatic Number Identification (ANI) numbers provided by the public 950 services, Feature Groups B and D, and enhanced 800 services to customize the configuration of the modem prior to answering a call. For example, the dialed phone number can be associated with specific applications, and the same modem pool can be dynamically configured on a call-by-call basis to adjust to the requirements of the application. For additional information, see the *Monitoring and Controlling Calls* chapter.

**Analog Modem
Function**

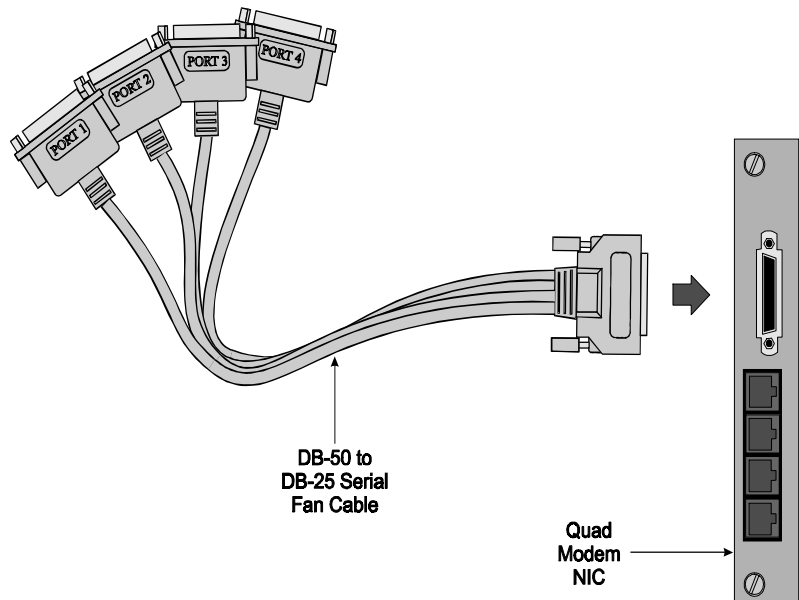
The Quad Analog and Analog/Digital in analog mode accepts analog phone signals via RJ-45 jacks on the Quad Analog/RS-232 NIC. The modem sends data external RS-232 ports on the NIC, or directs the data over the midplane bus to a chassis gateway card.

Quad Analog/RS-232 Network Interface Card

The Quad Modem NAC is compatible with the Quad Analog/RS-232 NIC. The Quad Analog/RS-232 NIC provides the physical interface for four RS-232 analog ports. There is a single 50-pin connector on the rear of the card. A fan-out cable (pictured below) is provided to adapt this interface to standard DB-25/DB-9 RS-232 connectors.

Each RS-232 port supports the full range of RS-232 signals needed for synchronous or asynchronous operation. The ports support operation at speeds up to 115.2 kbps, and provide four serial interfaces for the Quad Modem.

For analog-compatible Quad Modems, there are also four RJ-45 jacks. These are only for the Quad Analog Modem and the Quad Analog/Digital Modem in analog mode.



**Quad Modem
Software**

Each release of the Quad Modem with x2 / V.90 contains two concurrent versions of modem code. Each version of the Quad Modem board (Double Sided (DS) and Single Sided (SS)) has its own modem board architecture and therefore requires its own code; when using DS modem cards, use version 6.0 modem code and when using SS modem cards use version 6.1.

2

QUAD MODEM OVERVIEW

This chapter includes:

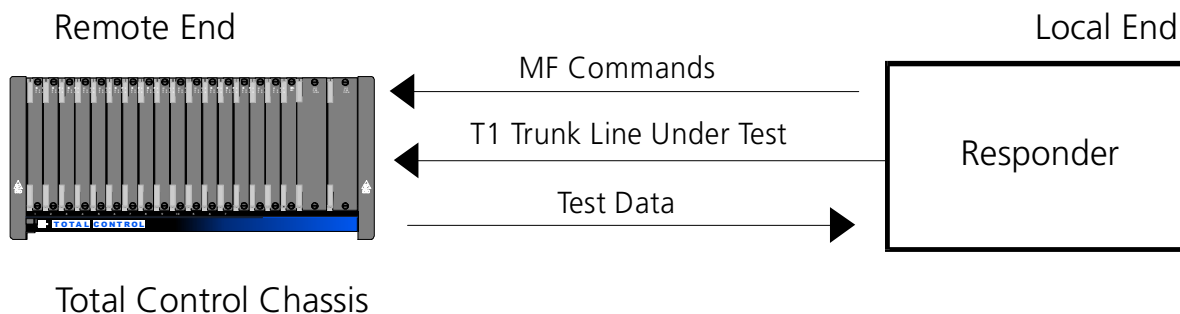
- New this Release
- Compatibility and Supported Standards
- x2 / V.90 Technology / Client and Server Modems

New this Release

Quad Modem 6.0/6.1 with x2 / V.90 has the following new features:

105 Responder Dial-In Functionality

The following diagram shows the mode in which the standard 105 Responder test operates from the responder unit to the chassis.



Follow these steps to enable the 105 Responder Dial-in test:

- 1 From the **Fault** menu, select **Remote Testing, Responder Test(s)**, and finally select the **102/105 Dial-Out** or **105 Dial-In** test.
- 2 If you are dialing out, enter a dial string and click the **Start** button. If you are dialing in, simply click the **Start** button.



The test is preformed at the modem level, not the card level.

To support dial-in functionality for the 105 Responder, the Quad Modem acts as a terminating responder instead of a director initiating calls.

Integrated Services Digital Network Auto-Detect

The following changes help improve Integrated Services Digital Network (ISDN) connect times:

- Fast ISDN connect times and improved compatibility.
- The V.110 detection is now done in parallel with High-level Data Link Control (HDLC) detection for faster V.110 connects.
- Better handling of non byte-aligned V.110 frames for increased compatibility.
- 56k/64k answer-mode rate detection has been improved to increase the chances of connecting at 64k with 3Com Courier I modems.

AB8000 TRAX Fast Train V.22/V.22 bis

This feature minimizes the time required for a modem to train in a transaction environment.

The Quad Modem supports the Fast Train feature of the Primary Access AB8000. This training sequence for V.22/V.22bis modulations provides very rapid mutual acquisition of level, timing, and carrier for calls over the Public Switched Telephone Network (PSTN).

The Quad Modem automatically determines if the call is a standard V.22 or V.22 *bis* call or a Fast Train call, so no configuration registers are required. To use this feature, it is recommended that the modem be configured for V.8 disabled, Bell answer sequence with a billing delay as short as possible and Automatic Retransmission reQuest (ARQ) disabled.

Bidirectional Connection Trap Enable and Reporting Objects

Four inbound and four outbound trap enable and reporting objects provide separate statistics for dial-in calls versus dial-out calls are now implemented.

Two new indicators are present to control these events from Total Control Manager: Enabling/Disabling Inbound/Outbound Call Fail Trap sends a corresponding message to the Quad Modem enabling/disabling a modem event accordingly.

**Data Over Voice
Bearer Service**

Data Over Voice Bearer Service (DOVBS) for Primary Rate Interface (PRI) and analog calls is now implemented. DOVBS is a technique allowing ISDN calls over a voice channel. New registers are S68.1 and S68.2, and new objects are implemented as well.

**Dual Tone
Multi-Frequency**

The Quad Modem supports the ability to collect Dual Tone Multi-Frequency (DTMF) tones sent from a client device. This feature transfers DTMF tones to a software application running either as part of the chassis, or as an application sitting outside of the chassis on the LAN. Communication occurs through either the packet bus or an RS-232 connection.

Activate this feature is by sending ATH1 command when receiving a call followed by AT%T. Three beeps can be sent to alert the caller to send the DTMF digits by setting S-Register 72.2=1. The AT%G command can be used to indicate the DTMF termination character.

Bell 208 Performance

Bell 208 performance and compatibility is improved as follows:

- A nine-phase detector is now implemented enabling the Quad Modem to quickly detect loss of carrier for faster line turnarounds. This change enables a connection to a problem Bell 208 Device.
- Quad Modem ensures capability of quick trains (within 50mS) and decreased error counts.
- Multi-mode training sequence falls back to Bell 208 for &M1 using normal sync, bisync, and High level Data Link Control (HDLC). This feature is enabled with S-Register 31.0=1
- Users can dial out using Bell 208 MultiMode training in V.25 *bis* mode.

Leased Lines

The Quad Modem now supports leased line and synchronous modes when the modem is on the packetbus as well as RS-232.



The leased line feature has been developed for a customer-specific feature request. 3Com's System Test Group did not test this feature, but the intent was to test it at the customer site. Before deploying this feature in a production network, users should fully test the functionality in a lab or controlled environment.

Updating Operating Modems

The Quad Modem, managed by a Total Control chassis, is capable of enabling and disabling events during an established call.

Point-to-Point Protocol Upgrade

The Quad Modem will automatically set *U1=3 (PPP) instead of the previous *U1=1 (V.120) for the default digital protocol for outbound ISDN calls. The Quad will only do this once when first downloading the new code. The AT&F command will not affect *U1 setting.

Updated Objects for Speed Changes

Quad Modem includes two new objects that indicate every speed shift or retrain for all modulations. These objects are minimum and maximum data rates per dial-up session. These objects are single byte enumerations, available on a Total Control Manager query and are included in the call termination event.

ZyXEL to Answer V.120 and X.75 Quad Calls

S-Register 68.3 enables and disables the Lower Layer Control (LLC) Information Element (IE) message for HDLC protocols. This feature enables the ZyXEL modem to connect successfully with V.120 and X.75 calls originating from the Quad I-Modem International.

European Dial Plan

The Dual PRI (E1) card set supports the European dial plan by handling phone numbers containing up to 25 digits. The Quad Modem also supports the European dial plan by communicating and displaying these extended digit strings.

Compatibility

The Quad Modem NAC is compatible with the Quad Modem NIC.
The Quad Modem NIC is compatible with the Quad Modem NAC
(Single-sided and Double-sided).

Supported Modem Standards

High speed Quad Modems adhere to the following standards, ensuring compatibility with a wide base of installed modems.

Standards	Functions
ITU-T V.90	<ul style="list-style-type: none"> 56K, 54.6K, 53.3K, 52K, 50.6K, 49.3K, 48K, 46.6K, 45.3K, 44K, 42.6K, 41.3K, 40K, 37.3K, 34.6K, 33.3K, 32K, 30.6K, 29.3K, and 28K, asynchronous, Pulse Coded Modulation (PCM) 33.6K to 4800 bps, asymmetrical, V.34 backchannel

Standards	Functions
U.S. Robotics x2	<ul style="list-style-type: none"> ■ 57.3K, 56K, 54.6K, 53.3K, 52K, 50.6K, 49.3K, 48K, 46.6K, 45.3K, 44K, 42.6K, 41.3K, 40K, 38.6K, 37.3K, 36K, 34.6K, 33.3K, 32K, 28K, 26.6K, and 25.3K, asynchronous and asymmetrical, Pulse Coded Modulation (PCM) ■ 31.2K to 4800 bps, asymmetrical, V.34 backchannel
ITU-T V.34	33.6K, 31.2K, 28.8K, 25.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200, and 4800 bps, synchronous/asynchronous, Trellis Coded Modulation (TCM)
V.Fast Class	28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K bps, synchronous/asynchronous, Trellis Coded Modulation (TCM)
U.S. Robotics V.32 <i>bis terbo</i>	<ul style="list-style-type: none"> ■ 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200 bps asynchronous, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200 bps synchronous, Trellis Coded Modulation (TCM) ■ 4800 bps, synchronous/asynchronous, Quadrature Amplitude Modulation (QAM)
U.S. Robotics High Speed Technology (HST--Dual Standards Only)	16.8K, 14.4K, 12K, 9600, 7200 and 4800 bps, asynchronous, asymmetrical, 450 bps back channel with automatic handshake adjustment to 300 bps, Trellis Coded Modulation (TCM), Quadrature Amplitude Modulation (QAM)
U.S. Robotics HST	Error control for HST modulation only
ITU-T V.32 <i>bis</i>	<ul style="list-style-type: none"> ■ 14.4K, 12K, 9600, 7200 bps, synchronous/asynchronous, Trellis Coded Modulation (TCM) ■ 4800 bps, synchronous/asynchronous, Quadrature Amplitude Modulation (QAM)
ITU-T V.32	<ul style="list-style-type: none"> ■ 9600 bps, synchronous/asynchronous, Trellis Coded Modulation (TCM) ■ 4800 bps, synchronous/asynchronous, Quadrature Amplitude Modulation (QAM)
ITU-T V.22 <i>bis</i>	2400 bps, synchronous/asynchronous, Quadrature Amplitude Modulation (QAM)
ITU-T V.22	1200 bps, synchronous/asynchronous, Differential Phase Shift Keying (DPSK)
ITU-T V.23	1200 bps, asynchronous, asymmetrical (1200/75 bps), Frequency Shift Keying (FSK)
ITU-T V.21	300 bps, asynchronous, Frequency Shift Keying (FSK)

Standards	Functions
Bell 208B	Bell 208B, 4800 bps, synchronous, Quadrature Amplitude Modulation (QAM)
Bell 212A	1200 bps, synchronous/asynchronous, Differential Phase Shift Keying (DPSK)
Bell 103	300 bps, asynchronous, Frequency Shift Keying (FSK)
V.25 <i>bis</i>	Synchronous
ITU-T V.42	Error control protocol for modulations, 1200 bps and higher, V.22, V.22 <i>bis</i> , Bell 212A, V.32, V.32 <i>bis</i> , V.32 <i>terbo</i> , V.FC, x2, and V.90
ITU-T V.42 <i>bis</i>	Data compression, 1200 bps and higher, for modulations V.22, V.22 <i>bis</i> , Bell 212A, V.32, V.32 <i>bis</i> , V.32 <i>terbo</i> , V.FC, x2, and V.90
MNP 2-4	Levels 2, 3 and 4 error control protocol, 1200 bps and higher, for modulations V.22, V.22 <i>bis</i> , Bell 212A, V.32, V.32 <i>bis</i> , V.32 <i>terbo</i> , V.FC, x2, and V.90
MNP 5	Level 5 data compression, 1200 bps and higher, for modulations V.22, V.22 <i>bis</i> , Bell 212A, V.32, V.32 <i>bis</i> , V.32 <i>terbo</i> , V.FC, x2, and V.90
ITU-T V.8	International standard protocol negotiating procedure. Supersedes V.25 and Bell answer sequences. Required for V.34, x2, and V.90.
ITU-T V.25	International standard answer sequence. Used to negotiate V-series modulations such as V.22, V.32, and V.32 <i>bis</i> . Contrasted with the Bell answer sequence which is used for Bell 103, Bell 212, and HST.
ITU-T V.54	Digital and remote digital loopback testing, analog loopback testing (Analog modems only)



Quad Analog and Quad Digital are supported by the same firmware.

Supported Cellular Standards

Modems with cellular support will negotiate for either of two cellular protocols: ETC and MNP10. These protocols are designed to combat a variety of link establishment and data transfer problems specific to cellular calls.



Cellular features are available only if cellular support has been purchased with the Quad Modem card or through the chassis Network Management Card (NMC). For information on the purchase of cellular support, please contact a sales representative. Quad Cellular Analog and Digital Card are supported by the same firmware.

Protocols	Functions
AT&T ETC	Cellular protocol for enhanced throughput across cellular links (cellular modems only)
MNP10	Cellular protocol for transmissions across cellular links (cellular modems only)
MNP10EC	Error correction protocol in cellular technology



For additional information on cellular operations, see the Using Microcom Networking Protocol 10 and Enhanced Throughput Cellular Protocols chapter.

Supported Fax Standards

Quad Fax modems provide Group III compatibility when combined with a Class 1 or Class 2.0 Fax software package, and support the following standards.

Standards	Functions
TIA/EIA-578	Service Class 1 Asynchronous Facsimile DCE Control Standard
TIA/EIA-592	Service Class 2.0 Asynchronous Facsimile DCE Control Standard
ITU-T V.17	14400/12000 bps
ITU-T V.29	9600/7200 bps
ITU-T V.27 <i>terbo</i>	4800/2400 bps
ITU-T V.21	300 bps



For additional information on faxing, see the Fax Capability chapter.

x2 / V.90 Technology

What is x2 / V.90? x2 / V.90 technology is a transmission technique based on “encoding” rather than “modulation” allowing for transfers up to 56K.

How x2 / V.90 Works x2 / V.90 technology enables analog modems to receive data at up to 56K over the standard analog, Public Switched Telephone Network (PSTN). x2 / V.90 overcomes the theoretical limitations imposed on standard, analog modems by exploiting the digital connections that most Internet and online service providers use at their end to connect to the PSTN.

The Shift from Analog to Digital Circuits When the first phone networks were established, they were completely analog. Over time, telephone companies began replacing portions of their original analog networks with digital circuits, which provided a higher telephone signal quality at a lower price.

Today, almost the entire PSTN is digital. Typically, the only analog portion of the phone network that remains is the phone line that connects a home to the telephone company's Central Office (CO). The rest of the telephone network is digital.

Speeds up to 56 kbps The Quad with x2 / V.90 allows Internet browsing and downloads over analog telephone lines at speeds up to 56 kbps.

How to Tell if x2 / V.90 is Enabled on the Quad Modem To see if x2 / V.90 is enabled on the Quad Modem, use the **ATI7** command to display product configuration information. If x2 is enabled the Quad Modem displays x2 / V.90 under the options listing.

Activating x2 / V.90 To activate x2 / V.90, a feature-enable key must be purchased through your sales representative.

Disabling x2 / V.90 To control general x2 operation, including disabling, use S-Register 76. For a complete description of S76, see the *S-Registers* appendix. To disable V.90 use S-Register 81=32. S-Register 82 sets the transmit level for V.90.

Controlling x2 Use the following commands to configure x2.

Command	Function
ATS74	Control the low-speed direction minimum speed
ATS75	Control the low-speed direction maximum speed
ATS76	Control general x2 operation
ATS77	Control the low-speed channel of asymmetric connections
AT&N	The upper speed limit of an x2 connection
AT&U	The lower speed limit of an x2 connection



For a complete description of S-Registers 74–77, see the S-Registers appendix.

Making x2 / V.90 Work

If an Internet Service Provider (ISP) or online service uses x2 technology, the following conditions must exist on a phone line so x2 operates properly:

- The ISP or online service must have a digital connection to the PSTN. Most major online services have digital connections to the PSTN.
- Only one digital to analog conversion in the phone network between the x2 server modem and the client's Digital to Analog Converter (DAC) is allowed.

Client and Server Modems



Quad Modem 6.0/6.1 may function as a server modem. The Quad Modem does not support client mode.

Client Modems

Client modems receive data over analog telephone lines at speeds up to 56 kbps and send data at speeds up to 33.6 kbps. The following modems are examples of client modems:

- U.S. Robotics V.Everything
- Sportster 56K

Client Modem Requirements

The following item is required to operate a client modem: analog telephone line.

Server Modems The Quad Modem is an x2 *server* modem. Server modems send data to analog x2 client modems at speeds up to 56K. The following modems are examples of server modems:

- Courier I-modem
- HiPer DSP
- Quad Modem
- MP I-modem

Server Modem Requirements The following items are required to operate your Quad Modem 6.0/6.1 in server mode:

- T1 line and T1 Card **or** PRI line and PRI Card
- Total Control chassis



A gateway card, such as the HiPer ARC, is required when routing to another Local Area Network.

Also, a T1 or PRI card set is necessary when using a T1 or PRI configuration.

3

QUAD MODEM FEATURES AND CONFIGURATION

This chapter includes:

- Standard Modem Features
- Analog Only Features
- Digital Only Features
- T1 Features
- Configuration Utilities
- Light Emitting Diodes and Dual Inline Package Switches

Standard Modem Features

The Quad Modem provides four modems on a single card. It is designed for use in the Total Control chassis. Each modem contains the following analog features:

Selective Reject

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

When Selective Reject is active, only the frame containing the error is resent, instead of the frame plus all of the following unacknowledged frames. S-Register 51.6 will disable Selective Reject.

Analog Fax/Modem Calls

The Quad normally operates in data mode, but it can also operate in fax mode. You can configure the Quad to detect fax or data calls by configuring Fax Auto Answer.

Error Control–V.42/ Microcom Networking Protocol

Data integrity is ensured when the Quad Digital connects with remote devices that use the V.42 (LAPM), High Speed Technology (HST), or Microcom Networking Protocol (MNP) error control protocols. Error control is available on analog calls at 1200 bps and above.

Data Compression–V.42bis/ Microcom Networking Protocol 5

Data compression enables potential throughput of up to 115.2 Kbps on analog 28.8 Kbps connections. Quad Digital Modems connecting under V.42 or HST error control use V.42 *bis* compression. Quad Digital Modems connecting under MNP error control use MNP Level 5 compression. Typically, files can be compressed from 2:1 to 4:1.

V.Everything

The Quad Modem provides full support of the V.34 standard, V.Fast Class, V.32 *terbo*, and many other modulation schemes, spanning the range of speeds between 33.6 Kbps and 300 bps. This unique combination of abilities is called V.Everything.

Flash ROM Upgradability

Quad Modems are software-upgradable using PCSDL or Total Control Manager file transfers, allowing quick, easy access to update the Quad's technology. For additional information, see the *Upgrading Quad Modem Software* chapter.

Dial Security

The Quad Modem's dial security functionality is part of its operating software, which allows controlled access at a modem-to-modem level instead of software running on a host computer.

With Dial Security, unauthorized access to a system is avoided using password prompting and dial back.

Remote Configuration and Diagnostics

The Quad Modem can be remotely configured and tested both from the console interface, using Telnet, and from an Simple Network Management Protocol (SNMP) graphical user interface, such as Total Control Manager. When supporting remote users, this feature saves time and money.



If using Telnet to access the console interface, avoid the following:

- Entering **atz** and changing RS-232 settings
- Using S-Register 71

If using SNMP, the Network management card will overwrite all command line interface commands / console interface commands.



For more information about using Telnet, refer to the HiPer Access Routing Card Product Reference.

Adaptive Speed Leveling

Quad Modems monitor line conditions while connected, and fall back to the next lower speed—for example, 19.2 K, then 16.8 K in V.32 *terbo* mode—if conditions are poor. Quad Modems also detect improved line conditions and step forward to the next higher speed. Transmit and receive channels adapt independently, each detecting and adjusting to line conditions.

Fax Support

When used with Fax capable communications software, the Quad Modem auto-detects and responds to calls from modems and Group III Fax machines, using Electronic Industries Association (EIA) standard Class 1 or 2.0 Fax software.

Synchronous Support

The Quad connects to synchronous serial ports to allow access to mini- and mainframe computers. For additional information, see the *Synchronous Operations* appendix.

Link Diagnostics

After each call, link diagnostics appear including information about the last call, the number of data characters transferred, line statistics, the call's rate, and the reason the call disconnected.

Modem Configuration Restoration

This feature, now available via AT commands, restores the Non-Volatile Random Access Memory (NVRAM) settings using the AT&F7 command in place of the ATZ command. The ATZ command should not be used when Network Management Card or NETServer cards are present in the chassis.

Dual Tone Multi-Frequency

This feature previously worked on the Plain Old Telephone Service, but it now works on T1 and Primary Rate Interface as well. Using the AT%T command you can configure the Quad to detect DTMF digits, which user application software can use for identification, custom routing, and reconfiguration. Using S-register 72.2, you can configure the Quad to prompt the user to enter the DTMF digits. And, using AT%G, you can configure the Quad to display a termination character. Also, in T1 or PRI mode, the Quad will generate a **D** tone for the user when it has collected all the digits.

Full Support for AT Commands from Gateway Cards

The modems now support the complete use of AT commands from across a gateway card.

Telnet Call Progress and Connect Messages

When dialing from a telnet terminal connection (ATDT...), the modem returns call progress and connect messages, such as RINGING, BUSY, NO ANSWER, and CONNECT.

Transmitter Level Adjustment

This function sets the decibel level of the modem's transmitter. This function is not available in all countries or may be restricted on the range. Also, you can set the following modulation levels:

- Various analog levels (use S-register 39)
- x2 level (use S-register 76.7)
- V.90 level (use S-register 82)

Analog Only Features**56 Kbps Connectivity**

The Quad contains software that enables 56 K connection rates, as well as improves throughput at lower speeds. While line conditions may not always allow for 56 K connections, the new software makes it more likely that the Quad will achieve and maintain 33.6 Kbps connections.

Testing

The Quad is capable of performing ITU-T V.54 analog loopback tests. For additional information, see the *Modem Testing/Leased Line Operations* chapter.

Dedicated and Leased Line Support

The Quad does not need to be connected to the PSTN. A connection made to a standard telephone cable between the Quad and another modem will allow connections without even dialing. The Quad is also capable of being connected to a leased line from the telephone company. For additional information, see the *Modem Testing/Leased Line Operations* chapter.

Modem Indicate/Modem Indicate Closure

Modem Indicate/Modem Indicate Closure (MI/MIC) support. This feature only applies to installations using an external dialer on a PBX. It requires a Quad Analog/Digital Network Interface Card (NIC).

Digital Only Features

Integrated Services Digital Network Terminal Adapter

The Quad Digital is an ISDN terminal adapter; it enables a computer to communicate on the ISDN at speeds of up to 64 kbps. The Quad supports V.120, X.75, PPP, V.110, and Clear Channel protocols.



The Quad does not support the complete PPP protocol stack, it only recognizes the protocol in automode and then sends the PPP signal to the Netserver, which handles the PPP protocol stack. Also, for a faster connection, the Quad handles the ACCM escaping if PPP offloading is enabled on the NETServer.

Dialed Number Identification Service and Automatic Number Identification

This is digital only with a T1 Card. With Primary Rate Interface, the modem receives the Called Party Number, which is essentially the same thing except sent in a Q.931 message as opposed to T1 MF signaling.

Rate Adaptation

The Quad supports the V.110 protocol, and therefore, it can map slower-speed asynchronous data to the 64 Kbps B-channel. The supported V.110 rates include 600, 1200, 2400, 4800, 9600, 19200, and 38400 bps. The supported RS 232 DTE rates include 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps. If used with NETServer, the V.110 DTE originate rate can be set with the %B command.

Incoming Call Support

The Quad modems support dial-in and dial-out for multiple PRI cards.

A-Law and mu-Law Support

The Quad supports both A-Law and mu-Law on T1 and PRI lines. Also, the modems no longer need to be configured for A-Law or mu-Law if the PRI card is properly configured—the modems will automatically switch with each incoming or outgoing call.

T1 Features (Digital and Analog/Digital Models)

- T1 interface with chassis T1 Application Card.
- Modem initialization string and DNIS/ANI code storage (3 sets).
- Digital Signal Level 0 (DS0) busy out.
- ANI/DNIS code dependent modem configuration.
- Supports ground start and loop start supervision and E and M, Type 2.

Configuration Utilities



3Com recommends using Total Control Manager to configure, save, and monitor most settings of the Total Control modem cards, HiPer DSP and Quad Modem. Use the console interface when directed.

Total Control Manager

Simple Network Management Protocol is a protocol used in network management. Network administrators use SNMP to manage Total Control chassis. It could also control any other network devices by any other manufacturer that uses SNMP.

Total Control Manager is a graphical user interface (GUI) you can use to manage a Total Control system. Total Control Manager is an application that simplifies management (similar to how Windows is simpler than DOS for managing a PC). The Total Control Manager application is based on SNMP commands, but it presents an English GUI with easily understood words instead of cryptic protocol words.

Management Information Base Browser

A Management Information Base (MIB) browser is a software application that performs a function similar to Total Control Manager. Common MIB browsers include HP OpenView, SunNet Manager, and SNMPc.

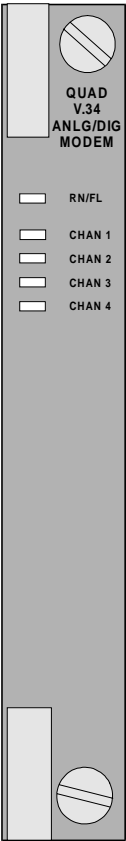
Console Interface

You can configure, monitor, and test individual cards (e.g. Quad Modem) from their respective console interface. Two common programs to use for this are HyperTerminal and Telnet (from both local and remote locations).

The following table includes information about the Quad Modem management tools:

If you want to configure	With System	Use
Modems using MIBs or Span lines using MIBs	Are using Windows 3.1, Windows 95/NT, or UNIX	Total Control Manager/SNMP software or MIB browser
Modem using CLI or Span lines using a CLI	Any operating system	Console Interface in conjunction with your preferred terminal program (such as HyperTerminal)

Light Emitting Diodes

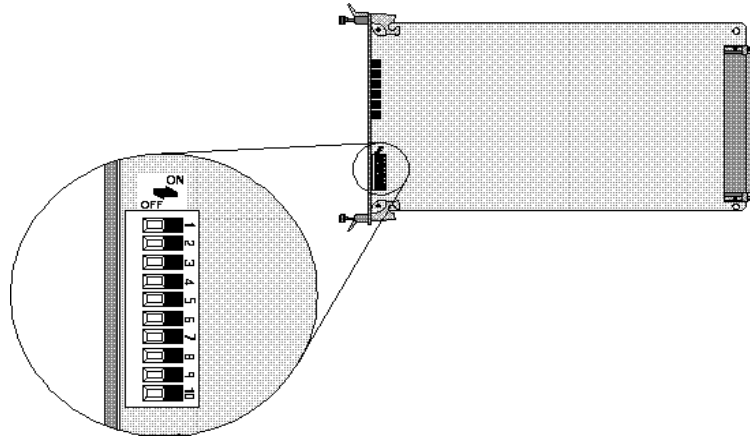


Light Emitting Diodes (LED)s display the current status of the Quad Modem.

LED	Displays status of:	Color:	Event Occurring:
RN/FL	The entire modem card	Green	The modem card is operating normally
		Flashing green	The modem card is testing/ SDL
		Red	The modem card has a critical failure
CHAN 1-4	Individual modems 1-4	Off	Modem is idle
		Orange	Modem is off hook/ training
		Green	Modem is online
		Red	Modem has a critical failure

Quad Modem Faceplate

Dual Inline Package Switch



Dual Inline Package (DIP) Switches provide the basic configuration for the Quad Modem. The following table describes the function of each switch.

Switch	Function	If set to Off	If set to On	Default	Effective
1	Data Terminal Ready (DTR) Operations	Computer must provide DTR signal for modem to accept commands; dropping DTR terminates a call	DTR always On (Override)	Off	Always
2	Verbal/Numeric Result Codes	Verbal (word) results	Numeric results	Off	DIP Switch 3 is set to On
3	Result Code Display	Results suppressed (quiet mode)	Results enabled	Off	Always
4	Command Mode Local Echo	Keyboard commands displayed	Echo suppressed	On	Always
5	Auto Answer	Modem answers on ring specified by S0	Auto answer disabled	Off	Always

Switch	Function	If set to Off	If set to On	Default	Effective
6	Carrier Detect (CD) Operations	Sets CD on when it connects with another modem, drops CD on disconnect	CD always On (Override)	Off	Always
7	Auxiliary	Result codes in Originate and Answer mode	Result codes in Answer mode disabled	Off	DIP Switch 3 is set to On
8	AT Command Set Recognition	Command recognition disabled (Dumb mode)	Recognition enabled (Smart mode)	On	Always
9	Escape Code (+++) Response	Modem hangs up, returns to Command mode, sends NO CARRIER result	Modem maintains connection, returns to Command mode, sends OK result	On	DIP Switch 8 is set to On
10	Power-on and Reset Defaults	Load from NVRAM	Load fail-safe default configuration template from ROM (AT&F0)	Off	Always



To change DIP Switches, remove the Quad Network Application Card from the chassis, locate the switches, and use a ball point pen or the end of a paper clip to move the switch to either the on or off position.

4

USING AT COMMANDS

This chapter includes:

- Structuring AT commands
- Sending AT commands to a modem
- Viewing Help
- Issuing commands while online
- Using AT commands to dial, answer, and disconnect calls

Overview

What is an AT Command?

AT is short for Attention, and the AT Command Set is a language enabling a terminal emulator such as HyperTerminal to “talk” to the modem directly using commands entered by the operator. An AT command is comprised of the prefix AT and a specific command such as H1 (takes the modem off hook).



The following guidelines apply to all AT commands, except where noted otherwise. For a complete list of AT Commands, see the AT Command appendix.

AT Command Overview

All modem commands must include the AT prefix—except for the following: +++, A>, and AV.

- A command string may be a maximum of 56 characters.
- Commands may be typed in upper (AT) or lower case (at), but not a combination of both. This only applies to the AT portion of the command. All letters following the AT command are not case sensitive. For example, ATH1 and AT h1 will both produce an OK response.

- Missing parameters are assumed to be zero (ATH is equivalent to ATH0).
- A valid command receives the OK response. The ERROR response indicates an invalid command or parameter.

Using S-Registers

S-Registers are addresses of places in memory where various timing parameters, redefinitions of selected ASCII characters, and other configuration settings are stored.

Initially, the S-Register settings are set to default, but as with any setting stored in NV-RAM, you can overwrite an S-Register's stored value.



For a complete list of all S-Registers, see the S-Registers appendix.

Configuring S-Registers

To configure S-Registers, use the following syntax:

ATS<r>=<n>

Where <r> is the S-Register number and <n> is a value.

Example

To set the number of rings to answer a call in Auto Answer mode to three, enter:

ATS0=3

Displaying S-Register Settings

To display the setting of an S-Register such as S0, enter the following command:

ATS0?

The Quad Modem displays 000 or the number set for that particular S-register.

Configuring
Bit-Mapped
S-Registers

Some registers are bit-mapped 0-7. These bit maps have corresponding values shown in the table below. The user is able to view the bit value of an S-Register or turn On or Off a register or its individual bits.

Bit	Value
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128

Turning Bits On and Off

Bit-mapped S-registers are changed in one of two ways:

- Select the bit(s) to turn On and set the S-register equal to the total of the values in the Value column.
- Set the bits to On (1) or Off (0)

Procedure 1: To turn On one or more bits in any bit-mapped register use the following syntax, where <r> is the S-Register number and <v> is the total value of the bits to be turned On. All other bits will be off.

Syntax **ATS<r>=<v>**

Example To turn On bits 0 (value=1), 2 (value=4), and 5 (value=32) of S-Register 47, enter:

ATS47=37

Procedure 2: To turn a bit On or Off, use the following syntax, where <r> is the register number, is the bit number and x equals either 1 for On or 0 for Off.

Syntax **ATS<r.b>=<x>**

Example To turn On bit 3 of S-Register 27, enter:

ATS27.3=1

To turn Off bit 3 of S-Register 27 use =0(zero) instead of =1.

Procedure 3: To turn On or Off multiple bits manually (not adding the values together), use the following syntax. Where <r> is the register number, is the bit number.

Syntax **ATS<r.b>=1 <.b>=1**

Example To turn On bits 0, 2, and 4 of S-Register 13, enter:

ATS13.0=1 .2=1 .4=1

To turn Off these bits, use =0(zero) instead of =1.

Procedure 4: To turn On or Off all the bits in a register, use the following syntax, where <r> is the register and <n> is either 0 (all bits Off) or 255 (all bits On).

Syntax **ATS<r>=<n>**

Example To turn On all bits of S-Register 27, enter:

ATS27=255

Example Turn Off all bits of S-Register 27, enter:

ATS27=0

Displaying S-Register Bit Values

To display the number of bits enabled for a specific bit-mapper S-Register, use the following syntax, where <r> denotes the register number. If 000 is displayed, all the bits are disabled. If 255 is displayed, all the bits are enabled.

Syntax **ATS<r>?**

Example To display the bit value of S-Register 34, enter:

ATS34?

The Quad Modem displays any combination of the values corresponding to individual bits, depending on which bits are turned On and Off.

Example To display the status (On or Off) for an individual bit of S-Register 27, enter:

ATS27.3?

The Quad Modem either displays a 1 for On or 0 for Off.

Sending Commands to the Modem

- Setup** To use AT commands, an EIA RS-232 serial connection must be established with the modem. To establish an EIA RS-232 connection:
- 1 Attach the fan-out cable (included with the NIC) to the DB-50 connector on the back of the NIC (the NIC must be installed in the slot directly behind the Quad Modem). It provides RS-232 ports 1–4 for the corresponding modems at channels 1–4.
 - 2 Connect the COM port of a terminal or a PC running a terminal emulation program (or a communications program in terminal mode) to the corresponding connector on the fan-out cable using an EIA RS-232 cable. Be sure the terminal or terminal emulation program is properly configured.

Example If using Com1 on the PC, connect Com1 to the fan-out cable.



Most communications programs send an initialization string to the modem when the program is loaded. Remove the software's initialization string so it does not interfere with the modem's power-on defaults.

- Typing Commands** After establishing a terminal session with the modem, type **AT** and press **Enter**. If you do not see the command on the screen as you type or the OK reply from the modem after pressing Enter, the modem's settings may need to be adjusted.
- To see AT commands as they are typed, Enable Command mode Local, Echo, or Local Echo, (ATE1).
 - To see the OK reply from the modem, enable Result Codes (ATQ0).

When sending commands to a modem, these options are available:

- 1 To see commands as they are typed and view result codes, temporarily enable local echo and result codes by entering:

ATE1Q0

- 2 Disable local echo and result codes by resetting the modem or by entering:

ATE0Q1



The En and Qn commands cannot be saved to NVRAM. Use DIP Switches 3 and 4 on the modem card to change local echo and result code defaults. DIP Switch 4 is factory set to suppress local echo (On) and DIP Switch 3 is factory set to suppress result codes (Off), as these functions sometimes interfere with DTE operations in dial-up applications.

Viewing Help Displays

Quad Modems provide six help or command-summary displays: the Basic AT command set, the Ampersand (&) command set, the Percent (%) command set, the S-Registers (S), the Asterisk(*) command set, and the Dial command options (D).



Help displays are not available when the Quad is in synchronous modes &M1, &M6, or &M7.

See the next page for a list of the help commands and functions.

This table provides the command to display each Help Screen:

Help Display Commands	Function
AT\$	Displays Basic Command Set
AT&\$	Displays Ampersand Command Set
AT\$S	Displays S-Register Command Set
AT%\$	Displays Percent Command Set
AT*\$	Displays the Asterisk Command Set
ATD\$	Displays the Dial Command Set

Issuing Commands While Online

Online command mode allows AT commands to be issued while the modem is connected to another modem or DCE. Two ways to enter online command mode are by using the escape code (+++) or by toggling Data Terminal Ready (DTR) with off-line mode.

Placing the Modem in Online Command Mode

Using the Escape Code

When DIP switch 9 is On, enter the escape code (+++) to set the modem in online command mode. When DIP switch 9 is off, enter +++ for the modem to disconnect the call. Precede and follow the escape code by a guard time of at least one second of no data transmission. Do not use the AT prefix or press Enter.

If necessary, change the character used in the escape code (S-Register 2), or the guard time (S-Register 12).



The modem ONLY enters online command mode in response to +++ if DIP switch 9 is On.

Using Data Terminal Ready Signaling

The modem enters online command mode during a call when DTR is toggled and the modem is in &D1 mode.



DIP switch 1 is set to OFF at the factory to allow DTR operations, but the default is &D2, which will disconnect the call if it is toggled while online. If DIP switch 1 is set to ON, DTR operations are ignored, so the modem will neither disconnect nor enter online command mode if DTR is toggled while online. You cannot save &D1 to NVRAM.

At the factory, DIP Switch 1 is set to Off allowing DTR operations. If DIP Switch 1 is set to On, enter the following AT command to temporarily override the setting of DIP Switch 1 and allow DTR operations:

AT&D1



This parameter must be set before going online.

Entering Command Mode After Dialing

To have the modem go into online command mode after dialing (assuming that the modem connects) place a semi-colon (;) after the dial string:

Example **atdt1(847)982-5092;**

Returning Online

Use the ATOn (where n= 0 or 1) command to return online when in online command mode.

Return Commands	Function
ATO0	Return online (normal).
ATO1	Return online and retrain. Use if there were errors in a non-ARQ (no error control) data transfer.

Dialing

This table provides the required dial commands:

Dial Commands	Function
ATD\$	Dial command summary request.
ATD	Dial the number that follows and enter Originate mode.

Optional Dial Command Parameters

Include after D command and before the number to be dialed unless indicated otherwise:

Dial Commands	Function
P	Pulse dial.
T	Tone dial.
.	<p><i>Note: The Quad modem card uses Adaptive Dial if you did not configure the modems for pulse or tone dialing, and you had previously set the Tone mode for X2 or higher.</i></p> <p>(Period) Use this command for T1 dialing. The . (period) terminates the MF dialing, sending an ST tone if necessary, and then switches the modem to DTMF mode.</p> <p>You can use this for complex T1 dialing where the trunk is configured for MF signaling, but the modem will need to send additional DTMF digits in certain instances, such as when a credit card number is involved.</p>
/	<p>(Slash) Pause 125 milliseconds. Commonly placed in a dial string to allow for switching from PBX to Telco lines, as in the following example:</p>

ATDT9//1/847/9825092

Dial Commands	Function
,	(Comma) Pause for duration set in S-Register 8 (2 seconds).
;	Return to Command mode after dialing.
"	Quote mode. Used to dial letters, as in the following example: ATDT1800"DIAL3COM Insert closing quotation marks if additional commands are to follow.
!	Transfer a call (flash switchhook). The following example flashes the switchhook, dials the extension "1234," returns to command mode, and hangs up. ATDT!1234;H
W	Wait for second dial tone, for example, when dialing for an outside line. Only for use with result codes set to X3 or higher.
@	Wait for an answer. After the modem detects at least one ring, it waits for five seconds of silence at the other end of the call, and then continues executing the Dial string. If the modem is set to X2 or lower, the command is ignored. If set to X5 or X6, the modem hangs up when it detects a voice answer and sends the VOICE result code. If the correct conditions do not occur—no rings, or no answer following five seconds of silence—the modem reports NO ANSWER after the timeout set in Register S7 (default, 60 seconds).
R	Reverse frequencies. This command allows calls to an originate-only modem. It reverses the modem's originate/answer frequencies, forcing the modem to dial out at the answer frequency. The command follows the dial command, before or after the phone number. ATDTR5551212 To cancel dial command execution, press any key.

Automated Redialing

Use the following commands to automate redialing (for example, for calls that return a busy signal). The modem dials the number, waits the number of seconds (default, 60 seconds) set in S-Register 7 for a carrier, hangs up, and redials after the number of seconds (default, 2 seconds) set in S-Register 8.

To dial 10 times repeatedly, use > at the end of a dial string.

Example

ATDT555-5555>

When used in a Dial string, automated redialing terminates after 10 attempts.

Use A> to re-execute the last issued command continuously until canceled by pressing any key. Dial strings are re-executed ten times, after which execution terminates. A> does not take the AT prefix or a Enter.

Example **ATDT555-5555**
A>

To abort automated redialing (> or A>), press any key when the result code appears, during the pause before the modem dials again. If any key is pressed while the modem is dialing, that dial attempt is canceled but the cycle continues.

Using Stored Phone Numbers

Each modem stores up to four dial strings in NVRAM, stores the last dialed number, and does an inquiry of stored phone numbers.

The dial string may be up to 56 characters long, of which only 37 may be digits and dial modifiers following the **D** dial command.



The AT and Carriage Return are not included in the count.

The string includes any valid Dial command options, but no other commands. The following is a table of valid stored phone number AT commands and their function.

Stored Number Commands	Function
AT&Zn=s	Write the following Dial String (s) to NVRAM at position n (n= 0 – 3)
AT&Zn=L	Write the last dialed number to NVRAM at position n (n= 0 – 3)
AT&Zn?	Display the phone number stored in NVRAM at position n (n= 0 – 3)
ATDSn	Dial the phone number stored in NVRAM at position n (n= 0 – 3)
ATDL	Dial the last dialed number
ATDL?	Display the last dialed number

Auto Dial

When set for Auto Dial, the modem automatically dials the number stored in NVRAM at position 0. To activate Auto Dial, enter:

ATS13.3=1 for Auto Dial on DTR signal.

ATS13.4=1 for Auto Dial at power on/reset



When using the Quad modem with a Dual PRI card, disable chassis awareness on the PRI card and manually configure the PRI card's chassis slot device configuration. Otherwise, you will not be able to use Auto Dial after you reset the Quad modem.

Answering

AT Command To force answer an incoming call, enter:

ATA

Auto Answer The modem ships with DIP switch 5 Off, enabling Auto Answer. Enter the following S-Register command to set the number of rings before the modem answers.

Example To set the number of rings for Auto Answer, enter:

ATS0=3

To disable Auto Answer, use = 0 (zero)

Disconnecting

Using the ATH Command To disconnect a call, use the ATH command from online command mode. To enter online command mode, see the earlier section *Placing the Modem in Online Command Mode*.

Using the Escape Code When DIP switch 9 is off and the escape code (+++) is sent to the modem, the modem hangs up and sends the NO CARRIER result code. The +++ must be preceded and followed by a guard time of at least one second of no data transmission. Do not use the AT prefix or press Enter after sending the command.

If necessary, change the character used in the escape code (S-Register 2), or the guard time (S-Register 12).



If DIP switch 9 is On, the modem remains connected and enters online command mode (see the online command mode section earlier in this chapter).



For unattended modem operations: in rare instances, the modem may fail to recognize the +++ escape code. If the modem is running unattended under software control, we suggest dropping the RS-232 DTR signal for at least 50 milliseconds to ensure against costly phone charges.

5

MONITORING & CONTROLLING CALLS

This chapter includes:

- Inquiry Commands
- Monitoring calls
- Controlling Calls Using Dialed Number Identification Service, Automatic Number Identification, and Carrier Access Code

Inquiry Commands

When an inquiry command is issued, the modem displays information on the terminal screen. The following inquiry commands are available.

AT10 Displays product code

AT11 Display results of ROM checksum. Reserved for factory testing only.

AT12 Display results of RAM test. The modem tests its RAM and returns either the OK (0) or ERROR (4) result code, followed by OK when the test completes. AT12 acts as a checkpoint if the modem appears to be malfunctioning.

AT13 Display call duration if set to K0 or real time if set to K1 Set the real-time clock with AT13=HH:MM:SS K1.

ATI4 Displays the current modem settings. The display appears similar to the following:

```

ati4
USRobotics Digital Quad Settings...
Copyright, 1988-98, 3Com Corp. All rights reserved.

B0 C1 E1 F1 Q0 V1 X0
BAUD=38400 PARITY=N WORDLEN=8 DTE=GATEWAY NAC
DIAL=TONE ON HOOK TIMER LINE=ISDN PRI

&A0 &B1 &C1 &D2 &G2 &H1 &I0 &K1 &L0 &M4 &N0 &P1 &R2 &S0 &T4
&U0 &X0 &Y1 &G15 &N6 *U1=3 *U2=0 *U3=1 *V2=0 *X0=0512 *X1=2

S00=000 S01=000 S02=255 S03=013 S04=010 S05=008 S06=002 S07=060
S08=002 S09=006 S10=007 S11=070 S12=050 S13=000 S14=000 S15=000
S16=000 S17=000 S18=000 S19=000 S20=000 S21=010 S22=017 S23=019
S24=150 S25=005 S26=001 S27=000 S28=008 S29=020 S30=000 S31=000
S32=009 S33=000 S34=000 S35=000 S36=000 S37=000 S38=000 S39=011
S40=000 S41=000 S42=126 S43=200 S44=015 S45=000 S46=255 S47=032
S48=000 S49=016 S50=100 S51=064 S52=005 S53=000 S54=064 S55=000
S56=000 S57=000 S58=001 S59=000 S60=000 S61=000 S62=000 S63=000
S64=000 S65=000 S66=000 S67=000 S68=000 S69=000 S70=000 S71=001
S72=001 S73=001 S74=000 S75=000 S76=000 S77=000 S78=000 S79=000
S80=000 S81=002 S82=012

LAST DIALED #:
LAST DNIS #:
LAST ANI #:
```

ATI5 Displays the settings stored in the modem's NVRAM. If the Quad Modem connects to a modem that has Link Security and Local Access enabled, the stored phone numbers cannot be viewed. The display appears similar to the following:

```

ati5
USRobotics Digital Quad NVRAM Settings...
Copyright, 1988-98, 3Com Corp. All rights reserved.

DIAL=TONE B0 F1 X7
BAUD=38400 PARITY=N WORDLEN=8

&A3 &B1 &G2 &H1 &I0 &K1 &L0 &M4 &N0 &P1 &R2 &S0 &T4
&U0 &X0 &Y1 &G15 &N6 *U1=3 *U2=0 *U3=1 *V2=0 *X0=2048 *X1=2

S00=001 S02=255 S03=013 S04=010 S05=008 S06=002 S07=060 S08=002
S09=006 S10=007 S11=070 S12=050 S13=000 S15=000 S19=000 S21=010
S22=017 S23=019 S24=150 S25=005 S26=001 S27=000 S28=008 S29=020
S31=000 S32=009 S33=000 S34=000 S35=000 S36=000 S37=000 S38=000
S39=011 S40=000 S41=000 S42=126 S43=200 S44=015 S46=255 S47=032
S48=000 S49=016 S50=100 S51=000 S52=005 S53=000 S54=064 S55=000
S56=000 S57=000 S58=001 S60=000 S61=000 S62=000 S63=000 S64=000
S65=000 S66=000 S67=000 S68=000 S69=000 S70=000 S71=001 S72=001
S73=001 S74=000 S75=000 S76=000 S77=000 S78=000 S79=000 S80=000
S81=002 S82=012

STORED PHONE
#0:
#1:
#2:
#3: 28382220379
```

AT16 Display link diagnostics. The modem displays a link diagnostic summary of the previous call, including characters transferred, data blocks retransmitted under error control, disconnect reasons, and other information. The display appears similar to the following:

```
ati6
USRobotics Digital Quad Link Diagnostics...
Copyright, 1988-98, 3Com Corp. All rights reserved.

Chars sent                0      Chars Received                0
Chars lost                0
Octets sent               0      Octets Received                0
Blocks sent              0      Blocks Received                0
Blocks resent            0

Retrans Requested         0      Retrans Granted                0
Line Reversals           0      Blers                          0
Link Timeouts            0      Link Naks                      0

Data Compression          NONE
Equalization             Long
Fallback                 Disabled
Last Call                00:00:00
```

Some results listed in the AT16 display are not self-explanatory and the following table provides their meanings:

Result	Meaning
Octet	Octet indicates the number of compressed characters. Buffering operations cause this number to be greater than the number of characters sent.
Line Reversal	Line Reversals indicates the number of times a modem in High Speed Technology (HST) mode switched the high speed and low speed channels.
Blers	Blers indicates errors in data and protocol (non-data) blocks corrected by ARQ (error control).
Link Timeout	Link Timeout Indicates that the error correction protocol severed momentarily (during which no data is transferred), but the protocol was able to recover.
Link Naks	Link Naks indicates negative acknowledgments of one or more blocks.
Data Compression	Data Compression indicates the type of data compression negotiated for the call (V.42 <i>bis</i> or MNP5) or NONE. A V.42 <i>bis</i> response includes the size of the dictionary and the maximum string length used, example 2048/32.
Equalization Long/Short	Equalization indicates the status of S15 bit 0; long if bit 0=0, short if bit 0=1.
(continued)	

Result	Meaning
Fallback	Enabled/Disabled: Indicates whether or not the modems can fall back to a slower speed.
Protocol	Protocol indicates the error control protocol negotiated (Link Access Procedure for Modems (LAPM), Microcom Networking Protocol (MNP), NONE, or SYNC for a synchronous call.

ATI7 Display product configuration. Displays the code date, revision, slot and channel number of the modem, and other useful information for diagnosing problems. The display appears similar to the following:

```

ati7
USRobotics Digital Quad Configuration Profile...
Copyright, 1988-98, 3Com Corp. All rights reserved.

Product type           International Rackmount
Slot/Channel           4/1
Options                HST,V32bis,Terbo,V.FC,V34+,x2,V90
Cellular Options       MNP10,MNP10EC & ETC
ISDN Options           V.110, V.120, SYNC, PPP, & X.75
Fax Options            Class 1/Class 2.0
Clock Freq             20.16Mhz
Flash Rom              512K
Ram                   384K

Supervisor date        12/10/98
DSP date               12/10/98

Supervisor rev         6.1.4
DSP rev                6.1.4

```

ATI8 Reserved.

ATI9 Display standard DNIS initialization string settings. The display appears similar to the following:

```

ati9
USRobotics Digital Quad DNIS Initialization Settings...
Copyright, 1988-98, 3Com Corp. All rights reserved.

#           DNIS           Call Initialization String

1           |-----|           |-----|
2
3
4           (unknown)

```

ATI10 View Link Security account status. Unavailable if Local Access security is enabled. The display appears similar to the following:

```

ati10
USRobotics Digital Quad
Copyright, 1988-98, 3Com Corp. All rights reserved.

                        DIAL SECURITY STATUS

SECURITY/AUTOPASS ENABLED:[N]                LOCAL SECURITY ENABLED:[N]

FALLBACK PROMPTING:[N]                      FORCED PROMPTING:[N]

LOCAL ACCESS PASSWORD:[NO PSW]              AUTOPASS PASSWORD:[NO PSW]

ACCOUNT PASSWORD                            SEND PROMPT FOR PHONE_#
                                           [Y]
```



ATI10 is not available if local access security is enabled and the local password has not been entered.

ATI11 Advanced link diagnostics. The display appears similar to the following:

```

ati11
USRobotics Digital Quad  Link Diagnostics...
Copyright, 1988-98, 3Com Corp. All rights reserved.

Modulation (recv/xmit)    Unknown Speed
Carrier Freq      ( Hz )  0/0
Symbol Rate              0/0
Trellis Code
Nonlinear Encoding
Precoding
Shaping
Preemphasis      (-dB )
Recv/Xmit Level  (-dBm)   0.0/0.0
SNR               ( dB )
Near Echo         ( dB )
Far Echo         ( dB )
Roundtrip Delay  (msec)
Timing Offset    ( ppm)
Carrier Offset   ( ppm)
x2 Status                x2 operational
x2 Signature
```


Some results listed in the ATI11 display are not self-explanatory and have the following meanings:

Result	Meaning
Carrier Freq	Carrier Freq is the frequency of a carrier wave.
Symbol Rate	Symbol Rate measures transmission speed over an analog phone line, sometimes called baud rate.
Trellis Code	Trellis Code improves noise immunity using a convolutional coder to select a sequence of subsets in a partitioned signal constellation. Used in HST, V.17 Fax, V.32 <i>bis</i> , V.FC, and V.34. It does this by saying the current symbol must be related to previous symbols.
Nonlinear Encoding	Nonlinear Encoding improves distortion immunity near the perimeter of a signal constellation by introducing a nonuniform two-dimensional (2D) signal point spacing.
Precoding	Precoding is a nonlinear equalization method for reducing equalizer noise enhancement caused by amplitude distortion.
(Constellation) Shaping	(Constellation) Shaping improves noise immunity by introducing a nonuniform two-dimensional probability distribution for transmitted signal points.
Pre-emphasis	Pre-emphasis is a linear equalization method where the transmit signal spectrum is shaped to compensate for amplitude distortion.
SNR	The ratio of the inbound signal to noise from all sources, including signal distortion, uncanceled echo, and quantization error. The number is displayed in dB, and the larger the number, the better the quality of the line.
Carrier and Timing Offset	These two are related to the timing recovery in the modems. Analog modems derive their timing from a crystal on the modem. Since these crystals are not at the exact same frequency, the modem needs to compensate for this. These numbers represent the difference in frequency and phase of the symbol rate in Hz between the two modems.

ATI12 Reserved.

ATI13 Microcom Networking Protocol (MNP) 10 Diagnostics. Cellular modems only. The display appears similar to the following:

```

ati13
USRobotics Digital Quad MNP10 Diagnostics...
Copyright, 1988-98, 3Com Corp. All rights reserved.

APS Max Packets          32
APS Bler                 0
Local AGC10             25
Local EQM10             0
Remote AGC10            0
Remote EQM10            0
LM-I Recv Seq Nr        0
LM-I Send Seq Nr        0
LM-I Ackd Seq Nr        0
MNP10 Current Speed     None
Unacked LMIs            0

```

ATI14 Enhanced Throughput Cellular (ETC) Diagnostics. Cellular modems only. The display appears similar to the following:

```

ati14
USRobotics Digital Quad ETC Diagnostics...
Copyright, 1988-98, 3Com Corp. All rights reserved.

CTetc detected?          No
Next ETC Tx Level       Not computed

```

ATI15 Remote Modem Management Information. The display appears similar to the following:

```

ati15
USRobotics Digital Quad Remote Modem Management Information
Copyright, 1988-98, 3Com Corp. All rights reserved.

Status                  Not present or enabled in remote modem
Number of updates       0
Time of last update     00:00:00
Update event
Manufacturer ID
Product ID
Serial Number
Version Number
Version Date
Signal Levels:
  Receive: Total        0.0 (-dBm)
                   3300 HZ    0.0 (-dBm)
                   3750 HZ    0.0 (-dBm)
                   Near-end echo 0.0 (-dBm)
                   Far-end echo  0.0 (-dBm)
                   Noise        0.0 (-dBm)
  Transmit              0.0 (-dBm)
x2 Status

```

ATY15 Displays the current DIP switch settings.

Monitoring Calls Using Inquiry Commands

Besides displaying information on previous calls, these diagnostic inquiries execute while online to determine speed, modulation, and other performance factors for the current call.

To perform an inquiry while online:

- 1 Enter online command mode by sending the modem the escape code `+++`. For additional information, see the *Using AT Commands* chapter.
- 2 Send the modem the desired inquiry command.
- 3 For two second incremental updates, type **A>** after sending the inquiry command. For additional information, see the *Using AT Commands* chapter.

Monitoring Calls Using Total Control Manager

Total Control Manager also monitors calls. To use this feature:

- 1 Using Total Control Manager to select one modem or all four modems.
- 2 Click on **Performance** from the menu bar and select **Session Monitor** from the drop down menu.
- 3 Choose the Functional Group desired and set the parameters.
- 4 Click **OK** to run the Session Monitor.

Using Number Services To Control Calls

Dialed Number Identification Service (DNIS) is a feature that provides the number the caller dialed to reach the Quad Modem. It is an optional feature.

Automatic Number Identification (ANI) provides the number of the calling telephone.

This Service	Provides the Quad Modem with the number	Digits Allowed
DNIS	That the calling telephone dialed	0–12
ANI	Of the calling telephone	0–12

Dialed Number Identification Service and Automatic Number Identification Applications

The Quad modem supplies the Dialed Number Identification Service (DNIS) and/or Automatic Number Identification (ANI) number in the incoming ring message in T1 mode (or the called party and calling party number in PRI mode) so that the application software can route the call to the appropriate location. You can also configure the Quad modem before accepting the call either by the application software, or automatically using the CAC reconfiguration string.



You can also reconfigure the Quad modem to route calls to an RS-232 NIC or to a gateway card, automatically based on the inbound number.

Use DNIS when multiple applications are connected to the same modem hunt group, or when you want to route calls to individual users.

Use ANI to look up a customer record based on the customer's phone number. This feature may also be used as a caller Identification (ID) service.

Obtaining Number Services

Contact your Regional Bell Operating Company (RBOC) to obtain DNIS.

Contact your long distance service provider to obtain ANI.

Using the Caller Access Code to Control Calls

The Caller Access Code (CAC) number enables the Quad Modem to route calls upon receiving DNIS or ANI information.

Configuring with the Caller Access Code Initialization String

The CAC initialization string enables the Quad Modem to set a modem configuration string upon receiving DNIS or ANI information.

To set the CAC	Command	Where <i>n</i> is a value	And <i>s</i> is
Number	AT%CNn=s	From 1–3	A numeric string containing up to 10 digits
Initialization String	AT%CIIn=s	From 1–4	A modem configuration string containing up to 30 characters



*Also, 3Com has developed two new commands: **%M0** and **%M1**. Enter **%M0** in the CAC Initialization String to configure the Quad modem for routing incoming calls to the RS-232 NIC. Enter **%M1** in the CAC Initialization String to configure the Quad modem for routing incoming calls to the Packet Bus.*

Also, to select either DNIS or ANI to verify the CAC number, use the following S-Registers:

- DNIS/Called Party: Enter S47.4=1
- ANI/Calling Party: Enter S47.4=0

Caller Access Code Number and Initialization String

Defines up to three full or partial telephone numbers that may be dialed to access the modem, using the AT%CN=s command.



An initialization string (without the AT command prefix) is associated with the CAC number using the AT%Cl=s command.

Up to four initialization strings are set in the Quad Modem. Three initialization strings must match the position of a specified CAC number. The fourth initialization string contains a specified CAC number that is executed if the modem receives an unknown CAC.

Incoming Calls

For an incoming call, the Quad Modem compares the number dialed against the defined CAC numbers. An initialization string configures the modem to answer the call.

The AT19 screen displays the CAC numbers and the associated initialization strings.

Identifying the Caller Access Code on Incoming Calls

If the Quad Modem is configured for X6 or X7, it identifies the CAC on incoming calls by returning special RING result codes, as follows:

When this information is received	The Quad Modem returns this RING result code
No DNIS or ANI information received	RING (normal)
DNIS/Called Party only	RING/5 (where 5 is the DNIS number)
ANI/Calling Party and DNIS/Called Party	RING/5/5551212 (where 5 is the DNIS and 5551212 is the ANI)
ANI/Calling Party only	RING//5551212 (where two slashes indicate no DNIS, and 5551212 is the ANI)

Viewing the Last Caller Access Code Used

The CAC associated with the last call received is viewed on current settings screen (ATI4), as follows:

Last DNI #: nn.nn

or

Last ANI #: nn.nn

6

RESULT CODES

This chapter includes:

- Overview of Result codes
- Enabling Result codes
- Result Code groups
- Extended Connect Message indicators
- Additional Options



For a complete list of Result Codes, see the Result Codes appendix.

Overview

When Result Codes are enabled, the modem responds to the Data Terminal Equipment (DTE) or terminal display by sending the appropriate Result Code.



The DTE can be either an RS-232 port or if the modem is in a telnet session with a gateway card (NETServer/EdgeServer/HiPer ARC), the DTE can be a gateway card.

The following are examples of common Result codes:

- *Command results* return in response to AT commands (OK and ERROR).
- *Call progress reports* return during originate and answer modes (for example, RINGING, RING, BUSY, NO ANSWER, and NO CARRIER)

- *Connect messages* report when the modem makes a connection. Optional settings allow the basic Connect Message to be appended with various *indicators* reporting connection diagnostics such as the speed at which the modems connect, protocol used, and whether the connection is under Automatic Retransmission reQuest (ARQ) error control.
- Result codes are typically for accounting information. For example, service providers may charge different rates to callers depending on the speed at which they connect. The Result Code logs the connect speed (9600, 14400, 19200) and the customer is charged accordingly. The following examples offer additional Result Code uses.
- Performance logs: Extended Result Codes indicate performance issues such as the average connect speed using V.34 modulation. A low average may indicate the need for better phone lines or transmitter level adjustment in the modems.
- Statistics: Result Code logging allows an administrator to generate statistics such as the number of callers using V.34 modems or the busiest hours during the work week.
- Alarms: Connect messages alert a system administrator to command errors, loss of dial tone, or unusually low connection rates.

Enabling Result Codes

The Quad Modem ships with Result Codes disabled. Result Codes must be enabled to monitor calls through a DTE.



Result Codes may not be compatible with every software version. Certain settings may need to be adjusted. Contact the software manufacturer for support if problems persist. Also, as mentioned earlier, the DTE can be either the RS-232 port or a gateway card.

The following table provides Dual Inline Package (DIP) Switch information to permanently enable Connect Messages and Result Codes.

DIP Switch #	Position	Function
2	On	Numeric Result Codes
	Off	Verbal Result Codes

DIP Switch #	Position	Function
3	On	Result Codes enabled
	Off	Result Codes disabled
7 (Applies only when DIP Switch 3 is On)	On	Enable Result Codes (during originate mode only)
	Off	Normal (Result Codes during originate and answer)



For more information on DIP Switches, see the Quad Modem Features and Configuration chapter.

Temporarily
Enabling/Disabling
Result Codes

AT commands override DIP switch settings and temporarily enable/disable Result codes. These settings cannot be saved in Non-Volatile Random Access Memory (NVRAM), and the modem returns to the DIP switch settings at power on or reset. The following AT commands are used for enabling Result Codes:

AT Command	Function
ATQ0	Display Result codes
ATQ1	Result codes suppressed
ATQ2	Result codes during originate mode only
ATV0	Numeric
ATV1	Verbal

Result Code Groups

The ATXn command reduces software incompatibility with certain Result Codes. The modem returns Result Codes for a particular group only.

ATX0 Basic group: Returns Result Codes 0–4, but does not return call progress and connect rates or offer advanced functions.

ATX1–ATX7 Extended Result codes.

Result Code Options

Result Codes	Settings							
	X0	X1	X2	X3	X4	X5	X6	X7
0/OK	•	•	•	•	•	•	•	•
1/CONNECT	•	•	•	•	•	•	•	•

(continued)

Result Code Options

Result Codes	Settings							
	X0	X1	X2	X3	X4	X5	X6	X7
2/RING	•	•	•	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•	•	•	•
4/ERROR	•	•	•	•	•	•	•	•
5/CONNECT 1200		•	•	•	•	•	•	•
6/NO DIAL TONE			•		•		•	•
7/BUSY				•	•	•	•	•
8/NO ANSWER				•	•	•	•	•
9/RESERVED								
10/CONNECT 2400		•	•	•	•	•	•	•
11/RINGING						•	•	•
12/VOICE						•	•	
13/CONNECT 9600		•	•	•	•	•	•	•
18/CONNECT 4800		•	•	•	•	•	•	•
20/CONNECT 7200		•	•	•	•	•	•	•
21/CONNECT 12000		•	•	•	•	•	•	•
25/CONNECT 14400		•	•	•	•	•	•	•
43/CONNECT 16800		•	•	•	•	•	•	•
85/CONNECT 19200		•	•	•	•	•	•	•
91/CONNECT 21600		•	•	•	•	•	•	•
99/CONNECT 24000		•	•	•	•	•	•	•
103/CONNECT 26400		•	•	•	•	•	•	•
107/CONNECT 28800		•	•	•	•	•	•	•

Result Code Functions

Result Codes	Settings							
	X0	X1	X2	X3	X4	X5	X6	X7
Adaptive Dialing			•	•	•	•	•	•
Wait for 2nd Dial Tone (W)				•	•	•	•	•
Wait for Answer (@)				•	•	•	•	•
Fast Dial			•		•		•	•
RING / DNIS / ANI							•	•

Function Definitions

Adaptive Dialing: The modem first attempts to use tone dialing. If that does not work, it reverts to rotary dialing.



Adaptive Dialing only applies to POTS calls, not T1 or PRI.

Wait for Second Dial Tone: See D command, the W option.

Wait for Answer: See D command, the @ option.

Fast Dial: The modem dials immediately on dial tone detect, instead of waiting the normal 2 seconds set in Register S6.

Extended Connect Message Indicators

The AT&An command enables Extended Connect Message indicators. The verbal Result Code is appended with an indicator according to the settings below:

Command	Function
AT&A0	No additional Result Code indicators.
AT&A1	ARQ indicator (Default): If the modem is set to X0, displayed only if the connection is between 1200 and 21.6K bps. At the remaining connect rates, a setting of X1 or higher is required.
AT&A2	Additional V32/HST modulation indicator.
AT&A3	Protocol indicator: Reports High Speed Technology (HST), Link Access Procedure for Modems (LAPM), or Microcom Networking Protocol (MNP) and V42 bis or MNP5. Also reports SYNC and NONE. AT&A3 protocol displays no other numeric Result Codes. When set to AT&A3, the modem returns the same numeric result codes as AT&A2.

Additional Options

Disable 250ms Delay Before Result Code

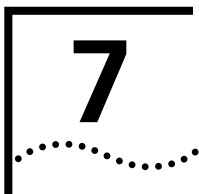
Set S-Register 13.2=1 to disable the 250ms pause preceding transmission of modem Result Codes.

Default: AT\$13.2=0 (Enabled)

**Unusual Software
Incompatibility**

Setting S-Register 27.7=1 often overcomes unusual software incompatibility. This setting disables Connect Message Result Codes above 9600 and displays the 9600 code instead.

Default: $ATS27.7=0$ (Displays Result Codes set by $ATXn$)



STORED CONFIGURATIONS

This chapter includes:

- Nonvolatile Random Access Memory
- Configuration Templates

Nonvolatile Random Access Memory

Each Quad Modem is equipped with Nonvolatile Random Access Memory (NVRAM). A modem's configuration changes are stored in NVRAM by entering the following command after an AT command:

AT&W

Example To set the number of rings for Auto Answer, enter:

ATSO=2&W



CAUTION: *This command overwrites any settings currently stored in NVRAM.*

The following is a factory setting. When the modem powers on or resets, the NVRAM settings load into active memory. This setting may be changed using DIP switch 10.

Switch	Function	If set to Off	If set to On	Default	Effective
10	Power-on and Reset Defaults	Load from NVRAM	Load fail-safe default configuration template from ROM (AT&F0)	Off	Always

NonVolatile Random Access Memory Factory Settings

The Factory Default Settings and Factory Default S-register Settings tables list the factory default NVRAM settings. These settings are identical to the &F1 template settings.



The following three paragraphs pertain to this note.

- 1. The following settings are not changed by AT&Fn factory template commands: &Z0 - &Z3, %P0, %P1, *U1 - *U3, *V2, *X0, *X1, S53, S71, S82.*
- 2. The following settings have different defaults in some country-specific configurations: &P, &G, S0, S6, S7, S8, S11, S27, S39, S71, S76, S82.*
- 3. The modem detects these settings using the AT prefix of the &W command that writes defaults to NVRAM. Set the software to the desired word length, parity, and serial port rate defaults before sending the modem the AT... &W string..*

Factory Default Settings

NVRAM Options	Setting	Description
Handshake option	B0	ITU-T answer sequence
Error control/sync	&M4	Normal/error control
Data compression	&K1	Enabled
Transmit data flow control	&H1	Hardware flow control enabled
Received data hardware flow control	&R2	Enabled
Receive data software flow control	&I0	Disabled
Serial port rate select	&B1	Serial port rate fixed higher than connect rate
Link rate select	&N0	Variable
Result Code subset	X7	Extended. Includes all codes except VOICE
Protocol response codes	&A3	Full protocol codes
Tone/Pulse dialing	T	Tone dial
Online local echo	F1	Disabled
Remote Digital Loopback (RDL)	&T4	Grant RDL
Leased line operation	&L0	Disabled
Data set ready operations	&S0	Override enabled

Factory Default Settings

NVRAM Options	Setting	Description
Break handling	&Y1	Clear buffer, send immediately
Stored telephone number	&Z0–3	Blank
Pulse dial make/break ratio	&P0	Disabled
Guard tone	&G0	Disabled
Word length	8	
Parity	0	None
DTE rate (Kbps)	19.2	
Lower Limit Link Rate	&U	Variable
Transmitter	C 1	Enabled
Clock Source	&X0	DCE Synchronous
DTMF Term. Digit	%G15	'#'
V.25 <i>bis</i> DTE Rate	%N6	9600
Originate HDLC mode	*U1=3	PPP
Originate non-HDLC	*U2=0	V.110 disabled
Originate Analog	*U3=1	Analog enabled
Originate/Answer mode	*V2=0	Automode
X.75 Frame Size	*X0=2048	2048 bytes per frame
X.75 Window Size	*X1=2	2 frames
Remote Access Password	%P0=	Blank (none) view password



Enter AT15 to display the current S-Register settings.

Factory Default S-Register Settings

NVRAM S-Register Options ($S_r=n$)	Factory Setting
Number of rings to answer, ASCII decimal	S0=1
Escape code character, ASCII decimal	S2=43
Carriage return character, ASCII decimal	S3=13
Line feed character, ASCII decimal	S4=10
Backspace character, ASCII decimal	S5=8
Dial wait-time, sec	S6=2
Carrier wait-time, sec	S7=60
Pause during dial/before repeat, sec	S8=2

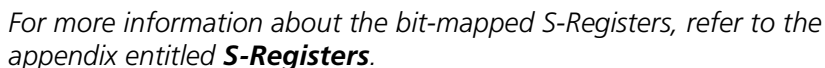
Factory Default S-Register Settings

NVRAM S-Register Options (<i>Sr=n</i>)	Factory Setting
Carrier detect time, 1/10th sec	S9=6
Carrier loss wait-time, 1/10th sec	S10=7
Tone duration, spacing, msec	S11=70
Escape code guard time, 1/50th sec	S12=50
Bit-mapped	S13=0
Bit-mapped	S15=0
Inactivity/hang up timer, min	S19=0
Received break length, 10-msec units	S21=10
XON character, ASCII decimal	S22=17
XOFF character, ASCII decimal	S23=19
Duration of pulsed DSR, 20-msec units	S24=150
Minimum DTR recognition time, 10-msec units	S25=5
Delay between RTS, CTS response (sync oper)	S26=1
Bit-mapped	S27=0
V.32 handshake time, 10-msec units	S28=8
V.21/V.23 fallback timer, 1/10th sec	S29=20
Unusual software compatibility	S31=0
Reserved	S32=0
Bit-mapped	S33=0
Bit-mapped	S34=0
Extra delay before connect	S35=0
Reserved	S36=0
Unusual software incompatibility	S37=0
Delay ARQ call hang-up when DTR drops, sec	S38=0
Transmit level	S39=11
International Compatibility	S40=0
Allowable login attempts	S41=0
Remote access ASCII characters	S42=126
Remote guard time, 1/50th sec	S43=200
Re-establish leased-line connect, sec	S44=15
Reserved	S46=255
Bit-mapped	S47=0
Bit-mapped	S48=0

Factory Default S-Register Settings

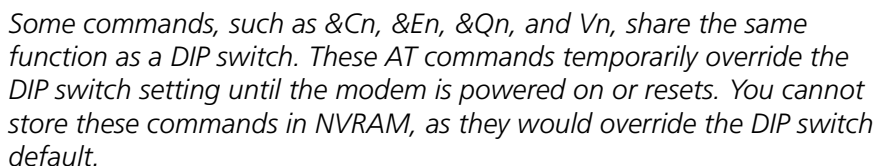
NVRAM S-Register Options (Sr=n)	Factory Setting
Reserved	S49=16
Billing delay period, 1/50 sec	S50=100
Bit-mapped	S51=0
Duration of the MNP link request timeout	S52=5
Bit-mapped Link Security Options	S53=0
Bit-mapped	S54=64
Bit-mapped	S55=0
Bit-mapped	S56=0
Reserved	S57=0
Reserved	S58=0
MNP10 protocol options	S60=0
Bit-mapped	S61=0
ANI digits	S62=0
DNIS digits	S63=0
ETC maximum link rate	S64=0
ETC transmit level	S65=0
ETC protocol options	S66=0
Bit-mapped	S67=1
Bit-mapped	S68=0
Reserved	S69=0
Reserved	S70=0
Idle/Disconnect pattern correction	S71=1 (North America, Japan) S71=84 (Europe)
Bit-mapped	S72=0
Default slot for the PRI card used to initiate an outgoing call	S73=1
x2 / V.90 backchannel minimum speed	S74=0
x2 / V.90 backchannel maximum speed	S75=0
Bit-mapped	S76=0
Reserved	S77=0
Reserved	S78=0
RMMIE Transmit disables	S79=0
RMMIE Request disables	S80=0

NVRAM S-Register Options ($Sr=n$)	Factory Setting
Bit-mapped	S81=2
V.90 transmit power limit	S82=12



To modify the active configuration in NVRAM, type the changes and save them to NVRAM with the &W command.

Example **AT&K3X3S10=40&A2T&W**



Any setting can be changed for the current session. This feature is useful for experimentation if there are performance difficulties. If the change does not achieve the desired effect, reset the modem (described below) to return it to its previous saved configuration. The example below changes the Result Code setting, but the power on/reset default remains intact.

Example **ATX6**

Resetting the modem restores the modem to the configuration saved in NVRAM. A modem can be reset by powering it Off and On (removing and replacing it in the chassis), issuing an AT command, or by toggling Data Terminal Ready (DTR).

Entering the following AT command resets the modem.

ATZ

If bit 0 of Register S13 is On (S13 = 1), the modem automatically resets when DTR drops and the modem hangs up. To enable this feature, enter:

ATS13=1



3Com does not recommend using this feature (Automatic Reset) because it interferes with reliable operation of both the management bus and the packet bus. Also, 3Com does not recommend issuing ATZ between every call. To restore settings between every call, issue S76=2 with ATZ or &F7.

Optional Lockout

This option makes the NVRAM settings and stored phone numbers read-only.

To secure the NVRAM configuration from being changed by unauthorized persons, enter:

ATR&W

OK displays. If the &W command is issued a second time, an ERROR message displays.

To disable Lockout, making NVRAM programmable by anyone, complete the steps below:

- 1 Remove the modem from the chassis and set DIP switch 10 On (load settings from ROM).
- 2 Reinsert the modem in the chassis. When it powers on, enter:

AT&F1S0=1&W

- 3 Remove the modem from the chassis and set DIP switch 10 Off (NVRAM settings).
- 4 Reinsert the modem in the chassis. The NVRAM feature is now enabled and configuration commands can execute.

Configuration Templates

The Quad modem has three permanent configuration templates stored in the modem's ROM.

A template is loaded into active memory by using the following syntax:

Syntax **AT&Fn**

&Fn indicates one of the following templates.

Command	Name	Description
AT&F0	Fail-safe Template	This template does not include features such as a fixed serial port rate or hardware flow control. It does offer compatibility with nontypical computers, older equipment, or software that cannot handle flow control and other features. If DIP switch 10 is set On, the low performance (&F0) template loads at power-on or reset.
AT&F1	Hardware Flow Control Template (factory default settings)	This template sets the modem to hardware flow control, a fixed serial-port rate, and the highest level result codes. We recommend this template for all systems and software that support Request to Send, Clear to Send, and a fixed serial port rate.
AT&F2	Software Flow Control Template	This template sets the modem to all of the &F1 defaults except hardware flow control. Instead, it substitutes Software Flow Control (XOn/XOff). Use this template if the software does not support Hardware Flow Control. Software Flow Control is not as reliable as Hardware Flow Control.



Loading a template into active memory returns all the current settings to settings defined by the chosen template

Saving Configuration Templates

Save a configuration template in NVRAM similar to any other AT command:

Example To save the &F1 template in NVRAM, enter:

AT&F1&W

Configuration templates cannot be customized since they are part of the modem’s ROM. However, a template may be loaded into active memory, modified, and saved to NVRAM with a single command string:

Example **AT&F2&K3S10=40&A2&W**

Be sure to insert your changes after the &Fn command but before &W. Otherwise, the changes will be overwritten by &Fn.

Initialization Strings

Most communication applications send an initialization string to the modem when the program is loading. You may want to modify the software’s initialization string to reflect the modem’s factory settings. The initialization string that corresponds to each template is as follows:

Template	Initialization String
&F0	AT &B0 &H0 &R1 X1 &A1 &I0
&F1	AT &F0 &B1 &H1 &R2 X7 &A3 &I0
&F2	AT &F0 &B1 &H2 &R1 &I2 X7 &A3

The AT&F0 Fail-Safe template settings and &F2 Software Flow Control template tables list the settings of each configuration template.



From the factory, the Quad modem has the &F1 template stored in NVRAM. The DTE rate/parity also comes stored in NVRAM.

Template Settings

Read-Only Memory Template

When DIP switch 10 is On, NVRAM is not used and the &F0 template is loaded directly from the ROM. The only difference between this and &F0 is that the DTE rate is set to 9600, the word length to 7, and the parity to even.

If DIP switch 10 is On when the modem powers on or resets, or when the fail-safe template (&F0) loads, the following settings take effect.



All other settings return to the factory defaults.

Template	Setting	Description
Transmit data flow control	&H0	Disabled
Received data hardware flow control	&R1Disabled	
Result Code subset	X1Basic	
Error-control response codes	&A1Enabled	
Word length	7	
Parity	1	Even
DTE rate (bps)	9600	

Hardware Flow Control Template

The settings for the hardware flow control template are identical to the factory default NVRAM settings. See the *Factory Default Settings* and *Factory Default S-Register Settings* tables for detailed information.

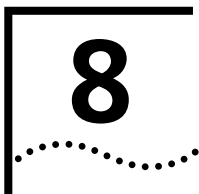
Software Flow Control Template

The &F2 template configures the modem with the following settings. All other settings are returned to factory defaults.

NVRAM Options	Setting	Description
Transmit data flow control	&H2	Software flow control enabled
Received data hardware flow control	&R1	Disabled
Received data software flow control	&I2	Enabled

Cellular Templates

Three additional templates, &F4, &F5, and &F6, are available for cellular modems. For additional information, see the *Using Microcom Networking Protocol 10 and Enhanced Throughput Cellular Protocols* chapter.



REMOTE ACCESS AND LINK SECURITY

This chapter includes:

- Remote Access
- Link Security

Remote Access

The Remote Access feature displays and configures the modem settings through a telephone connection.



The following terms describe Remote Access operations. Host refers to the modem accessed and controlled by a remote modem. Guest refers to the modem accessing and controlling the Host modem.

Host Modem Setup

To setup the Host modem for Remote Access:

- 1 Set Remote Access Security Passwords.
 - a Assign Query Only Access password, which allows a Guest to view settings only by entering:
AT%P0=[password]
 - b Assign Full CONFIGURATION password, which allows a Guest to view and change settings by entering:
AT%P1=[password]



Remote access passwords are up to eight alphanumeric characters, and are not case-sensitive. If the password is set with AT%P commands, it converts the password to all-caps as it saves. When the password is entered it converts to all-caps when being compared and if the password matches, Remote Access is established. If the password is set with Total Control Manager, it does not get converted to all-caps, so if lowercase is entered via Total Control Manager, it will fail when trying to gain access. We recommend entering passwords as all-caps when using Total Control Manager.

To Display a Password, enter: **AT%Pn?**

Where $n=0$ for the Query Only Access password or $n=1$ for the Full CONFIGURATION password.

Example To display the Full CONFIGURATION password, enter:

AT%P1?

To Disable Password Security. To disable an assigned password, use the **%Pn=** command to send a blank password.

Example **AT%P0=**
AT%P1=



CAUTION: A Guest user does not need to enter a password for configuration access if the AT%P1 password is disabled.

2 Enable Remote Access.

Set S-Register 41 for a value of 1 or greater. S-Register 41 sets the number of allowable login attempts. A setting of zero allows no login attempts, disabling Remote Access.

Example To set login attempts to one, enter:

AT S41=1

Establishing a Session from the Guest

Except synchronous connections, Remote Access is allowed any time during a connection. To establish a remote session:

- 1 Confirm the Host modem is set for remote configuration.
- 2 Establish a connection. It does not matter which modem originates the call.
- 3 After establishing a connection, the Guest modem sends the Host modem the following escape sequence:

~~~~~

preceded and followed by four seconds of no transmission. Do not press Enter.

S-Register 42 changes the escape sequence character. S-Register 43 modifies the pause duration (guard time). These values are set at the Host modem.

- 4 When the login sequence begins, the Guest modem displays the following or a similar message:

```
USRobotics Analog/Digital Quad V.34 Fax Remote Access Session
Serial Number 0007940012345678-00
```

- 5 If password security is active, password prompt displays:

```
Password (Ctrl-C to cancel)?.....
```

If the Query Access Only password is entered, the Guest can only view settings. If the Full CONFIGURATION password is entered, the Guest can also change settings. There is a three minute time limit for entering the password.

If the number of unsuccessful login attempts exceeds the set limit (Register S41), the modem returns online and refuses any further login attempts during the remainder of that connection.

When a password is accepted, the following prompt displays on the Guest modem's screen indicating that it has entered Remote Access mode.

```
Access Granted
Remote->
```

If password security is not active (no passwords have been set or both passwords are disabled), the modem automatically enters Remote Access mode and the remote prompt displays on the Guest's screen.

```
Remote->
```

Once the Remote Access session is established, there is a three minute inactivity timer. If the modem detects no activity for three minutes, it aborts the Remote Access session and resumes a normal online connection, and the following message displays.

Aborting the Request for Remote Access

- 6 To abort the Remote Access login before entering the password, return online by pressing Ctrl-C or typing ATO and pressing Enter.

## Remote Viewing and Configuration

Once Remote Access is established, the Guest modem sends AT commands and receive inquiry displays as if connected directly to the modem. If Query Access Only privileges are granted, the user may employ any of the inquiry (*In*) commands. If Full CONFIGURATION privileges are granted, the Guest modem is able to configure the Host modem parameters.

When remote configuration changes are made, the remote prompt is altered to indicate changes made. The prompt changes from:

Remote->

to

Remote+>

By default, configuration changes do not take effect until the connection terminates (see%*Cn*). However, the new configuration is immediately reflected on the information displays (AT*In*).

## Remote Configuration Commands

The following commands are only used during Remote Access.

### Configure Serial Port Rate

| Command | Port Rate                                                                                                                     |
|---------|-------------------------------------------------------------------------------------------------------------------------------|
| AT%B0   | Variable: The serial port rate adapts to match the speed of the connection.                                                   |
| AT%B1   | Fixed: The modem always communicates with your computer at the rate at which you have set, regardless of the connection rate. |
| AT%B2   | When answering calls, use the fixed rate for ARQ calls and variable rates for non-ARQ calls.                                  |

## Configure Data Format

| Command | Data Format              |
|---------|--------------------------|
| AT%F0   | No parity, 8 data bits   |
| AT%F1   | Mark parity, 7 data bits |
| AT%F2   | Odd parity, 7 data bits  |
| AT%F3   | Even parity, 7 data bits |

## Configuration Control

Use the `%Cn` command to defer, restore, or execute Remote Access configuration changes. The following table lists the available options:

| AT Command | Function                                                                                                                                                                                                                                                                                                                                                 |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT%Cn      | Configuration control. Default =%C0.                                                                                                                                                                                                                                                                                                                     |
| AT%C0      | Defer configuration. Configuration changes are effective when the call ends. They take effect for following connections.                                                                                                                                                                                                                                 |
| AT%C1      | Restore configuration. This command cancels any configuration changes made during Remote Access and restores the original configuration. However, commands written to NVRAM (with &W) are not restored to their previous settings. Additionally, if the user forced immediate configuration changes (with%C2), those changes cannot be reversed with%C1. |
| AT%C2      | Execute configuration. This command forces configuration changes to take effect immediately, during the current connection. We do not recommend forcing immediate configuration changes unless absolutely necessary, as this can result in an unreliable connection or even a loss of connection.                                                        |

## Remote Access Attempt Limit

*Syntax*   ATS41=n

*Description*   This function stores the number of login attempts the modem will accept for a Remote Access session. The default value of 0 disables Remote Access. If a user exceeds the number of attempts, the normal online session resumes and the user is blocked from further Remote Access attempts for that session.

Settings: 0–255

Default: 0

*Example* To set the Remote Access Attempt Limit to ten, enter:

**ATS41=10**

### **Remote Access Escape Code**

*Syntax* ATS42=n

*Description* This function stores the ASCII decimal value of the Remote Access escape code character. The default is the decimal value for the tilde (~).

Settings: 0 – 255

Default: 126

*Example* To set the Remote Access Escape Code to 122, enter:

**ATS42=122**

### **Remote Access Escape Guard Time**

*Syntax* ATS43=n

*Description* This function sets the duration, in 20 ms increments, of the guard time that the modem requires for the Remote Access escape sequence.

Settings: 0 – 255

Default: 200 (4 sec)

*Example* To set the Remote Access Escape Guard Time to four seconds, enter:

**ATS43=200**

### Ending a Remote Access Session

Any of the four commands below ends a Remote Access session.

| Command  | Function                                                      |
|----------|---------------------------------------------------------------|
| <Ctrl>-C | Aborts the login procedure.                                   |
| ATZ      | Resets the modem and terminates the connection.               |
| ATH      | Terminates the connection.                                    |
| ATO      | Ends the Remote Access session, but the modems remain online. |



*A Remote Access session automatically times out after three minutes of no activity.*

### Link Security

Link Security is designed to protect networks and data centers from unauthorized access. Unlike other security features based in computer or network software, Link Security is based in the modem's firmware, so security measures are activated *before* callers have any type of access to your computer or network.



**CAUTION:** *If you do not properly activate link security, the modem may deny all client access.*

To properly activate Link Security:

- 1 Set Local Access password by entering:

**AT%L=password**

*Description* Prevents anyone other than the network manager from viewing or changing passwords or otherwise modifying the Link Security account through Remote Access or the modem's RS-232 port.

- 2 Set the Autopass password by entering:

**AT%V=password**

Only callers with 3Com modems can use Autopass. The password is stored in the modem's NVRAM. When the 3Com modem calls the 3Com modem, no password prompt displays and access is automatically established.

- 3 Set the Fallback password by entering:

**AT%A=password,**



*The comma is required.*

- 4 Enable/Disable Local Access Protection.

To enable or disable Local Access Protection, set S-Register 53.2.

| Command   | Function                        |
|-----------|---------------------------------|
| ATS53.2=1 | Enable Local Access Protection  |
| ATS53.2=0 | Disable Local Access Protection |

Once Local Access Protection is enabled, the Link Security account cannot be viewed or changed without the Local Access password.

To view or configure the Link Security account after enabling Link Security, enter the AT%S command and the Local Access password.

*Example*    **AT%S=password**

Where password is the Local Access Password assigned in Step 1.

After making desired changes, reactivate Local Access Protection by resetting the modem with the ATZ command.

- 5 Enable/Disable Dialback Prompting.

Dialback prompting provides an extra layer of security or reverse charges on a call. After the modem receives the valid Autopass or Fallback password, the Guest is prompted for their modem's phone number. After a one-minute pause, the modem dials back to the calling modem. Telephone Company policy requires the one-minute delay.

To enable or disable Dialback Prompting, enter the following commands:

| Command | Function                   |
|---------|----------------------------|
| AT%A=Y  | Enable Dialback Prompting  |
| AT%A=N  | Disable Dialback Prompting |

6 Enable/Disable Fallback Password Prompting.

Fallback prompting allows secured access for callers who do not have Autopass, do not have Autopass enabled in their modems, or do not have a 3Com modem. If the Quad Modem does not receive an Autopass password from the Guest, the caller is prompted for the Fallback password.



*If the Guest has Autopass, but the Autopass password is invalid, the call is terminated.*

To enable or disable Fallback Prompting, set S-Register S53.1:

| Command   | Function                   |
|-----------|----------------------------|
| ATS53.1=1 | Enable Fallback Prompting  |
| ATS53.1=0 | Disable Fallback Prompting |

7 Enable/Disable Forced Password Prompting.

Forced prompting provides another layer of security to the Autopass feature. When the Quad Modem receives a valid Autopass password from the Guest's modem, the Guest is also prompted for the Fallback password.

To enable or disable Forced Password Prompting, set S-Register S53.3:

| Command   | Function                          |
|-----------|-----------------------------------|
| ATS53.3=1 | Enable Forced Password Prompting  |
| ATS53.3=0 | Disable Forced Password Prompting |

8 Enable/Disable Link Security by setting S-Register S53.0.

| Command   | Function              |
|-----------|-----------------------|
| ATS53.0=1 | Enable Link Security  |
| ATS53.0=0 | Disable Link Security |



## 9 Activate Link Security.



**CAUTION:** *Link Security is not fully active until all settings are saved to the modem's NVRAM and the modem resets. Before completing this step, verify all passwords to avoid the risk of being locked out of the modem.*

- a** Verify all passwords by entering:

**ATI10**

- b** Enter the following command to store settings to NVRAM:

**AT&W**

- c** Enter the following command to reset the modem, activating Link Security:

**ATZ**

### Viewing Account Status

To view account status, enter:

**ATI10**

If Local Access Protection is enabled, the ATI10 command cannot execute unless the AT%S command establishes local access to the Link Security account. See Local Access Protection in Step 4 above.

Erasing Account Information

After entering the Local Access Password, use the %E=*n* command to make system edits.

| Command | Function                     |
|---------|------------------------------|
| AT%E=1  | Erase Local Access Password. |
| AT%E=2  | Erase Autopass Password.     |
| AT%E=3  | Erase the Accounts password. |
| AT%E=4  | Erase Accounts phone number. |
| AT%E=5  | Erase Accounts Status.       |

To edit or overwrite the Host Security account, use the%A= command.

| Command                             | Function                                       |
|-------------------------------------|------------------------------------------------|
| AT%A=                               | Security Account Information Command Structure |
| AT%A=PW, ACCT E, DIAL B, NEW #, PH# | n= 0-9                                         |
|                                     | PW=Password                                    |
|                                     | ACCT E = Account Enable                        |
|                                     | DIAL B = Dial Back Enable                      |
|                                     | NEW # = New Dial Back #                        |
|                                     | PH # = Dial back Phone #                       |



# 9

## USING CELLULAR PROTOCOLS

This chapter includes:

- Overview of Microcom Networking Protocol 10 and Enhanced Throughput Cellular
- Using Cellular Templates
- Using Microcom Networking Protocol 10 Cellular Protocols
- Using ETC Cellular Protocols

---

### Overview

The Quad Modem uses the Microcom Networking Protocol 10 (MNP 10) and Enhanced Throughput Cellular (ETC) cellular protocols. These protocols are designed to combat a variety of link establishment and data transfer problems specific to cellular calls.



*Cellular features are available only if cellular support was purchased for the Quad Modem or through the chassis Network Management Card (NMC). For more information on purchasing cellular support, please contact your sales representative.*

### What is Microcom Networking Protocol 10?

MNP10 is one of the leading error-correction protocols. It operates with existing data compression standards such as V.42 *bis* or MNP 5, yet goes beyond basic error-correction techniques to improve overall throughput, especially if channel conditions are less than ideal, such as:

- Cellular calls
- Long-distance land-line calls
- Calls in rural areas

### How Microcom Networking Protocol 10 Works

MNP10 modifies data transfer techniques to increase reliability over cellular links. It uses three major strategies:

| Strategy                                   | Function                                                                                                                                   |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Aggressive Adaptive Packet Assembly (AAPA) | Adjusts the data packet size during data transfer in response to line conditions, ensuring the maximum allowable packet size at all times. |
| Link Management Idle (LMI)                 | Monitors line conditions when no data is being sent, and helps guard against lost connections.                                             |
| Dynamic Transmit Level Adjustment (DTLA)   | Changes the transmit level dynamically to adapt to changing line conditions and determine the best level for a cellular link.              |



*DTLA is necessary only for calls across cellular links. In answer mode, the modem detects when an incoming call is using DTLA, and automatically activates its own DTLA. If calls are originating from a mobile site (cell side), the modem must be set for MNP10 Cellular (S60.3=1) to implement DTLA.*

### Non-Cellular Microcom Networking Protocol 10 Calls

MNP10 is negotiated for noncellular calls, but offers no advantage over other protocols. Disable MNP10 (ATS60.1=0) to originate calls under V.34, V.FC, HST, or V.32 Terbo.

### What is Enhanced Throughput Cellular?

ETC is a set of cellular protocol enhancements allowing the Quad Modem to send data at 14.4 kbps.

### How Enhanced Throughput Cellular Works

When ETC is enabled, the modems recognize calls from other modems using ETC and alters settings for increased performance when transmitting data across cellular links.

ETC requires the modems to establish V.42 error control. ETC also requires a V.32 *bis*, V.32, or V.22-type connection. ETC does not function under V.34 modulation.

The modem uses ETC when it answers a call and receives the ETC calling tone. The modem must receive the ETC calling tone from the originating modem. It is the only way the Quad Modem knows it will be transmitting over a cellular link. If the Quad Modem does not receive the ETC calling tone, the call progresses normally without ETC settings.

Originating  
Non-Cellular  
Enhanced  
Throughput Cellular  
Calls

When enabled for ETC, the modem implements ETC settings for all outgoing calls. Even if it is not connecting across a cellular link, the modem forces a V.32 or V.22-type modulation and V.42 with a reduced packet size, and will not connect using V.34. It also transmits using de-emphasis and reduced transmit level, which results in reduced throughput or even dropped calls. If the Quad Modem is used to originate calls across noncellular links, use the Disable ETC During Originate Mode setting (ATS66.7=1).

Using the Cellular  
Templates

Three cellular templates stored in the modem's ROM allow activation of ETC or MNP10 with the modem settings that offer maximum performance.

Use the &Fn command to load a template.



**CAUTION:** Do not load cellular templates if special configuration changes have been made to the modem. When a template is loaded, it overwrites all settings with the modem defaults. Instead, use the AT command string equivalent or configure cellular parameters individually with the settings listed under the appropriate template.

Activating Enhanced Throughput Cellular and Microcom  
Networking Protocol 10 at the same time

Only one template may be loaded at a time. Perform the following actions to activate both ETC and MNP10:

- 1 Load the ETC Cellular Template.

| To Load This Template   | Use this AT Command | AT Command String Equivalent |
|-------------------------|---------------------|------------------------------|
| MNP10 Cellular          | AT&F4               | ATS60=3                      |
| ETC Mobile Cellular     | AT&F5               | ATS66=103 S7=90 S10=100      |
| ETC Fixed Site Cellular | AT&F6               | ATS66=101 S7=90 S10=100      |

- 2 Configure the modem with the settings or AT Command String listed for the MNP10 template.

## Using Microcom Networking Protocol10

All the options listed apply only for MNP10 calls. The settings do not affect normal connections.

### Negotiation

Use the following table to enable and disable negotiation.

| Command   | Function                   |
|-----------|----------------------------|
| ATS60.0=1 | Enable MNP 10 Negotiation  |
| ATS60.0=0 | Disable MNP 10 Negotiation |

### Extended Services

Microcom Networking Protocol Extended Services (MNPX) allows the modems to negotiate MNP10 as a part of the V.42 negotiation process.



**CAUTION:** If MNPX is disabled, calls from modems using MNPX and V.42 bis connect without MNP10.

| Command   | Function     |
|-----------|--------------|
| ATS60.0=1 | Enable MNPX  |
| ATS60.1=0 | Disable MNPX |

### V.42 bis Compression

Used for testing purposes only. With V.42 bis compression disabled, the modem only negotiates for MNP5 compression, and if unsuccessful, connects without compression.

| Command   | Function                                 |
|-----------|------------------------------------------|
| ATS60.2=0 | Enable V.42 bis compression negotiation  |
| ATS60.2=1 | Disable V.42 bis compression negotiation |

### Cellular

When enabled, DTLA is used when originating calls from the cell side of a cellular link. With the default setting, DTLA is only used when answering calls from across cellular links (if the caller's modem is set for cellular).

| Command   | Function                                  |
|-----------|-------------------------------------------|
| ATS60.3=0 | Use DTLA only if caller is using DTLA     |
| ATS60.3=1 | Use MNP10 Cellular (originate using DTLA) |

**Forcing 1200 bps Connection**

This command forces a V.22 1200 bps link rate for MNP10 connections.

| Command   | Function                              |
|-----------|---------------------------------------|
| ATS60.4=0 | Negotiate for highest connection rate |
| ATS60.4=1 | Force 1200 bps                        |

**Fallback**

MNP 10 Fallback prevents the modem from falling back to lower speeds during MNP10 connections. This feature is used for testing purposes only.

| Command   | Function         |
|-----------|------------------|
| ATS60.5=0 | Enable Fallback  |
| ATS60.5=1 | Disable Fallback |

**Fallforward**

MNP 10 Fallforward prevents the modem from falling forward to higher speeds during MNP10 connections. This feature is used for testing purposes only.

| Command   | Function            |
|-----------|---------------------|
| ATS60.6=0 | Enable Fallforward  |
| ATS60.6=1 | Disable Fallforward |

**Microcom Networking Protocol Extended Services Detection Pattern**

Typically, the MNPX detection pattern expedites connections under MNP10 when connecting with other modems supporting MNPX. However, the MNPX detection pattern can cause problems when dialing to MNP10 modems without MNPX. They will connect, but without MNP10. Disable the MNPX detection pattern if you experience this problem.



*In answer mode, always enable the MNPX detection pattern.*

| Command   | Function                       |
|-----------|--------------------------------|
| ATS60.7=0 | Enable MNPX Detection Pattern  |
| ATS60.7=1 | Disable MNPX Detection Pattern |



### Providing Compatibility with Older Modems

This feature provides V.42 *bis* compatibility when originating to some older MNP10 modems that do not have MNPX capabilities. The short form assumes the maximum string length is 32 octets and the direction of compression is always bidirectional.

| Command | Function                                      |
|---------|-----------------------------------------------|
| ATS61=0 | Allows for normal V.42 <i>bis</i> compression |
| ATS61=1 | Allows for form 1 Code Words 512              |
| ATS61=2 | Allows for form 2 Code Words 1024             |
| ATS61=3 | Allows for form 3 Code Words 2048             |

### Using Enhanced Throughput Cellular Protocols

All the options listed apply only for ETC calls. The settings do not affect normal connections.

#### Negotiation

The modem uses ETC in response to the ETC calling tone.

| Command   | Function                |
|-----------|-------------------------|
| ATS66.0=1 | Enable ETC Negotiation  |
| ATS66.0=0 | Disable ETC Negotiation |

#### Site Operations

ETC Site Operations determines whether the modem uses a fixed site or mobile site cellular profile. The cellular profile sets transmit levels based on ETC specifications.

| Command   | Function                    |
|-----------|-----------------------------|
| ATS66.1=0 | Set the fixed site profile  |
| ATS66.1=1 | Set the mobile site profile |

#### Calling Tone

Use the ETC calling tone if originating calls from the mobile side (cell side) of a cellular link. The calling tone is generated during link establishment, and tells the answering modem to use ETC settings.

Disable the calling tone only if you experience problems when originating calls to non-cellular modems.

| Command   | Function                 |
|-----------|--------------------------|
| ATS66.2=1 | Enable ETC Calling Tone  |
| ATS66.2=0 | Disable ETC Calling Tone |

### Forcing Enhanced Throughput Cellular

Some callers may be using an earlier ETC version that does not generate the ETC calling tone used as of version 1.1. For the modem to implement ETC when answering calls from these modems, it must be set to Force ETC for every call it receives. (In this case, the system administrator may wish to dedicate some modems for cellular calls only.)

| Command   | Function                              |
|-----------|---------------------------------------|
| ATS66.3=0 | Force ETC on calling tone detect only |
| ATS66.3=1 | Force ETC for all calls               |

### Data Communications Equipment Startup Rate

Some cellular links may be so poor that calls drop even before the modems can initialize modulation and error control negotiation. To reduce the number of dropped calls, set the modem to a 9600 bps start-up rate. The modems negotiate at the lower and more stable link rate, and after the link is established, raise the link rate to the higher levels offered by ETC

| Command  | Command  | Function      |
|----------|----------|---------------|
| ATS66.4= | ATS66.5= | Start-up Rate |
| 0        | 0        | Auto          |
| 1        | 0        | 4800          |
| 0        | 1        | 9600          |
| 1        | 1        | Reserved      |

### Transmit De-emphasis

We recommend Transmit De-emphasis when connecting over a cellular link, whether the modem is on the fixed site or mobile site. If enabled, transmit de-emphasis is automatically implemented whenever the modem receives an ETC call.

| Command   | Function                     |
|-----------|------------------------------|
| ATS66.6=1 | Enable Transmit De-emphasis  |
| ATS66.6=0 | Disable Transmit De-emphasis |

### Originate Mode

This setting disables ETC when originating calls, yet allows it to negotiate ETC in answer mode. If the modem places outgoing calls to noncellular modems, use this setting to disable ETC in originate mode.

| Command   | Function                     |
|-----------|------------------------------|
| ATS66.7=0 | Enable ETC during originate  |
| ATS66.7=1 | Disable ETC during originate |

**Maximum Link Rate**

Setting the maximum Link Rate prevents the modem from connecting or falling forward to link rates higher than that specified. Lowering the maximum link rate to 9600 bps provides more stability for cellular calls under adverse conditions. However, higher throughput is sacrificed for calls over stronger cellular links that can support higher link rates.

| Command | Function                                        |
|---------|-------------------------------------------------|
| ATS64=0 | Allow the modem to select the maximum link rate |
| ATS64=4 | Connect at maximum of 4800 bps                  |
| ATS64=5 | Connect at maximum of 7200 bps                  |
| ATS64=6 | Connect at maximum of 9600 bps                  |
| ATS64=7 | Connect at maximum of 12000 bps                 |
| ATS64=8 | Connect at maximum of 14400 bps                 |

**Transmit Level**

Data transfer across cellular links requires a reduced transmit level. When ETC is established for a call, the modem automatically reduces its Transmit level to the value specified by this parameter.

With the default setting, the modem sets the Transmit level according to ETC specifications based on whether it is transmitting over T1 or analog lines and whether the modem is set for fixed site or mobile. We do not recommend changing this setting.

| Command | Function                                                             |
|---------|----------------------------------------------------------------------|
| ATS65=0 | Allow modem to control Transmit Level                                |
| ATS65=n | Transmit level fixed to n for ETC calls, where n=10-25 negative dBms |

# FAX CAPABILITY

This chapter includes:

- Overview
- Fax and Data Modes
- Additional Information

## Overview

The Quad Modem can send and receive faxes in both Class 1 and Class 2.0 Fax modes.

Fax operations require fax-compatible software. For more information about fax operations, follow the instructions in the fax software documentation.

## Fax and Data Modes

The Quad Modem normally operates in Data mode. Fax software typically switches the modem to Fax mode when the program runs, and resets the modem to Data mode when it exits.



*If the fax modem is reset with the ATZ command, by toggling the DTR signal, or by turning the power Off and On, the modem is set to Data mode.*

### Determining if the Modem is in Data or Fax Mode

Use this table to determine if the Quad Modem is in data or fax mode::

| To do this                                    | Use this command | If the modem returns | The modem is in this mode |
|-----------------------------------------------|------------------|----------------------|---------------------------|
| Determine if the modem is in Data or Fax mode | AT+FCLASS?       | 0                    | Data                      |
|                                               |                  | 1                    | Class 1 Fax               |
|                                               |                  | 2.0                  | Class 2.0 Fax             |

## Switching to Data or Fax Mode

| To do this         | Use this command |
|--------------------|------------------|
| Data Mode          | AT+FCLASS=0      |
| Class 1 Fax mode   | AT+FCLASS=1      |
| Class 2.0 Fax mode | AT+FCLASS=2.0    |

## Fax Service Class 1 Commands

| Command                  | Function                            |
|--------------------------|-------------------------------------|
| AT+FTS=n (0,255)         | Stop transmission and pause, 10 ms. |
| AT+FRS=n (0,255)         | Wait for silence, 10 ms.            |
| AT+FTM=n (3,24,48,72,96) | Transmit data with carrier          |
| AT+FRM=n (3,24,48,72,96) | Receive data with carrier           |
| AT+FTH=n (3,24,48,72,96) | Transmit HDLC data with carrier     |
| AT+FRH=n (3,24,48,72,96) | Receive HDLC data with carrier      |

## Optional Class 2.0 Fax Commands Supported

| Command          | Function                                          |
|------------------|---------------------------------------------------|
| AT+FNS           | Pass-through non-Standard negotiation byte string |
| AT+FCR=0,1       | Capability to receive                             |
| AT+FAA=0,1       | Adaptive Answer mode                              |
| AT+FCT=0-255 sec | Phase C Timeout                                   |
| AT+FHS?          | Hangup Status Code, read only                     |
| AT+FMS=0-3       | Minimum Phase C Speed                             |
| AT+FBS?=500,100  | Buffer size, read only                            |

## Additional Information

Fax operations require facsimile-compatible software. Follow the instructions in the fax software documentation to send and receive faxes.



*Lists of supported Class 1 fax commands and optional Class 2.0 commands are in the Technical Specifications in the Quad V.34 Modem/Quad Network Interface Card documentation.*

## More Information About Class 1 Fax Commands

For more information about Class 1 fax commands, refer to the standard for the Service Class 1 fax protocol.

ANSI/EIA/TIA-578-1990 (EIA-578)

Asynchronous Facsimile DCE Control Standard November, 1990  
Approved: October 22, 1990

**More Information  
About Class 2.0 Fax  
Commands**

For more information about Class 2.0 fax commands, refer to the standard for the Service Class 2.0 fax protocol.

ANSI/EIA/TIA-592-1993 (EIA-592)

Asynchronous Facsimile DCE Control Standard May, 1993

*Copies of these standards are available by contacting Global Engineering Documents, at 1-800-854-7179.*

**Call Detection**

Quad Modems support Call Detection, which is a method of reporting whether an incoming call is Data, Fax Class 1, or Fax Class 2.0. It is especially useful for Bulletin Board systems, as it automates recognition of different calls from multiple users.

Call Detection is an optional Service Class 2.0 feature, and is also implemented for Fax Class 1 applications.

To obtain a copy of the technical specification for the implementation of Call Detection for Fax Class 1, refer to the contact information at the front of this Product Reference.

For information on implementing Fax Class 2.0 Call Detection, refer to the Additional Information section in this chapter.



# 11

## UPGRADING QUAD MODEM SOFTWARE

This chapter includes:

- Overview
- Checking The Software Version
- Getting New Operating Software
- Software Download Using Total Control Manager
- Software Download Using PCSDL

---

### Overview

Updates and enhancements to Quad Modem operating software are periodically released. This software is available from the 3Com Total Service web site (<http://totalservice.3com.com>).

A standard terminal program that can send files using PCSDL is necessary to send new code to the Quad Modem.



*You can also download software using Total Control Manager.*

*Also, 3Com documentation often refers to upload as download. Download, in most instances of 3Com documentation, refers to sending files to another network device, particularly the Total Control Enterprise Network System.*

---

### Checking The Software Version

To verify the software version, enter:

**ATI7**



A display similar to the following appears:

```

ati7
USRobotics Analog/Digital Quad Configuration Profile...
Copyright, 1988-97, U.S. Robotics. All rights reserved.

Product type           US/Canada Rackmount
Slot/Channel           13/1
Options                HST,V32bis,Terbo,V.FC,V34+
Cellular Options       MNP10,MNP10EC & ETC
ISDN Options           V.110, V.120, SYNC, PPP, & X.75
Fax Options            Class 1/Class 2.0
Clock Freq             20.16Mhz
Flash Rom              512K
Ram                   384K

Supervisor date        04/21/98
DSP date               04/20/98

Supervisor rev         6.0.0
DSP rev                6.0.0

```

Check the Supervisor and Digital Signal Processor (DSP) dates. The best way to find the most recent version of Quad Modem software is to check the Total Service web site (see below).

---

### Getting New Operating Software

The newest version of Quad Modem operating software is available for download at 3Com's Total Service web site. The URL for this site is:

<http://totalservice.usr.com/>

---

### Installing New Software Using Total Control Manager

Before uploading a new software code version, make sure the Quad Modem software upgrade is compatible with the NMC or HiPer ARC software version.

When Total Control Manager performs a the upload, the information is sent across the management bus to the appropriate Network Application Card (NAC). Software for firmware upgrades through Total Control Manager is by default installed into C:\USRSUITE\SDL.



**CAUTION:** Do not do anything to disturb the hub while a software download is running or the download will crash.

To download new Quad Modem software:

- 1 Obtain the NAC and SDL files necessary for the Quad upgrade, the same files necessary for SDL1 (i.e. \*.sdl and \*.nac files).
- 2 Load these files into a directory on the management station connected to the Quad's chassis.
- 3 Use Total Control Manager to access the chassis.
- 4 Select the Quad Modem card, then select **Software Download** from the **Configure** menu.
- 5 Double click any cell to browse the management station's directories to locate the appropriate upgrade files.
- 6 When these files show in the download window, click **Start**.
- 7 A message indicates that the software uploaded successfully.



*If the Quad is operating on a busy network, the file transfer may fail due to a Trivial File Transfer Protocol (TFTP) time-out. If this occurs, reduce the traffic on the network and retry the upload—or try to upload the files from a workstation in close proximity to the chassis.*

---

## Software Download Using PCSDL

Before downloading new software, confirm the Quad Modem software upgrade is compatible with the NMC or HiPer ARC software version. That information is available on at **<http://totalservice.3com.com>**.

The SDL1 Program executes a software download from a management station connected to the appropriate NAC through a serial connection. Connect a PC to the RS-232 port of the Quad NIC behind the Quad Modem to be upgraded.

SDL1 is used with all NACs except the HiPer DSP and HiPer ARC, which require SDL2 to perform a software download. The following files are required to complete a PCSDL to a Quad Modem:

- PCSDL.EXE -- software download program.
- \*.SDL -- example qfo4o3o1.sdl, Loader help file.
- \*.NAC -- example qf030202.nac, actual firmware code

The advantage of using PCSDL over Total Control Manager is that the download can automatically resume if it is interrupted.

To connect the workstation to the Quad:

- 1 Use the DB-50 to DB-25 fan out cable provided with the Quad, and attach it to the DB-50 port on the NIC.
- 2 Attach a standard serial cable between the appropriate fan cable modem port (1–4) and the work station serial port. (A null modem adapter is not necessary.)



*The software must be downloaded to each individual modem.*

After the work station is connected to the appropriate NIC, and the files are copied to the work station's hard disk, the download process can begin.

Enter all commands using the MS DOS Prompt. Commands may be entered in either upper or lower case. Leave a space after each command. All parameters are required, except **-d**. PCSDL assumes all required files are in the current directory. Use the **-d** parameter to specify an alternate directory.

*Syntax*     pcsdl -p# -r# -vsd#.#.# -vna#.#.# -nsd\_ \_ -nna \_ \_

This table defines all parameters used in the command syntax.

| Parameter   | Purpose                                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>pcsd</b> | Executes the SDL Program                                                                                                                         |
| <b>-p</b>   | Selects the communication port ( ports 1 or 2 )                                                                                                  |
| <b>-r</b>   | Selects serial port rate which should equal the DIP switch settings of the card                                                                  |
| <b>-vsd</b> | Software download file, <b>*.SDL</b> , version number - substitute a real number for #.#.# (Example: -vsd1.0.2)                                  |
| <b>-vna</b> | Software <b>*.NAC</b> operation code version number - substitute a real number for #.#.# (Example: -vna 1.0.3)                                   |
| <b>-nsd</b> | Identifies card type from the <b>*.SDL</b> file name prefix - substitute real letters for _ _ (Example: -nsdqf identifies the V.34 Quad Modem)   |
| <b>-nna</b> | Specifies card type from the <b>*.NAC</b> file name prefix - substitute real letters for _ _ (Example: -nnaqf identifies the V.34 Quad Modem)    |
| <b>-d</b>   | Optional - Specifies the directory path name; <b>-d</b> should be followed by the directory name where the operation and SDL software are stored |

Once the SDL1 program begins, the PC sends a special AT command to the NAC. The NAC enters SDL mode and control transfers to a loader. Once a NAC enters SDL mode, no other application code can run. The NAC becomes entirely devoted to performing the SDL. The SDL program first verifies the initialization and operation software, then begins the download. As the program executes, status messages display.

This table lists SDL and NAC prefixes related to the Quad Modem.

| SDL Prefix | NAC Prefix | Card                           |
|------------|------------|--------------------------------|
| qf         | qf         | V.34 Quad Modem (all versions) |
| qm         | qm         | V.32bis Quad Digital Modem     |
| qr         | qr         | Single Sided Quad Modem        |
| qt         | qt         | V.32 Terbo Quad Modem          |

The SDL1 procedure:

*Example* C: \SDL>pcsd1 -p1 -r38400 -vsd2.1.0 -vna2.3.1 -nsdqf -nnaqf  
 Verifying Initialization Program File:100%\n  
 Verifying Operation Program File:100%\n  
 Establishing Communication. . .  
 Downloading Initialization Program: 100%\n  
 Initiating Software Download . . .  
 Downloading Operation Program . . .  
 Erasing Flash ROM . . .  
 Programming Flash ROM . . .  
 Downloading Operation Program . . .  
 Programming Flash ROM . . .  
  
 Checking Downloaded Program CRC . . .  
 Software download Successful!



# 12

## CHANGING CALL CONTROL SETTINGS

This chapter includes:

- Overview
- Call control settings

---

|                 |                                                                                              |
|-----------------|----------------------------------------------------------------------------------------------|
| <b>Overview</b> | Use AT commands to dial, answer, and disconnect phone calls, as well as negotiate protocols. |
|-----------------|----------------------------------------------------------------------------------------------|

---

|                              |                                                                                                                                                                                                                                                                                                |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Call Control Settings</b> | The defaults listed are based on the modem's shipping configuration. They are loaded from nonvolatile random access memory (NVRAM), and are equivalent to configuration template &F1. For additional information about NVRAM and templates, refer to the <i>Stored Configurations</i> chapter. |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Answer  
Sequence/Tone Select**

*Syntax*    ATBn

Default: ATB0

| Command | Selects                                                                                                                                                |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| ATB0    | ITU-T / V.32 answer sequence; required to answer all V.34 and overseas calls                                                                           |
| ATB1    | Bell Answer Tone. This setting selects High Speed Technology (HST) modulation, but uses it only if the modem is not required to answer V.34 type calls |
| ATB2    | Bell 208B 4800 synchronous                                                                                                                             |

*Example* To set the Answer Sequence/Tone Select to Bell 208B 4800 synchronous, enter:

**ATB2**



*Quad Modems use the V.8 answer sequence and falls back to V.25 if not supported. V.8 can be disabled using S-Register 54.7.*

### **Additional Answer Tone Time**

*Syntax* **ATS49=n**

Default: 16

Settings: 0–30

ATS49 sets extra Answer Tone Time, in msec., transmitted in answer mode. The modem normally transmits 1000 msec. Available values are 0–30, so the answer tone is scalable to 4000 msec. Values greater than 30 are treated as 30. The default is 16 for an answer tone of 2600 msec.

*Example* To set the Answer Tone Time to twenty, enter:

**ATS49=20**

### **Answer in Originate Mode**

*Command* **ATS13.1=1**

Default: ATS13.1=0 (Disabled)

Enables Auto Answer in Originate mode.

# Automatic Retransmission reQuest Negotiation

Syntax AT&Mn

Default: AT&M4 (Normal ARQ)

| Command | Selects    |
|---------|------------|
| AT&M0   | None       |
| AT&M4   | Normal ARQ |
| AT&M5   | ARQ Only   |

Example To set Automatic Retransmission reQuest (ARQ) to None, enter:

**AT&M0**



*If set to None, it allows asynchronous connections without error control. If set to Normal ARQ (default), the local modem attempts to connect under error control, but will connect without if it cannot be negotiated. If set to ARQ Only, the local modem attempts to use error correction and hangs up if the remote modem is not using error correction.*

## Auto-Dial on DTR

Command **ATS13.3=1**

When ATS13.3 is enabled, the modem dials the number stored in position 0 of the modem's NVRAM when Data Terminal Ready (DTR) is toggled.

Default: ATS13.3=0 (Disabled)



## Auto Dial on Power Up

*Command*     **ATS13.4=1**

When ATS13.4 is enabled, the modem dials the number stored in position 0 of the modem's NVRAM when the modem powers on or resets.

Default: ATS13.4=0 (Disabled)



*When using the Quad modem with a Dual PRI card, disable chassis awareness on the PRI card and manually configure the PRI card's chassis slot device configuration. Otherwise, you will not be able to use Auto Dial after you reset the Quad modem.*

## Billing Delay Time

*Syntax*     **ATS50=n**

ATS50 sets the billing delay period, in fiftieths of a second. This defines a period of silence between the time the modem goes off-hook and when it begins the answer sequence.

Settings: 0–255

Default: 100

*Example*     To set the Billing Delay Time to thirty, enter:

**ATS50=30**

## Carrier Wait Time

*Syntax*     **ATS7=n**

ATS7 sets the duration, in seconds, that the local modem waits to detect a carrier signal from the remote modem.

Settings: 0–255

Default: 60

*Example* To set the Carrier Wait Time to forty, enter:

**ATS7=40**

### **Default Phone Number**

*Syntax* AT&Z0=s

AT&Z0 stores dial strings in the modem's NVRAM at position 0. This setting is used for either the Dial on DTR Active or Auto Dial on Power Up features.

*Example* To store 555-5555 to the NVRAM, enter:

**AT&Z0=5555555**

### **Disconnect/Reset on Data Terminal Ready Drop**

*Command* **ATS13.0=1**

With this setting, the modem hangs up and resets when DTR drops.

Default: ATS13.0=0 (The modem does not reset when DTR drops)

### **Data Terminal Ready Low Before Ready**

*Command* **ATS27.6=1**

When enabled, the modem requires that DTR go low before it accepts another call. The modem also implements a Fast Connect in Native Mode, which asserts CD before the link negotiation process is complete. This feature is reserved for a private, custom application and is not recommended for general usage.

Default: ATS13.4=0 (Disabled)

## Idle Time

*Syntax*    **ATS19=n**

If the value of this function is set greater than 0, the Inactivity Timer is activated when there is no data activity in either the transmit or receive direction. If no data activity is detected by the time-out period (specified in minutes), the modem hangs up.

Settings: 0–255

Default: 0

*Example*    To set the Idle Time to ten, enter:

**ATS19=10**

## Guard Tone

*Syntax*    **AT&Gn**

AT&G sets a guard tone of either 550 Hz (required for some European countries) or 1800 Hz (for UK and some Commonwealth countries). Guard tone requires B0 setting (ITU-T answer sequence).

| Command | Selects            |
|---------|--------------------|
| AT&G1   | 550 Hz guard tone  |
| AT&G2   | 1800 Hz guard tone |

Default: AT&G0 (No guard tone, U.S. and Canada)

*Example*    To set the Guard Tone to 1800 Hz, enter:

**AT&G2**

### Modem Indicate/Modem Indicate Closure

*Command*    **ATS34.5=1**

ATS34.5 enables the Mode Indicate/Mode Indicate Common (MI/MIC) closure function required for some systems.

Default: ATS34.5=0 (Disabled)



*Not supported by all modems.*

### MNP/V.42 Link Request Timeout

*Syntax*    **ATS52=n**

ATS52 stores the duration of the time-out, in seconds, when the modem is negotiating an Microcom Networking Protocol (MNP)/V.42 link request for 1200/2400 answer mode.

Settings: 0–14

Default: 5

*Example*    To set the MNP/V.42 Link Request Timeout to ten, enter:

**ATS52=10**

### V.32 300/600 Hz Tone Times

*Syntax*    **ATS28=n**

ATS28 sets the duration, in tenths of a second, of the Electronic Industries Association (EIA) specified Multimode Training sequence for V.32 modems, which includes Dual Standard modems set to answer V.32 calls (set to B0). The delay gives V.32 modems additional time to connect with most U.S./Canada modems at 9600 bps before falling back to attempt a V.21 connection (to answer overseas calls, 300 bps) or a V.23 connection (some United Kingdom modems, 1200 bps with a 75-bps back channel).

The fallback occurs only if the modem is set for V.21 (S27, bit 0 enabled) and/or V.23 (S34, bit 3 enabled).

Settings: 0–255

Default: 8

*Example* To set the V.32 Tone Times to ten, enter:

**ATS28=10**

## Auto Answer

*Syntax*   ATS0=n

ATS0 sets the number of rings on which to answer incoming calls when the modem is in Auto Answer mode. Setting to 0 or setting DIP Switch 5 On disables the modem's Auto Answer feature.

Settings: 0–255

Default: 1

*Example* To set the Auto Answer rings to three, enter:

**ATS0=3**

## Start Dialing Time

*Syntax*   ATS6=n

ATS6 sets the number of seconds the modem waits to dial after detecting a dial tone.

Settings: 0–255

Default: 2

*Example* To set the time to start dialing to three, enter:

**ATS6=3**

## Tone Recognition

*Command*     **AT%T1**

AT%T1 enables the Quad Modem, when off hook, to recognize the tone frequencies of dialing modems.

Default: AT%T0

## UK Pulse Dialing Make/Break Ratio

*Command*     **AT&P1**

AT&P1 sets pulse dialing make/break ratio for UK and some Commonwealth countries.

Default: AT&P0 (U.S./Canada make/break ratio)

## V.21/V.23 Fallback Time

*Command*     **ATS29=n**

ATS29 sets the length of the V.21 answer tone before falling back to V.23 if both V.21 and V.23 are enabled.

Settings: 0–255

Default: 20

*Example*     To set the Fallback time to forty, enter:

**ATS29=40**

## V.23 Call Negotiation

*Command*     **ATS34.3=1**

ATS34 allows the Quad Modem to negotiate a V.23 connection (used in UK) at 1200 bps after failing to negotiate a higher rate.

Default: ATS34.3=0 (Disabled)



# 13

## CHANGING DATA TERMINAL EQUIPMENT INTERFACE SETTINGS

This chapter includes:

- Overview
- Changing Data Terminal Equipment (DTE) Interface Settings

---

### Overview

The settings that affect the interface between the Quad Modem and the Personal Computer it connects to are changed using the following procedures.



*The defaults listed are based on the modem's shipping configuration. They are loaded from Nonvolatile Random Access Memory (NVRAM), and are equivalent to configuration template &F1. For additional information about NVRAM and templates, see the Stored Configurations chapter.*

---

### Changing Data Terminal Equipment Interface Settings

The following are various interface settings.

#### Appletalk InterBridge Network

*Command*     **ATS15.7=1**

Enable this command when connecting with an AppleTalk InterBridge Network.

Default: ATS15.7=0 (Disabled)



## Break Length

*Syntax*    **ATS21=n**

This command sets the duration of breaks, in 10 ms increments, sent by the modem to the DTE when in Automatic Retransmission reQuest (ARQ) error control mode.

Settings: 0–255

Default: 10

*Example*    To set the Break Length to fifteen, enter:

**ATS21=15**

## Carrier Detect State

*Syntax*    **AT&Cn**

With Carrier Detect (CD) always On, CD remains true (high). With the CD on Connect option, the modem asserts CD only when it connects with a remote modem, and drops CD when it disconnects.



*The &Cn command only temporarily overrides the DIP Switch 6 setting until power-on or reset.*

| Command | Selects       |
|---------|---------------|
| AT&C1   | CD on connect |
| AT&C0   | CD always on  |

Default: DIP Switch 6 Off (CD on Connect)

*Example*    To set CD to always on, enter:

**AT&C0**

## Clear to Send Delay

*Syntax*    `ATS26=n`

This command sets the duration, in 10 ms increments, of the delay between the DTE's assertion of Ready To Send (RTS) and the modem's assertion of Clear To Send (CTS). This function is valid only for synchronous communications when the Hardware Flow Control parameter is set to CTS Delayed after RTS.

Settings: 0–255

Default: 1

*Example*    To set the CTS Delay to five, enter:

**ATS26=5**

## Data Set Ready Functionality

*Syntax*    `ATSn`

Data Set Ready (DSR) signaling is normally overridden (always on). However, some systems require the modem to signal the DTE when the modem is ready to answer a call.

Depending on the system requirements, set DSR functionality to one of the following settings.



*The duration of pulsed DSR is programmable. See Register S24.*

| Command | Selects                                                                                                                                                                               |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&S0   | DSR always On (DSR Normal).                                                                                                                                                           |
| AT&S1   | Modem sends a DSR signal when it detects a modem tone on the phone line.                                                                                                              |
| AT&S2   | On loss of carrier, modem sends computer a pulsed DSR signal and Clear to Send (CTS) follows Carrier Detect (CD). This setting is also required by Smart-mode modems on leased lines. |
| AT&S3   | This is the same as &S2, but without CTS following CD.                                                                                                                                |
| AT&S4   | DSR follows CD.                                                                                                                                                                       |
| AT&S5   | CTS follows CD, with DSR normal.                                                                                                                                                      |

Default: AT&S0 (DSR always On)

*Example* To set DSR to follows CD, enter:

**AT&S4**

## Rate Mode

*Syntax* AT&Bn

When set to the default, fixed, the modem automatically sets its port speed to that of the DTE. The modem determines the DTE rate from the speed at which AT commands are sent to it.



*If AT commands cannot be sent, the modem's port speed must be manually matched with that of the DTE. This can be done by sending the modem the AT prefix through a communications software set at the port speed of your DTE.*

With the Follows Link rate setting, the modem switches its DTE speed to match the connection (link) rate. This is not recommended for non-ARQ (non-error-corrected) calls.

With the Adaptive setting, the modem's serial port reverts to the fixed mode for ARQ calls, or Follows Link rate for non-ARQ calls. Rate Mode requires X1, &A1, or higher, and it also requires the desired high fixed rate (38.4 K, 57.6 K, or 115.2 Kbps) be stored in NVRAM. Set the software to the high rate and enter the following command to write the rate to NVRAM.

**AT&B2&W**

When the modem makes an error control connection, it checks the rate in NVRAM and shifts up to that rate. If the connection is not under error control, the modem acts as though it were set to &B0 and shifts its serial port rate to match the link rate.

| Command | Selects           |
|---------|-------------------|
| AT&B0   | Follows Link Rate |
| AT&B1   | Fixed             |
| AT&B2   | Adaptive          |

Default: AT&B1 (Fixed)

*Example* To set the Port Rate to Fixed, enter:

**AT&B1**

Data Terminal Ready  
Response

*Syntax* AT&Dn

This command sets response to DTR signal from the computer (DTE).



*The &Dn command only temporarily overrides the setting of DIP Switch 1 until power-on/reset.*

| Command | Selects                                                                                                                 |
|---------|-------------------------------------------------------------------------------------------------------------------------|
| AT&D0   | Does not respond to loss of DTR. Behaves as if DTR always On.                                                           |
| AT&D1   | When DTR is toggled during a call, the modem enters online command mode. This command must be issued before connecting. |
| AT&D2   | Normal DTR. The computer must provide DTR for the modem to accept commands. Dropped DTR terminates a call.              |

Default: DIP Switch 1 Off (Normal DTR)

*Example* To set DTR Response to DTR always On, enter:

**AT&D0**

Escape Code Guard  
Time

*Syntax* ATS12=n

Defines the guard time, in 50ths of a second, for the modem escape code sequence.

Settings: 0–255

Default: 50 (1 second)

*Example* To set the Escape Code Guard Time to two seconds, enter:

**ATS12=100**

## Half Duplex Connection

*Syntax*   ATFn

This command defines whether or not the modem sends a local echo of the data transmitted to the DTE during a half duplex connection.

| Command | Selects        |
|---------|----------------|
| ATF0    | Local Echo On  |
| ATF1    | Local Echo Off |

Default: ATF1 (Local Echo Off)

*Example* To set the Half Duplex Connection to On, enter:

**ATF0**

## Pulse Length

*Syntax*   ATS24=n

This command sets the length of a pulse, in 20ms increments, when Data Set Ready (DSR) is high, and pulsed DSR mode is selected.

Settings: 0–255

Default: 150

*Example* To set the Pulse Length to fifty, enter:

**ATS24=50**

# CHANGING LINK OPTION SETTINGS

This chapter includes:

- Overview
- Data Format Requirements
- Controlling Link Speeds

---

## Overview

The settings that affect link options between the Quad Modem and the modems it connects to are changed using the following commands.



*The defaults listed are based on the modem's shipping configuration. They are loaded from Nonvolatile Random Access Memory (NVRAM), and are equivalent to configuration template &F1. For additional information about NVRAM and templates, see the Stored Configurations chapter.*

---

## Data Format Requirements

To successfully exchange data, both modems must use the same data format. One Start bit is universal and not programmable. The configuration options are listed in the following table. The default setting is 8-none-1.

| Data Bits | Parity              | Stop Bits |
|-----------|---------------------|-----------|
| 7         | Even,Odd,Mark,Space | 1         |
| 7         | None                | 2         |
| 8         | None                | 1         |

## Line Source

To display the current line source, enter:

**ATI6**

## Modifying Line Source

*Syntax*    **AT%Dn**

The Standard Analog setting is for analog phone lines through a Quad Analog/Digital NIC. The T1/DS0 setting is for a T1 DS0 through a chassis T1 card. The T1/PRI is for an ISDN line through a chassis Primary Rate Interface (PRI) card.

| Command | Selects                |
|---------|------------------------|
| AT%D0   | Standard Analog (POTS) |
| AT%D1   | T1/DS0                 |
| AT%D2   | T1/PRI (ISDN)          |

### Example

To set the Line Source to T1/DS0, enter:

**AT%D1**



*After changing the line source to Primary Rate Interface (ISDN), save the settings to the modem's NVRAM and reset the modem for it to take effect.*

## Highest Possible Link Rate

*Syntax*    **AT&Nn**

The variable link setting is recommended, it negotiates the highest possible link rate with remote modem. To set the variable link rate, enter:

**AT&N0**

For a list of link rate settings, see the following table. The modem only connects at the fixed rate. Modem hangs up if called or calling modem does not operate at that rate.



*The link rate should never be fixed higher than the serial port (DTE) rate.*

| Command | Selects   | Command | Selects   |
|---------|-----------|---------|-----------|
| AT&N0   | Variable  | AT&N23  | 36.0 Kbps |
| AT&N1   | 300bps    | AT&N24  | 37333 bps |
| AT&N2   | 1200bps   | AT&N25  | 38666 bps |
| AT&N3   | 2400bps   | AT&N26  | 40.0 Kbps |
| AT&N4   | 4800bps   | AT&N27  | 41333 bps |
| AT&N5   | 7200bps   | AT&N28  | 42666 bps |
| AT&N6   | 9600bps   | AT&N29  | 44.0 Kbps |
| AT&N7   | 12K bps   | AT&N30  | 45333 bps |
| AT&N8   | 14.4K bps | AT&N31  | 46666 bps |
| AT&N9   | 16.8K bps | AT&N32  | 48.0 Kbps |
| AT&N10  | 19.2K bps | AT&N33  | 49333 bps |
| AT&N11  | 21.6K bps | AT&N34  | 50666 bps |
| AT&N12  | 24K bps   | AT&N35  | 52.0 Kbps |
| AT&N13  | 26.4K bps | AT&N36  | 53333 bps |
| AT&N14  | 28.8K bps | AT&N37  | 54666 bps |
| AT&N15  | 31.2K bps | AT&N38  | 56.0 Kbps |
| AT&N16  | 36.6K bps | AT&N39  | 57333 bps |
| AT&N 17 | 28.0 Kbps | AT&N40  | 58666 bps |
| AT&N18  | 29333 bps | AT&N41  | 60.0 Kbps |
| AT&N19  | 30666 bps | AT&N42  | 61333 bps |
| AT&N20  | 32.0 Kbps | AT&N43  | 62666 bps |
| AT&N21  | 33333 bps | AT&N44  | 64.0 Kbps |
| AT&N22  | 34666 bps |         |           |

*Example*    To set the Link Rate to 21.6 Kbps, enter:

**AT&N11**



## Break Handling Methods

*Syntax* AT&Yn

This command selects one of the methods for sending a break to abort a data transfer without disconnecting from the data link.

- Destructive Breaks clear data from the modem's transmit buffer.
- Expedited Breaks are sent immediately to the remote system, ahead of any data currently in the transmit buffer.
- Unexpedient Breaks are sent in sequence with data received from the computer.

| Command | Selects                     |
|---------|-----------------------------|
| ATY0    | Destructive, Unexpedited    |
| ATY1    | Destructive, Expedited      |
| ATY2    | Nondestructive, Expedited   |
| ATY3    | Nondestructive, Unexpedited |

Default: AT&Y1 (Destructive, expedited)

*Example* To set Brake Handling to Destructive, Expedited, enter:

**ATY1**



*Under data compression, destructive breaks cause both modems to reset their compression tables. The tables adapt to allow compression to become increasingly efficient as data is transferred, so resetting the tables temporarily decreases the call's throughput.*

## 2100 Hz Answer Tone

*Command* **ATS27.3=1**

This command disables the 2100 Hz answer tone, allowing V.42 modems to connect more quickly and/or eliminating problems with older 2400 bps modems that do not recognize this tone.

Default: ATS27.3=0 (Enabled)

## Carrier Receive Delay

*Syntax*    **ATS9=n**

This command sets the duration, in tenths of a second, that the remote modem's carrier signal must be present before the local modem recognizes the signal. This setting is ignored at speeds above 2400.

Settings: 0–255

Default: 6

*Example*    To set the Carrier Receive Delay to ten, enter:

**ATS9=10**

## Delay from Carrier Detect to Receive

*Syntax*    **ATS35**

When ATS35 is set to a number greater than 0, and the Custom Connect/Disconnect Mode is enabled (\$27.6=1), the modem inserts a Receive character transmission delay. The number selected for the delay represents 10ms units between Carrier Detect and the first received character. This feature is reserved for a private, custom application and is not recommended for general usage.

Settings: 0–255

Default: 0

*Example*    To set the delay from Carrier Detect to Receive to one, enter:

**ATS35=1**

## Dial Pause Delay

*Syntax*    **ATS8=n**

This ATS8 sets the duration, in seconds, for the pause (,) option in the Dial command, and for the pause between dialing attempts with automatic redialing (> or A>) commands.

Settings: 0–255

Default: 2

*Example*    To set the Dial Pulse Delay to five, enter:

**ATS8=5**

## Duration of Loss of Carrier Before Disconnect

*Syntax*    **ATS10=n**

This command sets the duration, in tenths of a second, and the modem waits after the loss of the remote modem's carrier signal before hanging up. This setting distinguishes between a momentary lapse due to line quality and a true disconnect by the remote modem.

If this value is set to 255, the modem does not hang up on loss of carrier. It hangs up only when DTR is dropped or if it receives the +++ escape code sequence and returns to command mode.



*The exact action taken by the modem on receipt of the escape sequence depends on the setting of the Response to +++ parameter. When Response to +++ is set to Ignore or Enter Online Command Mode, the ATH command must be used to hang up the modem.*

Settings: 0–255

Default: 7

*Example*    To set the Duration of Loss of Carrier before Disconnect to ten, enter:

**ATS10=10**

### Transmitter Level Adjustment

*Syntax*    **ATS39=n**

The Transmitter Level has a possible range of -9 to -20 dBm for analog line sources and -3 to -30 dBm for digital T1 line sources. The default setting of -11 dBm (S39=11) provides optimal performance for most analog line sources. A setting of -13 dBm (ATS39=13) is recommended for calls over digital T1 or PRI lines.

Default: S39=11

*Example*    To set the Transmitter Level to ten, enter:

**ATS39=10**

### Modem Transmitter

*Syntax*    **ATCn**

This command disables the modem's transmitter. When two computers and modems share a phone line for monitoring, the transmitter of the second modem must be disabled. This feature should be used only at 300 or 1200 bps.

| Command | Function |
|---------|----------|
| ATC0    | Disable  |
| ATC1    | Enable   |

Default: ATC1 (Enabled)

*Example*    To Disable Modem Transmitter, enter:

**ATC0**

## Tone Dial Timing

*Syntax*    `ATS11= n`

This command sets the duration and spacing, in milliseconds, of dialed touch tones.

Settings: 0–255

Default: 70

*Example*    To set the Tone Dial Timing to eighty, enter:

`ATS11= 80`

---

## Controlling Link Speeds

### &N and &U Commands

The AT&N and AT&U commands control the link speeds of the Quad Modem. Use the following table to determine how to use &N and &U commands:

| Command       | Sets                             |
|---------------|----------------------------------|
| AT&N          | Highest possible connect speed   |
| AT&U          | Lowest possible connect speed    |
| AT&U and AT&N | Range of possible connect speeds |

### Setting the Highest Possible Connect Speed

The &N command sets the highest possible connect speed. If a remote modem connects to the Quad Modem at a speed higher than &N, the Quad Modem will not allow it to connect.

### Setting the Lowest Possible Connect Speed

The &U command sets the lowest possible connect speed. If a remote modem connects to the Quad Modem at a speed lower than &U, the Quad Modem will not allow it to connect.

## Setting a Range of Possible Connect Speeds

Setting &N and &U values controls the range of speeds at which the Quad Modem connects. If a remote modem does not connect to the Quad Modem at a range between the speeds designated by the &N and &U commands, the Quad Modem will not allow it to connect. For asymmetric links, &N and &U constrain the speed of the higher speed direction of the link. The speed of the lower speed direction is constrained by values given in S-Registers.



*The link speed associated with the &U argument cannot be greater than the link speed associated with &N argument. The values of &U and &N are equal, refer to the &N table for those values.*

The relationship between &U and &N commands:

| If &U             | And &N                                   | Then the Quad Modem                                               |
|-------------------|------------------------------------------|-------------------------------------------------------------------|
| Equals zero       | Equals zero                              | Connects at the highest possible speed                            |
|                   | Is greater than zero                     | Connects at the &n speed only                                     |
| Is greater than 0 | Is greater than zero and greater than &U | Connects at the highest possible speed in the range from &U to &N |



*Quad Modem v4.0/4.1 permitted speed indices 0 through 16. The speeds associated with these indices remain the same for backward compatibility. The speeds associated with indices 17 through 32 are new speeds supported by the x2 protocol and newer versions of the Quad Modem. As a result, the associated link speeds are no longer monotonic non-decreasing with index, as they previously were. For example, 17 is greater than 16, but 32000 (the speed associated with index 17) is not greater than 33600 (the speed associated with index 16).*



# 15

## CHANGING FLOW CONTROL SETTINGS

This chapter includes:

- Overview
- Hardware and Software Flow Control
- Changing Flow Control

---

### Overview

**Buffers** The Quad Modem has two buffers, one for data transmitted from the originating computer, and one for data received from the phone line. Buffers are data storage areas of variable size.

**Flow control** Flow control provides a system for stopping and starting transmission depending on how full the buffers are. Its goal is to prevent overfilling the buffers and losing data.

Two kinds of flow control are:

- Hardware flow control
- Software flow control

Quad Modems support both types of flow control, but the managing computer and communications software must also support the same flow control.



*Use hardware flow control because it does not affect the data stream. If used, depending on the communications software, it may also be necessary to disable the communications software's software flow*



control. With software flow control, there is the possibility of characters in the data stream being confused with the control characters (XOn/XOff) being sent by the modem. Some file transfer protocols also use characters that can be interpreted as software flow control characters.

## Hardware and Software Flow Control

The defaults listed are based on the modem's shipping configuration. They are loaded from Nonvolatile Random Access Memory (NVRAM), and are equivalent to configuration template &F1. For additional information about NVRAM and templates, see the *Stored Configurations* chapter.

Hardware and Software Flow Control:

| This type of flow control | Detects when the buffer is 90% full and sends                           | When the buffer is 50% full the Quad Modem sends                           |
|---------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Hardware                  | Clear to Send (CTS) signal to stop the flow of data                     | CTS to restart the flow of data                                            |
| Software                  | Special character (<Ctrl>Q) in the data stream to stop the flow of data | Special character (<Ctrl>S) in the data stream to restart the flow of data |

## Problems with Software Flow Control

Software flow control uses (<Ctrl>Q) to stop and (<Ctrl>S) to start the flow of data. Enabling software flow control instructs the Quad Modem to recognize and act on these characters, even if they are not intended to control the data flow.

Using software flow control may prove satisfactory if transferring text files only.

If transferring non-text (binary) files, disable flow control entirely.

- 1 Enter the following command to Ignore RTS:  
**ATR1**
- 2 Enter the following command to Disable Software Flow Control:  
**AT&I0**
- 3 Verify the serial port and connection rates equal using the AT&B0 and AT&N0 commands.

The start command is also called transmit on (XOn) and the stop command is called transmit off (XOff). It is possible to change the characters used. For additional information, see S-Registers 22 and 23 in the S-Registers appendix.

## Changing Flow Control

### Transmit Data Flow Control

Transmit Data Flow Control controls data flow from the computer (or DTE) to the modem, and is necessary when the modem is receiving data from the computer at a higher rate than it can transmit over the phone line.

The modem signals the computer with either Hardware (CTS) or Software (XOn/XOff) to stop or start sending data. This setting should match the setting of the communications software.

| Command | Function                                     |
|---------|----------------------------------------------|
| AT&H0   | Disable Transmit Data Flow Control           |
| AT&H1   | Enable Hardware (CTS) Flow Control (Default) |
| AT&H2   | Enable Software (XOn/XOff) Flow Control      |
| AT&H3   | Enable Hardware and Software Flow Control    |

### Transmit Data Buffer Sizes

The size of the Transmit Data buffer depends on whether or not the connection is under Automatic Retransmission reQuest (ARQ) error control.

ARQ connections: 3.25 Kbytes.

Non-ARQ connections: 1.5 Kbytes, allowing error control file transfer protocols such as XMODEM and YMODEM without flow control.

If bit 3 of S-Register 15 is On, the non-ARQ buffer size is reduced to 128 bytes, for the convenience of remote users of slower modems. Limiting the buffer size allows these users to send an XOff to the remote DTE without causing the data already in transit or in the modem's buffer to exceed the size of their screens.

## Received Data Flow Control

Controls data flow from the modem to the computer or DTE. The computer uses either Hardware (CTS) or Software (XOn/XOff) to signal the modem to stop or start sending data. Use of received data flow control is optional for most types of connections. For example, there may be a need to signal the modem to temporarily stop passing data to read what is on the screen.

Hardware and software received data flow control options are set using separate commands. As explained in the note at the beginning of this section, hardware flow control is recommended whenever possible.

## Software Received Data Flow Control

*Syntax*     `AT&Rn`

This command changes the Software Received Data Flow Control.

| Command | Function                                                                                                                              |
|---------|---------------------------------------------------------------------------------------------------------------------------------------|
| AT&R0   | Delay between DTE's RTS signal and the modem's CTS response; duration set by Register S26. Used for synchronous calls.                |
| AT&R1   | Ignore RTS. Required for systems that do not support RTS.                                                                             |
| AT&R2   | Enable received data hardware flow control. Received data sent to computer only when RTS is high; used only if computer supports RTS. |

Default: AT&R2

*Example*     To Ignore RTS, enter:

**AT&R1**

# Hardware Received Data Flow Control

Syntax    AT&In

This command changes the Hardware Received Data Flow Control.

| Command | Function                                                                                                                                                                                                                                                                                                                                                            |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&I0   | Disable Software flow control.                                                                                                                                                                                                                                                                                                                                      |
| AT&I1   | XOn/XOff to local modem and remote computer. Use with ARQ connections only.                                                                                                                                                                                                                                                                                         |
| AT&I2   | XOn/XOff to local modem only. Use with ARQ connections only, recommended over &I1. For non-ARQ connections, use &I5.                                                                                                                                                                                                                                                |
| AT&I3   | Host mode, Hewlett Packard protocol. Use this setting if the modem is attached to a Hewlett Packard Host computer using the ENQ/ACK protocol, and the remote DTE is an HP terminal that recognizes the ENQ/ACK exchange. Use this setting in ARQ mode only. The modem's Transmit Data flow control setting must be either &H0 (disabled) or &H1 (hardware control). |
| AT&I4   | Terminal mode, Hewlett Packard protocol. Use this setting if the modem is attached to a Hewlett Packard terminal. This setting implements the Hewlett Packard ENQ/ACK protocol when the remote DTE is an HP Host. Use this setting in ARQ mode only. The modem's Transmit Data flow control setting must be either &H0 (disabled) or &H1 (hardware control).        |
| AT&I5   | Same as &I2 during ARQ connections. When used with non-ARQ connections, acts on XOn/XOff signals from the remote computer.                                                                                                                                                                                                                                          |

Default: AT&I0

Example    To set Disable Software Flow Control, enter:

**AT&I0**

### Decimal XOff Flow Control Character

*Syntax*    `ATS23=n`

This command stores the ASCII decimal value of the XOff Character.

Settings: 0–255

Default: 19

*Example*    To set the Decimal XOff Character to ten, enter:

**ATS23=10**

### Decimal XOn Flow Control Character

*Syntax*    `ATS22=n`

This command stores the ASCII decimal value of the XOn Character.

Settings: 0–255

Default: 17

*Example*    To set the Decimal XOn Character to ten, enter:

**ATS23=10**

# CHANGING ERROR CONTROL SETTINGS

This chapter includes:

- Overview
- Error Control Standards
- Changing Error Control Settings

---

## Overview

Some of the following text includes the term Automatic Retransmission reQuest (ARQ). ARQ is a method used in many error control protocols to ensure that any corrupted data transmission is retransmitted. The term ARQ designates a connection under error control.



*High speed calls are highly vulnerable to errors unless the data is protected by error control. The operations described below take place even if the Quad or the remote device is not set for error control.*

Error control is available for calls at 1200 bps and above. It can be disabled, although high speed calls (above 2400 bps) should always be under error control. The operations defined in an error control protocol include the following:

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

The Quad is set at the factory to &M4, causing it to try for an error control connection and, if that is not possible, to proceed with the call in Normal mode.

The Quad first tries for a V.42 connection, then an Microcom Networking Protocol (MNP) connection. The following information is based on the setting of AT&M4.

---

## Error Control Standards

- V.42 Error Control** This international standard includes a two-stage hand-shaking process:
- A Detection phase based on an exchange of predefined characters.
  - A Link Access Procedures for Modems (LAPM) Negotiation phase, during which the devices identify their capabilities concerning maximum data block size and the number of outstanding data blocks allowed before an acknowledgment is required.

- MNP Error Control** This protocol is supported by the ITU-T V.42 Recommendation. It was originally developed by Microcom, Inc. and is now in the public domain.

Microcom Networking Protocol (MNP) is based on special protocol frames. If the remote device does not recognize an MNP Link Request, error control is not possible. In HST asymmetrical mode, 3Com devices use a proprietary scheme similar to MNP.

- Error Control and Flow Control** Flow control of data from the computer is required under error control for two reasons:
- The transmitting device buffers a copy of each frame it transmits to the remote end until the receiving device acknowledges it.
  - If errors are encountered, retransmission activity can cause a steady stream of data from the computer to overflow the buffer.



*Error control is required for data compression and recommended for all calls above 2400 bps.*

CRC detects errors. An ARQ is issued when a corrupted data frame is detected, and the data frame is retransmitted.

A data frame may be retransmitted a maximum of twelve times, after which the modem aborts the call. Disconnection from retry time-out only occurs under serious line disturbances.

|                                        |                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Changing Error Control Settings</b> | <p>The defaults listed are based on the modem's shipping configuration. They are loaded from Nonvolatile Random Access Memory (NVRAM), and are equivalent to configuration template &amp;F1. For additional information about NVRAM and templates, see the <i>Stored Configurations</i> chapter.</p>                                    |
| <b>Error Control</b>                   | <p>To disable Error Control, enter:</p> <p><b>AT&amp;M0</b></p> <p>Not recommended for calls above 2400 bps.</p> <p>Default: AT&amp;M4 (Enabled)</p>                                                                                                                                                                                    |
| <b>Error Control Only</b>              | <p>To connect only with ARQ, enter:</p> <p><b>AT&amp;M5</b></p> <p>Use this setting to guard against the transfer of data at high speeds without the reliability of error control. The Modem hangs up if an ARQ connection cannot be made.</p> <p>Default: AT&amp;M4 (Will establish non-ARQ call)</p>                                  |
| <b>Special 2400 bps MNP</b>            | <p>To enable connections with older, 2400 bps modems that are not fully compatible with the MNP protocol, enter:</p> <p><b>ATS15.6=1</b></p> <p>Default: ATS15.6=0 (Standard 2400 bps MNP)</p>                                                                                                                                          |
| <b>V.42/MNP Negotiation Method</b>     | <p><i>Syntax</i>    <b>ATS27.4 =n ATS27.5=n</b></p> <p>When set to disable either V.42 or MNP, the modem only attempts to negotiate the enabled protocol.</p> <p>If the remote modem has V.42 set to Disable Detection Phase. The V.42 detection phase is skipped during the handshaking process, allowing for a faster connection.</p> |



Settings:

| ATS27.4=n | ATS27.5=n | Result                                                                 |
|-----------|-----------|------------------------------------------------------------------------|
| 0         | 0         | Complete handshaking sequence: V.42 Detection, LAPM error control, MNP |
| 1         | 0         | Disable MNP                                                            |
| 0         | 1         | Disable V.42                                                           |
| 1         | 1         | Disable Detection Phase                                                |

*Example* To Disable MNP, enter:

**ATS27.4=1 ATS27.5=0**

Default: Complete handshaking sequence (.4 and .5 = 0)

## ARQ Buffer Timing

*Syntax* ATS38=n

This command sets the duration, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call, allowing time for a remote modem to acknowledge receipt of all transmitted data. If the modem is in Smart mode and receives the ATH command to hang up, it ignores the S38 setting and hangs up immediately.

Settings: Integers

*Example* To set the ARQ Buffer Timing to ten, enter:

**ATS38=10**

## Non-ARQ Transmit Buffer Size

To enable the non-ARQ Transmit Buffer size, enter:

**ATS15.3=1**

This setting reduces the size of the non-ARQ mode Transmit buffer to 128 bytes. The smaller value is designed for bulletin boards, to accommodate callers with slower modems so that they can control received data scrolling up and off the screen.



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

Default: AT515.3=0 (1500 byte non-ARQ transmit buffer)

### **Selective Reject**

Selective reject can be disabled by entering:

**ATS51.6=1**

Default: AT51.6=0 (Selective Reject enabled)

Selective reject may produce significant throughput improvements over noisy lines when connecting with other modems. Selective reject allows the modems to retransmit only blocks containing errors, rather than having to retransmit data that was successfully transmitted during the time between when the block was sent and when it was detected as corrupted.



*Disabling this feature is only necessary for certain trouble clearing purposes.*



# 17

## CHANGING DATA COMPRESSION SETTINGS

This chapter includes:

- Overview
- Enable/Disable Data Compression Mode

---

### Overview

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

If a Quad Modem successfully establishes an MNP connection with a remote device, it also negotiates Microcom Networking Protocol (MNP) 5 data compression.

The type of compression for a call, if any, is reported in the ATI6 display and in the CONNECT message if the Quad Modem is set to AT&A3 (see the *Result Codes* chapter).

### V.42 *bis* versus MNP5 Data Compression

Quad Modems using V.42 *bis* compression negotiate the following options and report them in the ATI6 display.

- Dictionary size, the amount of memory available for compression table entries. Entries are codes devised for redundant data. The data is packed into shorter data units, called code words, and unpacked by the receiving device.
- Possible dictionary sizes:

| Bits | Entries |
|------|---------|
| 9    | 512     |
| 10   | 1024    |
| 11   | 2048    |

- Quad Modems use 11-bit, or 2048-entry dictionary, but they can reduce its size to accommodate a remote modem that uses a 9- or 10-bit dictionary.
- Maximum string length of each entry. As the dictionary fills, the Quad Modem deletes the oldest unused strings.

V.42 *bis* compression is more efficient than MNP5 compression in part because it deletes entries no longer in use. In addition, it works better with files already compressed. These include ZIP files down loaded from many Bulletin Boards and 8-bit binary files, which modems interpret as compressed

MNP5 compression should not be used with precompressed files because it adds data to the files, which lessens throughput. (The additional data is stripped when the file is decompressed by the remote modem.) When transferring such files, it is best to set the Quad Modem to &K3. This setting allows V.42 *bis* compression to work dynamically with the compressed data, but disables MNP5.

---

## Enable/Disable Data Compression Mode

The defaults listed are based on the modem's shipping configuration. They are loaded from Nonvolatile Random Access Memory (NVRAM), and are equivalent to configuration template &F1. For additional information about NVRAM and templates, see the *Stored Configurations* chapter.

### Data Compression Mode

*Syntax*     AT&K *n*

When compression is enabled, the modem negotiates for V.42 *bis* first, and if unsuccessful, tries for MNP level 5 data compression.



*Compression does not occur unless the modems establish an ARQ connection.*

The Auto Enable setting disables compression if the DTE rate matches the connection rate (if the modem is set to &B0), compression offers no advantage if the DTE rate is not higher than the link rate.

The Enable option allows data compression regardless of the DTE rate.

The MNP 5 Disabled setting allows V.42 compression when transferring compressed files. MNP 5 compression is not useful when transferring files already compressed because it tends to add data to the transmission so

throughput over the link is not optimal. V.42 *bis* only compresses data when compression will yield an advantage.

| Command | Function             |
|---------|----------------------|
| AT&K0   | Compression Disabled |
| AT&K1   | Auto Enable          |
| AT&K2   | Enable               |
| AT&K3   | MNP 5 Disabled       |

Default: AT&K1 (Auto Enable)

*Example*    To set Auto Enable Data Compression, enter:  
**AT&K1**



# 18

## MODEM TESTING AND LEASED LINE OPERATIONS

This chapter includes:

- Testing with &T
- Testing with S-Register 16
- Leased Line Operations

Software-initiated testing is available through the &T command or S-Register 16. All testing conforms to the International Telecommunications Union - Telecommunications Standardization Section (ITU-T) loopback recommendation, V.54. Earlier high speed modems, however, did not perform the &T test. If the modem's command set does not include &T capability, or if the software only supports S-Register 16 testing, use the S-Register 16 tests.



*If testing a modem set to ATB1 HST mode, the software must be set to 2400 bps or lower to avoid high speed asymmetrical modulation.*

---

### Testing With &T

The tests supported through the &Tn command include digital loopback and remote digital loopback. Key in data during testing, or use the modem's internal test pattern and error detector.



*In all cases, disable error control before testing. If the modem is detecting errors and retransmitting the affected data, the results will be invalid.*

During testing, the modem's CHAN Light Emitting Diode (LED) flashes.

### Ending a Test—&T0, S-Register 18

The &T0 option terminates a test in progress.

Alternatively, set S-Register 18 to a specified number of seconds, for example, ATS18=15. When the 15 seconds are up, the modem automatically ends the test and returns to Command mode.





*If the S-Register 18 test timer is set, but during testing, an ATZ command is issued, S-Register 18 resets to zero and the timer is disabled.*

### Analog Loopback

These tests are available only with the Quad Analog Modem or the Quad Analog/Digital Modem in analog mode. Two analog loopback options check the operation of the modem's transmitter and receiver.

- The first, &T1, involves typing data that can be verified on the screen.
- The second option, &T8, is an internal self-test that does not involve the keyboard or screen. It isolates the modem from the computer interface to give more specific results.

**&T1 Test** To perform this analog loopback test:

- 1 If testing a Dual Standard modem, set the terminal or software to 2400 bps.
- 2 The modem must be in Command mode. Optionally, set S-Register 18 as a test timer, as explained earlier in the *Ending A Test* section.
- 3 Enter the command:

**AT &M0 &T1**

The modem disables error control, enters analog loopback (AL) mode, and sends a CONNECT message. The modem's Run/Fail LED for the flashes green.

- 4 Type recognizable data to verify when it is looped back to the screen.
- 5 End the test. If S-Register 18 is set, the modem automatically stops the test at the time-out, exits AL mode and responds OK.
  - a If S-Register 18 was not set, wait one second and type +++ to bring the modem back to Command mode. If DIP switch 9 is Off, the modem also hangs up and ends the test.
  - b If DIP switch 9 is On, type AT&T0 to end the test.
  - c Send either ATH or the ATZ reset command. The latter two commands end the test and hang up the modem. The modem responds OK. If the modem sends an ERROR message, an invalid command is issued.
- 6 If no errors occur, reset the modem to &M4 for error control, unless you issued ATZ to reset the modem.



*If the modem is in online command mode, connected to a remote modem, and receives an &T1 or &T2 command, it drops the call, enters AL mode, sends a CONNECT result, and waits for loopback characters.*

**&T8 Test** This AL option causes the modem to send an internal test pattern to its transmitter and loop it back to the receiver. An internal error detector counts any errors and, when the test ends, sends the number of errors or 000 (no errors) to the screen.

Since nothing is typed during this test, and the modem does not send anything to the screen, this option verifies only the modem. If no errors occur but the problem continues, the problem may be with the computer interface.

- 1 The modem must be in Command mode. Optionally, set S-Register 18 as a test timer, as explained earlier in the *Ending A Test* section.
- 2 Enter the command:

**AT &M0 &T8**

The modem disables error control and enters AL mode. The modem's Run/Fail status indicator flashes green. The modem sends its internal test pattern to the transmitter, and loops the pattern back to the receiver. No data displays on the screen.

- 3 End the test. If S-Register 18 is set, the modem automatically stops the test at the time-out.

If S-Register 18 was not set, type AT&T0 or ATH to end the test, or ATZ to end the test and reset the modem.

The modem hangs up and returns a three-digit code, followed by OK. A code of 000 indicates no errors were found. A code of 255 indicates 255 or more errors. An error message indicates an invalid command.

- 4 If there were no errors, reset the modem to &M4 for error control, unless the ATZ reset command was issued.

**&T2 Test** This option is reserved.

**Digital Loopback** If the modem passed the AL test, this test helps locate a problem with a remote modem or the telephone channel.



*This test requires the modem to establish a connection and return to online command mode in response to the +++ escape code. DIP switch 9 must be On (factory setting) so the modem does not hang up on receipt of the escape code. If necessary, remove the modem and reset the switch.*

To perform a local digital loopback:

- 1 Set the modem to &M0, to disable error control.
- 2 Establish a connection with the remote modem.
- 3 Bring the modem back to Command mode with the +++ escape code, and then send it the AT&T3 command. The modem enters Digital Loopback mode and the Status LED for the modem being tested flashes green.
- 4 Type a short message. It will loop back by the modem's transmitter for verification on the remote screen. Neither the message nor any other data will display.
- 5 When the test completes, issue the AT&T0 command to end the test. Or send either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If the modem sends an error message, an invalid command was issued.
- 6 If normal operations require DIP switch 9 Off, remove the modem and reset the switch. When it is reinstalled, the modem resets to its &M4 default. Otherwise, reset the modem to &M4 unless the reset command, ATZ, was used.

**&T4, &T5 Test** The &T4 option causes the modem to grant a remote modem's request for a Remote Digital Loopback test (Default).

The &T5 option cancels &T4, and the modem fails to recognize such a request.

**Remote Digital Loopback**

This test, like the local digital loopback test, verifies the condition of both modems and the phone link. The request for and granting of Remote Digital Loopback testing requires that both modems use ITU-T V.22 standard signaling. The test must be performed at 2400 bps or lower.

If the remote modem does not have the capability or is not set to respond, an error result code is displayed.

The following are two Remote Digital Loopback options. If &T6 is selected, keyboard data is sent to the modem and is verified when it returns over the phone lines and to the local screen. If &T7 is selected, the modem sends its internal test pattern and returns an error count to the screen.



*Both test options require the modem to establish a connection and return to online command mode in response to the +++ escape code.*

*DIP switch 9 must be On so the modem does not hang up on receipt of the escape code. If necessary, remove the modem and reset the switch.*

**&T6 Test** To perform a Remote Digital Loopback (RDL):

- 1** Set the software to 2400 bps or lower. Set the modem to &M0. Optionally, set the S-Register 18 timer.
- 2** Establish a connection with the remote modem. Arrange with the remote operator to cooperate with the testing and, if necessary, set the remote modem to acknowledge the RDL request.
- 3** Bring the modem back to Command mode with the +++ escape code. Send the AT&T6 command. The modem enters RDL mode and the Status LED flashes green.
- 4** Type a short message. It loops back to the local modem by the remote modem and to the local screen for verification. The remote user will not see the data.
- 5** End the test. If S-Register 18 is set, the modem automatically ends the test when the test timeout is reached.

If S-Register 18 is not set, type AT&T0 to end the test. Or send either ATH or the ATZ reset command. The latter two commands end the test and hang up the modem. The modem responds OK. If an invalid command is issued, the modem sends an error message.

Data errors indicate a problem with the remote modem or the phone link.

- 6** If normal operations require DIP switch 9 Off, remove the modem and reset the switch. When it is reinstalled, the modem resets to its &M4 default. Otherwise, reset the modem to &M4 unless the reset command, ATZ, was used.

**&T7 Test** This test option causes the modem to send an internal test pattern through the Remote Digital Loopback. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

Nothing has to be typed during this test. The modem sends only its final error count to the screen.

- 1 Set the software to 2400 bps or lower. Set the modem to &M0. Optionally, set the S-Register 18 timer.
- 2 Establish a connection with the remote modem. Arrange with the remote user to cooperate with the testing and, if necessary, set the remote modem to acknowledge the RDL request.
- 3 Bring the modem back to Command mode with the +++ escape code. Then send it the AT&T7 command. The modem enters RDL mode and the STAT LED flashes green.

The modem sends its internal test pattern to the remote modem, which loops it back to the local modem. The data does not display on the local screen.

- 4 End the test. If S-Register 18 is set, the modem automatically stops the test when the timer times out.

If S-Register18 was not set, enter AT&T0 to end the test. Or enter either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If an invalid command is issued, the modem sends an error message.

When the test is terminated, the modem returns a three-digit code, followed by OK. The three-digit code represents the number of errors. A code of 255 indicates 255 or more errors.

If the modem is known to be working properly, errors indicate a problem with either the phone connection or the remote modem.

- 5 If necessary, remove the modem and reset DIP switch 9 Off. When it is reinstalled, the modem resets to its &M4 default. Otherwise, reset the modem to &M4.



*Do not reset the modem to &M4 if you enter ATZ.*

**Tone Test** The tone test only applies to the Quad Digital Modem, or the Quad Analog/Digital Modem in digital mode. This test uses the modem's ability to generate and receive analog tones to test the T1 line. In addition to the tone test method, you can use the management software to configure the modem to send and receive tones for the test. For additional information see the Total Control Manager documentation.

This test is performed through the T1 Card, and the T1 Card must be placed in Transparent Test mode before the test runs. The T1 Card automatically enters Transparent Test mode when the test is conducted through the management software, and is performed manually on the T1 Card through the RS-232 Operator Interface. Refer to the T1 documentation for additional information.

Press any key to cancel the test.

**Generating a Tone** The following example shows the command to generate a tone:

**AT&T9=Freq,Amp**

The modem reports three frequencies: 404 Hz, 1004 Hz, and 2804 Hz. The Amplitude is expressed as any number from -40 to 0 DBMS.

*Example* **AT&T9=404,-20**

The modem prompts for confirmation before executing the command.

**Receiving a Tone** Enter the following command to a modem to receive tones:

**AT&T10**

This test reports the frequency and amplitude of received tones to the DTE interface on a five-second basis.

Press any key to cancel the test.

## Testing with S-Register 16

S-Register 16 is a bit mapped register with the following bit functions.

| Bit | Value | Function                      |
|-----|-------|-------------------------------|
| 0   | 1     | Reserved                      |
| 1   | 2     | Dial Test                     |
| 2   | 4     | Test Pattern                  |
| 3   | 8     | Remote Digital Loopback (RDL) |



*Earlier modems require bit 3 enabled to grant RDL to a remote modem. The modem now requires its default &T4 setting instead. Set a 3Com modem that does not use the &Tn test commands to ATS16=8 so that it can grant RDL testing.*

## Analog Loopback

This test is available only for the Quad Analog Modem and the Quad Analog/Digital Modem in analog mode.

As with the hardware-initiated and &T AL tests, do not attempt this test under error control.

To use the modem's Test Pattern (S16, bit 2) instead of typing data, see Test Pattern S16=4 later in this chapter.

- 1 To initiate testing, enter:  
**AT&M0S16=1D**
- 2 The modem disables error control, enters AL mode and sends a CONNECT result code. The modem's RN/FL status indicator flashes green.
- 3 Type data to the modem for the modem to transmit, loop to its receiver, and output to the screen. An alternative is to use the Test Pattern.
- 4 End the test by not entering anything for one second, then entering three pluses (+++), and waiting another second. This forces the modem back to command mode. If DIP switch 9 is Off, the modem exits AL mode and returns to Command mode. If DIP switch 9 is On, the modem maintains the connection when it receives the +++ escape code. Issue the ATH command to end AL mode.
- 5 Reset the modem to Data mode, ATS16=0, and error control (&M4), or issue the ATZ (reset) command.

**Dial Test ATS16=2**

The Dial Test factory tests the frequencies of tone values. When S-Register 16 is set to 2 and a single tone is dialed (for example, ATD7), the modem continues to transmit that tone until Enter is pressed.

**Test Pattern ATS16=4**

Use this test pattern as an alternate to typing data during AL or RDL. The test pattern is available at all speeds, but at 300 bps, the modem's DTE rate must be fixed (&B1) and the link rate fixed at 300 bps (&N1). At rates over 9600 bps, just set the modem for a fixed DTE rate (&B1).

To use the test pattern during AL testing, enter:

**AT&M0S16=5D**

The test pattern is sent through the loopback.

For RDL testing with the test pattern, enter:

**AT&M0S16=12**

For &T AL or RDL tests with the test pattern, set the modem to the test pattern before issuing the test command. The first of the following commands initiates AL, the second RDL:

**ATS16=4&T1**

**ATS16=4&T6**

**Ending Testing with the Test Pattern**

Pressing any character key cancels all test pattern tests. If S-Register 16 was used, reset S-Register 16 to Data mode when the modem resets to its error control defaults, for example, ATZ or AT&M4S16=0.

The test pattern alone (ATS16=4) is used for testing equipment and the phone line. When S-Register 16 is set to 4, the modem transmits the test pattern on connection with a remote modem. Terminate the call to stop the modems from transmitting the test pattern.

**Remote Digital  
Loopback ATS16=8****Responding Modem**

The responding modem must be ready to act on the initiating modem's RDL request. High speed modems need a setting of &T4. If they do not have &Tn testing capability, they should be set to ATS16=8.



### Initiating Modem

- 1 If DIP switch 9 on the initiating modem is Off, remove the modem from the chassis and set the switch On. Switch 9 allows the modem to make a connection and return to Command mode for the RDL command, without hanging up.
- 2 Reinstall the modem.
- 3 Set the software to 2400 or 1200 bps. The ITU-T-specified RDL signals only define connections at 2400 or 1200 bps.
- 4 Disable error control by setting the modem to &M0. Then establish a connection with the remote modem.
- 5 Bring the modem back to Command mode by sending it the escape code: one second of no data, three pluses (+++), and another second of no data.
- 6 When the OK result code appears, enter:

**ATS16=8 O**



*The last character is the letter O and not a zero.*

The modem enters RDL mode (S16=8), the Status LED for the tested modem flashes green, and the modem goes online (O command). Then it transmits the ITU-T defined RDL signals, and the remote modem enters RDL mode.

- 7 Enter data into the computer.
- 8 To end the test, send the modem the +++ escape code again to bring it back to Command mode.
- 9 When the modem sends the OK result, reset the modem to Data mode by entering:

**ATS16=0**

The modem signals the responding modem that RDL testing is over. Terminate the call normally, and reset the modem to its M4 or &M5.

Or, to resume data transmission with the remote modem, add the O command to the ATS16=0 string to return the modem online. Keep in mind, however, that error control is disabled. Because error control is negotiated during the connection sequence, its status cannot be changed until the modem is back on hook and in Command mode.

## Leased Line Operations

Traditional leased line operations are only supported by the Quad Analog Modem and the Quad Analog/Digital Modem when in analog mode.

When set according to the following instructions, the Quad Modem and the remote modem make a continuous connection without dialing. If the modems disconnect, they automatically reconnect.

For optimal operations, it is recommend that the physical length of these lines not exceed five miles. Dial-up modems are bound by the limits on signal attenuation set by the public switched telephone networks.



*To operate on 4-wire leased lines, the modems require 4-wire-to-2-wire converters. These are usually available from the telephone company.*

## Setting the Modem

| Command | Function                                             |
|---------|------------------------------------------------------|
| AT&Ln   | Used to switch from normal to leased line operation. |
| AT&L0   | Normal phone line. Default.                          |
| AT&L1   | Leased line; enables the modem to reconnect.         |

If the modem is set to &L1, at power-on it automatically connects with a remote modem that has the same capability. They also reconnect, without any operator intervention, if a disturbance on the line breaks the connection.

To set the modem:

- 1 Set the communications software for a high serial port rate; this will determine the rate at which the modems communicate. For example, use a software setting of 115.2K bps and, if both modems have the capability, they will connect at 28.8K bps.
- 2 Enter the command:

**AT &S2 &L1 &W**

Be sure the modem is set to &B1, which fixes the modem's serial port rate at 115.2K bps. &S2 causes the modem to send a Clear to Send (CTS) signal *only* after it sends the Carrier Detect (CD) signal, after it connects with the remote modem.

&L1 forces the modem off hook at power-on and enables it to re-establish the connection should it be broken. &W writes the settings to nonvolatile memory (NVRAM) as power-on defaults.



*As a precaution, use the &S2 setting to delay CTS after the connection is made. If the modems are in the process of connecting or reconnecting, they interpret any keyboard data entry, including an accidental key stroke, as a key-press abort, and hang up. Delaying CTS until after carrier detection prevents this from happening. Be sure the modem is set for hardware flow control, &H1.*

If the installation does not support CTS, set the modem to &S0, and follow the Transmit Data flow control (&Hn) guidelines. Keep in mind that if the modems fail to connect or reconnect, the reason could be a key-press abort.

- 3 Set the modem to load NVRAM settings at power-on, DIP switch 10 Off. The modem may be in Dumb or Smart mode (DIP switch 8).
- 4 Decide which modem will be the calling modem and which will be the answering modem. Set the answering modem to Auto Answer, DIP switch 5 Off, and the calling modem to Auto Answer suppressed, DIP switch 5 On.
- 5 Insert the modem in the rack. This initiates the new DIP switch settings and loads the power on defaults, including &L1. The modems go off hook and establish the connection.

### **Re-establishing a Connection**

When the Quad Modem originates a leased-line connection and carrier is lost, it waits 15 seconds after sensing loss of carrier before attempting to re-establish the connection. This default delay is stored in S-Register 44, and is intended to give the modem at the other end of the line time to return on hook. If the delay is too short, the calling modem attempts to reconnect while the answering modem is still off hook. If the default delay is not giving the modems enough time to reconnect, store a higher value in S-Register 44.



*If the modems cannot restore the connection and the modem cannot be set to &S2, the reason could be a key-press abort. If the problem persists, the telephone company may have to check the line.*

# TROUBLE CLEARING

This chapter contains the following information:

- Disconnect Reasons
- Fail to Connect Reasons
- General Troubleshooting Issues
- What to do if problems still exist

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**Disconnect Reasons** This table provides the most common disconnect reasons:



*Error codes listed as obsolete or not used, still show up in some Management Information Base (MIB) browsers, but they are no longer used or valid.*

| Symptom                                                                | Cause                                                                                                                                                                       | Trouble Clearing                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value #1 <i>dtrDrop</i> . | The Data Terminal Equipment (DTE) dropped the Data Terminal Ready (DTR) signal, terminating the call.<br><br>This reason only applies to the RS-232 Network Interface Card. | 1. This reflects normal operation.<br><br>2. This reason only applies to the RS-232 NIC.<br><br>3. Use DIP Switch 1 to override the DTR Signal for modems on the packet bus.<br><br>4. This value may occur incorrectly within Total Control Manager because it is the default value until initialized to MIB value 32 <i>none</i> . |

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(continued)

| Symptom                                                                                    | Cause                                                                                                                                                                                                                                                                  | Trouble Clearing                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value # 2 <i>escapeSequence</i> .             | The user or application software sent the modem the +++ escape code (or other escape character as set in S-Register 2) and the modem was configured (DIP Switch 9 Off) to disconnect the call on reception of the escape code.                                         | <ol style="list-style-type: none"> <li>1. This reflects normal operation.</li> <li>2. You may need to reconfigure the application software to send a different escape code using S-Register 2.</li> <li>3. Set DIP Switch 9 to On so that it does not disconnect upon the receipt of the disconnect message.</li> <li>4. Total Control Manager can disable +++ detection which is equivalent to setting S-Register 2 greater than 127.</li> </ol> |
| The Quad Modem disconnected and returned MIB value #3 <i>athCommand</i> .                  | The user or application software sent the modem the ATH or the ATH0 command while the modem was in online Command Mode.                                                                                                                                                | This reflects normal operation.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| The Quad Modem disconnected and returned MIB value #4 <i>carrierLoss</i> .                 | The modem detected loss of the remote modem's carrier and waited the duration specified in S-Register 10 (default = 0.7 seconds).                                                                                                                                      | <ol style="list-style-type: none"> <li>1. This reflects normal operation.</li> <li>2. Increase the duration of S-Register 10 to two seconds.</li> </ol>                                                                                                                                                                                                                                                                                           |
| The Quad Modem disconnected and returned MIB value #5 <i>InactivityTimeout</i> .           | The modem detected no activity (characters being sent or received) for the duration specified in S-Register 19 (default is 0, timer disabled).                                                                                                                         | <ol style="list-style-type: none"> <li>1. This reflects normal operation.</li> <li>2. Disable Inactivity Timeout by setting S-Register 19 to 0:<br/><b>ATS19=0</b></li> </ol>                                                                                                                                                                                                                                                                     |
| MIB value #7                                                                               | Undefined                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| MIB value #8 <i>remotePassword</i>                                                         | Not Used                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| MIB value #9 <i>linkPassword</i>                                                           | Not Used                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| The Quad Modem disconnected and returned MIB value # 10 <i>retransmitLevel</i> .           | The modem reached the maximum number of attempts to transfer a frame under Automatic Retransmission reQuest (ARQ) error control. The number of attempts is 12 for low speeds and 48 for high speeds. Under cellular protocols, the number of attempts may be 10 or 20. | This may be the result of poor line conditions. Contact your phone company and determine why line conditions are poor.                                                                                                                                                                                                                                                                                                                            |
| The Quad Modem disconnected and returned MIB value # 11 <i>LinkDisconnectMsgreceived</i> . | The remote modem sent an MNP error control Link Disconnect request. This is a normal disconnect procedure under MNP error control when the remote modem is the initiator of the disconnect.                                                                            | <ol style="list-style-type: none"> <li>1. This is a normal disconnect procedure under MNP error control when the remote modem is the initiator of the disconnect.</li> <li>2. This error can occur if the user or software application sent +++, ATH, or dropped DTR on the remote modem.</li> </ol>                                                                                                                                              |

(continued)

| Symptom                                                                            | Cause                                                                                                                                                                                                                                                                                                                     | Trouble Clearing                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value # 12 <i>noLoopCurrent</i> .     | The modem detected a loss of current on the loop connecting it with the telephone company central office. This usually occurs because the remote modem has hung up: the central office drops current momentarily when there is a disconnect at the other end of a call. This reason only applies to regular analog calls. | This reflects normal operation. It is the first reason triggered when the phone line is disconnected on the local side. Loop loss can also be triggered by Call Waiting on the local side or by Call Waiting on the remote side if the remote modem hardware supports loop loss detection. |
| The Quad Modem disconnected and returned MIB value #14 <i>UnableToRetrain</i> .    | After several attempts, disturbances on the phone line prevented the modems from retraining, and they could no longer transmit or receive data.                                                                                                                                                                           | This may be the result of poor line conditions. Contact your phone company and determine why line conditions are poor.                                                                                                                                                                     |
| The Quad Modem disconnected and returned MIB value # 15 <i>managementCommand</i> . | The modem was issued an On-Hook or Software Reset command via management                                                                                                                                                                                                                                                  | This reflects normal operation.                                                                                                                                                                                                                                                            |
| The Quad Modem disconnected and returned MIB value # 17 <i>keyAbort</i> .          | The modem detected a keypress while training.                                                                                                                                                                                                                                                                             | This reflects normal operation.                                                                                                                                                                                                                                                            |
| MIB value #20 <i>voice</i> .                                                       | Not Used                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                            |
| MIB value #21 <i>noAnswerTone</i> .                                                | Not Used                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                            |
| MIB value #22 <i>noCarrier</i> .                                                   | The modem was not able to connect with the remote modem within the number of seconds set in S-Register 7.                                                                                                                                                                                                                 | Increase the time of S-Register 7.                                                                                                                                                                                                                                                         |
| The Quad Modem disconnected and returned MIB value # 25 <i>v42BreakTimeout</i> .   | Incompatible processing of a Break Signal Occurred.                                                                                                                                                                                                                                                                       | Try connecting again.                                                                                                                                                                                                                                                                      |
| The Quad Modem disconnected and returned MIB value # 26 <i>v42Disconnect Cmd</i> . | The remote modem sent a V.42 error control disconnect request.                                                                                                                                                                                                                                                            | This is a normal disconnect procedure under V.42 error control when the remote modem is the initiator of the disconnect. This would occur if the user or application sent +++, ATH, or dropped DTR on the remote modem.                                                                    |
| The Quad Modem disconnected and returned MIB value # 28 <i>v42BadSetup</i> .       | Extra Setup - The modem received an invalid V.42 <i>bis</i> frame. Abnormal operation under V.42 error control. Most likely due to a mistake by one of the modems or extremely bad line conditions.                                                                                                                       | Try connecting again.                                                                                                                                                                                                                                                                      |

(continued)

| Symptom                                                                                | Cause                                                                                                                                                                                                                                                                                                                                                                                            | Trouble Clearing                                                    |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value # 29<br><i>v42InvalidCode Word.</i> | Illegal Command Code - The modem received an invalid V.42 <i>bis</i> frame. Abnormal operation under V.42 error control. Most likely due to a mistake by one of the modems or extremely bad line conditions.                                                                                                                                                                                     | Try connecting again.                                               |
| The Quad Modem disconnected and returned MIB value # 30<br><i>v42StringTooLong.</i>    | A Rootless Tree - The modem received an invalid V.42 <i>bis</i> frame. Abnormal operation under V.42 error control. Most likely due to a mistake by one of the modems or extremely bad line conditions.                                                                                                                                                                                          | Try connecting again.                                               |
| The Quad Modem disconnected and returned MIB value # 31<br><i>v42InvalidCmd.</i>       | Invalid Codeword - The modem received an invalid V.42 <i>bis</i> frame. Abnormal operation under V.42 error control. Most likely due to a mistake by one of the modems or extremely bad line conditions.                                                                                                                                                                                         | Try connecting again.                                               |
| MIB value # 32 <i>none</i>                                                             | This is the value reported to the Network Management Card (NMC) on a query of disconnect reason during modem training or while connected, or a query of the call fail reason when the call did not fail.<br><br>In the I6 screen, the modem will report No Connection after being reset or on powerup.<br><br>From Online Command Mode, it will display 'Online' instead of a disconnect reason. | This reflects normal operation.                                     |
| The Quad Modem disconnected and returned MIB value # 34 <i>dialSecurity.</i>           | Hub security failed for any one of several reasons such as:                                                                                                                                                                                                                                                                                                                                      |                                                                     |
|                                                                                        | Invalid password                                                                                                                                                                                                                                                                                                                                                                                 | Verify all passwords                                                |
|                                                                                        | The modem was not able to communicate with the NMC for a Hub Security session and was set to refuse calls                                                                                                                                                                                                                                                                                        | Verify chassis communications                                       |
|                                                                                        | The modem is disconnecting the initial call in preparation for dialback security                                                                                                                                                                                                                                                                                                                 | If for dialback security, the disconnect reflects normal operations |
| MIB value # 35 <i>remoteAccessDenied</i>                                               | Not Used                                                                                                                                                                                                                                                                                                                                                                                         |                                                                     |
| MIB value # 36 <i>loopLoss</i>                                                         | Not Used                                                                                                                                                                                                                                                                                                                                                                                         |                                                                     |

(continued)

| Symptom                                                                               | Cause                                                                                                                                                                                                                                                                       | Trouble Clearing                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MIB value # 37 <i>ds0Teardown</i> .                                                   | The T1 or PRI card initiated the disconnect. This usually occurs because the remote modem has hung up: the central office signals to the T1 or PRI card when there is a disconnect at the other end of a call. This reason only applies to T1 or PRI calls, not POTS calls. | This is a catch all for T1 and PRI calls. As fail to connect reason, this could mean that a non-modem call was received.                                                                                                            |
| MIB value # 40 <i>nonARQmode</i> .                                                    | Not Used                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                     |
| MIB value # 43 <i>dialBackLink</i> .                                                  | Not Used                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                     |
| The Quad Modem disconnected and returned MIB value # 46 <i>pbGenericError</i> .       | Packet Bus Generic Error - The packet bus link to the modem was brought down and the modem was not able to determine the reason.                                                                                                                                            | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them.             |
| The Quad Modem disconnected and returned MIB value # 47 <i>pbLinkErrTxPreAck</i> .    | Packet Bus Link Error (Transmit Pre ACK) - An error occurred in the physical layer of the packet bus link between the modem and a gateway card which was detected by the packet bus protocol.                                                                               | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them.             |
| The Quad Modem disconnected and returned MIB value # 48 <i>pblinkErrTxTardyACK</i> .  | Packet Bus Link Error (Transmit Tardy ACK) - An error occurred in the physical layer of the packet bus link between the modem and a gateway card which was detected by the packet bus protocol.                                                                             | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them.             |
| The Quad Modem disconnected and returned MIB value # 49 <i>pbTransmitBusTimeout</i> . | An error occurred in the packet bus physical layer. May also be due to a modem that is not functioning properly.                                                                                                                                                            | 1. This error could be caused by removing or resetting a gateway or PRI card in the chassis, or because the receiver of the gateway card is busy and cannot accept any more data.<br><br>2. This error is fairly unlikely to occur. |
| MIB value # 50 <i>pbReceiveBusTimeout</i> .                                           | This value is obsolete.                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                     |
| MIB value # 51 <i>pbLinkErrTXTAL</i> .                                                | This value is obsolete.                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                     |
| MIB value # 52 <i>pbLinkErrRXTal</i> .                                                | This value is obsolete.                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                     |

(continued)



| Symptom                                                                                     | Cause                                                                                                                                                                                                                                                                      | Trouble Clearing                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value # 53<br><i>pbTransmitMasterTimeout.</i>  | An Error occurred in the packet bus physical layer. May also be due to a modem that is not functioning properly.                                                                                                                                                           | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value # 54<br><i>pbClockMissing.</i>           | This value is obsolete.                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                        |
| The Quad Modem disconnected and returned MIB value # 55<br><i>pbReceivedLs WhileLinkUp.</i> | An error occurred in the packet bus link layer. The modem received a request to start a new link, when it was already in a link. So, the current link is dropped and a new link is attempted.                                                                              | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value # 56<br><i>pbOutOfSequence Frame.</i>    | Out of sequence Frame - An error occurred in the packet bus link layer. The modem received a frame out of sequence, or a frame was missing.                                                                                                                                | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value # 57<br><i>pbBadFrame.</i>               | Bad Frame - An error occurred in the packet bus link layer. The modem received a frame with an invalid frame type. The frame was neither a data frame nor a recognized control frame.                                                                                      | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value # 58<br><i>pbAckWaitTime out.</i>        | ACK Wait Timeout - An error occurred in the packet bus link layer. The modem did not receive an acknowledgment frame for a data frame it had sent.                                                                                                                         | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value # 59<br><i>pbReceivedAckSequenceErr.</i> | An error occurred in the packet bus link layer. The modem received an acknowledgment frame which was not between the last ack received and the last frame transmitted.                                                                                                     | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value #60<br><i>pbReceiveOvrflw RNRFailed.</i> | An error occurred in the packet bus link layer. The modem ran out of buffer space for received data frames. This should not occur because the modem sends Receiver Not Ready control frames to tell gateway cards to stop sending data before it runs out of buffer space. | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |

(continued)

| Symptom                                                                                   | Cause                                                                                                                                                                                                             | Trouble Clearing                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem disconnected and returned MIB value # 61<br><i>pbReceiveMsgBuf OvrFlw.</i> | An error occurred in the packet bus link layer. The modem received a frame which was larger than the negotiated frame size between the modem and the gateway card. The maximum allowed size is currently 4Kbytes. | This error should never occur, but if it does occur more than just sporadically, reboot the NETServer. If it still occurs, try to isolate which card(s) (Quad, PRI, NETServer) are having the problem and replace them |
| The Quad Modem disconnected and returned MIB value# 62<br><i>rcvdGatewayDiscCmd.</i>      | The Gateway card sent the modem a disconnect command.                                                                                                                                                             | This is a normal method of terminating a call locally.<br>This only applies to calls on the packet bus and is analogous to dtrDrop on the RS-232 NIC interface.                                                        |
| The Quad Modem disconnected and returned MIB value # 63<br><i>tokenPassingTimeout.</i>    | An error occurred in the internal communications with the Digital Signal Processor of the modem.                                                                                                                  | Try placing the call again.                                                                                                                                                                                            |
| The Quad Modem disconnected and returned MIB value # 64<br><i>dsplInterruptTimeout.</i>   | An error occurred in the clock signal generated by the modem's DSP.                                                                                                                                               | Try placing the call again.                                                                                                                                                                                            |
| The Quad Modem disconnected and returned MIB value # 65<br><i>mnpProtocolViolat.</i>      | An error occurred in the MNP error control protocol. The modem received a frame out of sequence.                                                                                                                  | Try placing the call again.                                                                                                                                                                                            |
| The Quad Modem disconnected and returned MIB value #66<br><i>class2faxHangupCmd.</i>      | The fax application software sent the modem the Class 2.0 Fax command to terminate the call. This is a normal disconnect message from a Class 2.0 Fax call.                                                       | This reflects normal operation.                                                                                                                                                                                        |
| The Quad Modem disconnected and returned MIB value # 67<br><i>hstSpeedSwitchTimeout.</i>  | Under a High Speed Technology (HST) connection, the modem was not able to complete a speed shift. This might be due to too many disturbances on the line.                                                         | This might be due to too many disturbances on the line.                                                                                                                                                                |
| The Quad Modem disconnected and returned MIB value # 68<br><i>tooManyUnacked.</i>         | 128 Unacked LMI's - Under an MNP10 Cellular connection, the modem was not receiving acknowledgment messages from the remote modem.                                                                                | This might be due to too many disturbances on the line.                                                                                                                                                                |
| The Quad Modem disconnected and returned MIB value # 69<br><i>timerExpired.</i>           | RDL Timer expired - A Remote Digital Loopback test was terminated using the S-Register 18 timer.                                                                                                                  | Increase the S-Register 18 timer using the following command:<br><b>ATS18=30</b>                                                                                                                                       |
| MIB value # 73 <i>normalUserCall Clear</i>                                                | Not Used                                                                                                                                                                                                          |                                                                                                                                                                                                                        |
| MIB value # 74 <i>normalUnspecified</i>                                                   | Not Used                                                                                                                                                                                                          |                                                                                                                                                                                                                        |
| MIB value # 75 <i>bearer Incompatibility</i>                                              | Not Used                                                                                                                                                                                                          |                                                                                                                                                                                                                        |
| MIB value # 76 <i>protocolErrorEvent</i>                                                  | Not Used                                                                                                                                                                                                          |                                                                                                                                                                                                                        |
| MIB value # 77 <i>abnormal Disconnect</i>                                                 | Not Used                                                                                                                                                                                                          |                                                                                                                                                                                                                        |

(continued)

| Symptom                                   | Cause    | Trouble Clearing |
|-------------------------------------------|----------|------------------|
| MIB value # 78 <i>invalidCauseValue</i>   | Not Used |                  |
| MIB Value # 79 <i>resourceUnavailable</i> | Not Used |                  |

## Fail To Connect Reasons



*Disconnect Reasons 46 – 61 could also be Fail to Connect Reasons depending on when the error occurs.*

| Symptom                                                                              | Cause                                                                                                                                                                              | Trouble Clearing                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem failed to connect and returned MIB value # 6 <i>MnpIncompatible</i> . | The modem is set to forced ARQ Mode (&M5), and the remote modem does not support V.42 or MNP capability or there was an error negotiating ARQ.                                     | Either do not force ARQ Mode by setting the modem to &M4 or &M0, or connect to a remote modem that supports V.42 or MNP capability.<br><br>See also S-Register 27.4 and S-Register 27.5 for selectively enabling MNP-only, V.42-only, or V.42 without Detection phase. |
| The Quad Modem failed to connect and returned MIB value # 13 <i>invalidSpeed</i> .   | The modem has &N, &U, or both nonzero and the modems were not able to establish a connection in the valid range of data rates.                                                     | Set both &N and &U to zero by entering the following commands:<br><b>AT&amp;N0</b><br><b>AT&amp;U0</b><br><br>This will allow for connection at the highest possible speed.                                                                                            |
| The Quad Modem failed to connect and returned MIB value # 16 <i>noDialTone</i> .     | The modem was set for X2,4,6, or 7 and the modem was not able to detect Dial Tone from the central office before dialing, or after the 'W', wait for 2nd dial tone, dial modifier. | Check %D and verify the modem is configured correctly for Analog (%D0), T1 (%D1), or PRI (%D2) operation.<br><br>If PRI, check S-Register 73 for PRI dialout slot.<br><br>If POTS, check the phone line connected to the Quad NIC.                                     |
| The Quad Modem failed to connect and returned MIB value # 18 <i>lineBusy</i> .       | The modem detected a busy tone over a normal analog phone line.                                                                                                                    | This reflects normal operation.                                                                                                                                                                                                                                        |
| The Quad Modem failed to connect and returned MIB value # 19 <i>noAnswer</i> .       | The modem was dialing with the @dial modifier, and did not detect an answer.                                                                                                       | This reflects normal operation.                                                                                                                                                                                                                                        |
| The Quad Modem failed to connect and returned MIB value # 23 <i>undetermined</i> .   | This value is reported to the NMC on a Query during modem training.                                                                                                                | Try connecting again.                                                                                                                                                                                                                                                  |

(continued)

| Symptom                                                                                 | Cause                                                                                                                                                                                                                                                                                                                                         | Trouble Clearing                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem failed to connect and returned MIB value # 24 <i>v42SabmeTimeout</i> .   | Set Asynchronous Balance Mode Extended (SABME). The modems failed this part of the link negotiation.                                                                                                                                                                                                                                          | Try connecting again.                                                                                                                                                                          |
| The Quad Modem failed to connect and returned MIB value # 27 <i>v42IdExchangeFail</i> . | XID Time Out - The Modems failed to negotiate the V.42 XID Exchange Phase.                                                                                                                                                                                                                                                                    | Abnormal operation under V.42 error control. Most likely due to bad phone lines.                                                                                                               |
| The Quad Modem failed to connect and returned MIB value # 33 <i>v32ClearDown</i> .      | This applies to V.32, V.34, V.FC, and x2 connections and is more generally called General Switch Telephone Network (GSTN) Clear Down.<br><br>As a failure to connect reason, this means that the modems were unable to find a common connect rate.<br><br>As a disconnect reason, this is a normal disconnect method for high speed connects. | 1. In part this reflects normal operation.<br>2. Make sure both modems are set to variable link connection speeds, by entering the following commands:<br><b>AT&amp;N0</b><br><b>AT&amp;U0</b> |
| The Quad Modem failed to connect and returned MIB value # 34 <i>dialSecurity</i> .      | Hub security failed for any one of several reasons such as:                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                |
|                                                                                         | Invalid password                                                                                                                                                                                                                                                                                                                              | Verify all passwords                                                                                                                                                                           |
|                                                                                         | The modem was not able to communicate with the NMC for a Hub Security session and was set to refuse calls                                                                                                                                                                                                                                     | Verify chassis communications                                                                                                                                                                  |
|                                                                                         | The modem is disconnecting the initial call in preparation for Dialback security                                                                                                                                                                                                                                                              | For Dialback security, this reflects normal operations                                                                                                                                         |
| The Quad Modem failed to connect and returned MIB value # 38 <i>promptNotEnabled</i> .  | Prompting Not Enabled - With Link Security enabled, the modem hung up because the originating modem did not send an autopass password, and Fallback prompting was not enabled.                                                                                                                                                                | 1. Disable Link Security by entering the following command:<br><b>ATS53.0=0</b><br>2. Enable Fallback Password Prompting by entering the following command:<br><b>ATS53.1=1</b>                |
| The Quad Modem failed to connect and returned MIB value # 39 <i>noPromptingInSync</i> . | With Link Security enabled, the originating modem did not send an autopass password. Without the autopass password, the answering modem cannot prompt for a password in any Synchronous Mode.                                                                                                                                                 | 1. Disable Link Security by entering the following command:<br><b>ATS53.0=0</b><br>2. Configure the autopass password on the originating modem.                                                |
| The Quad Modem failed to connect and returned MIB value # 41 <i>modelIncompatible</i> . | With Link Security, the modem hung up because both modems were not set to the same error control setting.                                                                                                                                                                                                                                     | Make sure that originating and answering modems are set for the same error control setting.                                                                                                    |

(continued)

| Symptom                                                                                    | Cause                                                                                                                                                                                                                                                  | Trouble Clearing                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem failed to connect and returned MIB value # 42 <i>noPromptInArQ</i> .        | With Link Security, prompting was enabled, but the modem hung up because the originating modem was set for error control and the answering modem was set for non-error control. The answering modem cannot prompt when it is set for no error control. | Enable error control on the Quad Modem by entering the following command:<br><br><b>AT&amp;M4</b>                                                                                   |
| The Quad Modem failed to connect and returned MIB value # 44 <i>linkAbort</i> .            | Security Abort - With Link Security, the modem hung up because: 1) it received an invalid password too many times, there was a time-out waiting for the user to enter a password, or 2) the modem is disconnecting preparing to do Dial Back Security. | Verify user password in the RADIUS Server or the Gateway.                                                                                                                           |
| The Quad Modem failed to connect and returned MIB value # 45 <i>autopassFailed</i> .       | With Link Security enabled, the originating modem did not send an autopass password, and the answering modem did not have prompting enabled, but does have Forced Security Mode enabled.                                                               | Verify user autopass password in the RADIUS Server or the Gateway.                                                                                                                  |
| The Quad Modem failed to connect and returned MIB value # 70 <i>t1Glare</i> .              | A Glare (trying to dial at the same time as an incoming call) condition occurred on a T1 line causing the modem to abort the dial out attempt to accept the incoming call.                                                                             | This reflects normal operation.                                                                                                                                                     |
| The Quad Modem failed to connect and returned MIB value # 71 <i>priDialoutRqTimeout</i> .  | For PRI calls, the modem was unable to get a B-channel allocated from the PRI card. See also S-Register 73, the default PRI card slot.                                                                                                                 | In part reflects normal operations if all B-channels are active.<br>Verify that the PRI is in the default slot.                                                                     |
| The Quad Modem failed to connect and returned MIB value # 72 <i>abortAnlgDstOvrIsdn</i> .  | The Quad Modem was originating a PRI-ISDN call in Universal Connect Mode. It detected an analog modem answering but was configured to not accept analog calls (S68.0=1)                                                                                | Configure the Quad to accept analog calls by entering the following command:<br><br><b>ATS68.0=1</b>                                                                                |
| The Quad Modem failed to connect and returned MIB value # 79 <i>FastBusy</i> .             | The modem detected a busy signal over a T1 line.                                                                                                                                                                                                       | This reflects normal operation. Try connecting again.                                                                                                                               |
| The Quad Modem failed to connect and returned MIB value # 80 <i>RemoteOnHook Timeout</i> . | A remote modem was detected, but went back on hook before modems could finish training.                                                                                                                                                                | Verify that S-register 7 is not set too short. This also can occur if the modems are forced to use different modulations or to use a modulation not supported by one of the modems. |

(continued)

| Symptom                                                                               | Cause                                                                                                                 | Trouble Clearing                                                                                                                                                           |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Quad Modem failed to connect and returned MIB value # 81 <i>TrainingTimeout</i> . | A remote modem was detected, but went on hook because S-Register 7 timer expired before modems could finish training. | Verify that S-Register 7 is not set to short. This also can occur if the modems are forced to different modulations or to a modulation not supported by one of the modems. |

General Trouble Clearing Issues

Use the following table for general trouble clearing issues.

| Symptom                                       | Cause                                       | Trouble Clearing                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Response to AT commands.                   | The bit rate and word length are unmatched. | Make sure the terminal emulation program is set to the correct bit rate and word length (7 bits with or without a parity bit, or 8 bits and no parity).To set the Data Format to default 8-N-1, enter the following command:<br><br><b>AT%F0</b><br><br>Verify the connection speed for the Quad and the terminal program are the same. Use &Nn and &Un to set the connection speeds for the Quad Modem. |
|                                               | DIP Switch 8 is Off.                        | Set DIP switch 8 to On, for "Recognition Enabled or Smart Mode." For additional information on changing DIP Switches, see the <i>Quad Modem Features and Configuration</i> chapter.                                                                                                                                                                                                                      |
|                                               | Verbal Result Codes are not enabled.        | To make sure verbal result codes (status messages) are enabled, enter these commands:<br><br><b>ATV1</b> (to display verbal messages)<br><b>ATE1</b> (to enable local echo)<br><b>ATQ0</b> (to enable message display)                                                                                                                                                                                   |
| Quad will not answer a call: General reasons. | The wrong &F template is loaded             | Verify that the correct &F template is loaded onto the Quad modem.                                                                                                                                                                                                                                                                                                                                       |
|                                               | Auto Answer is not enabled                  | 1. To enable Auto Answer, enter the following command:<br><b>ATS0=0</b><br><br>2. Set DIP Switch 5 Off to enable Auto Answer, so that the modem will answer on the first ring.                                                                                                                                                                                                                           |
| Quad will not answer an analog call:          | Incorrect Line Interface Source             | To set the Line Interface Source to Analog, enter the following command:<br><br><b>AT%D0</b>                                                                                                                                                                                                                                                                                                             |
| Quad will not dial                            | Incorrect Line Interface Source             | Verify that the modem is correctly configured to %D0 (NIC) for analog, %D1 (T1TDM) for T1, %D2 (PRITDM) for PRI.                                                                                                                                                                                                                                                                                         |

(continued)

| Symptom                                                        | Cause                          | Trouble Clearing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quad will not dial when using T1                               | Incorrect T1 settings          | Verify T1 card settings, and S-Register 74 for 'will not answer'. Also check S-Register 47.1 for MF or DTMF.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Quad will not dial when using Primary Rate Interface (PRI)     | Incorrect PRI card slot        | Verify that S-Register 73 is set to the correct PRI card slot.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Carrier signals present, but no communication link             | Incorrect Data Mode            | Make sure the Quad is in the correct mode, fax or data, depending on whether the connection is to be made with a facsimile device or a data device. Enter the following command for Data Mode:<br><br><b>AT+FCLASS=0</b>                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                | Incorrect Synchronous settings | Synchronous operations: review the instructions in Appendix A, Synchronous Applications. If the Quad is configured correctly, the problem may be with the synchronous adapter or with the system trying to call.                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                | Incorrect connection speed     | Make sure that the Quad's connection rate setting, &Un and &Nn, is correct for the call. If the connection rate is locked at a speed (&N1*&N14) different from the calling modem's, the Quad hangs up. The default setting of &N0, variable link operations, allows the two modems to negotiate the highest possible connection rate. To set the connection speed to variable, enter the following command.<br><br><b>AT&amp;N0</b>                                                                                                                                                                |
| Quad will not answer a call when using NETServer or HiPer ARC: | The port is not active.        | If using a NETServer or HiPer ARC card all ports must be active, or at least the ones assigned to modems. If not, the Quad Modem sends a Ring No Answer (RNA) error message. To activate the ports type the following commands to the NETServer or HiPer ARC, depending upon number of modem cards present. For example, with 12 modem cards starting from slot 1 type the following commands:<br><br>1) set modem s1-s48 active<br><br>2) save all<br><br>3) reset s1-s48.<br><br>For additional information, please refer to the NETServer Product Reference or the HiPer ARC Product Reference. |

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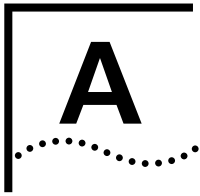
## **What To Do if You Still Have Problems**

The problems above are the most common ones that users encounter. If the suggestions in the table above do not solve the problems you may encounter, try the following:

- 1 Review the manual carefully to see if you have missed something.
- 2 Refer to the Contacting 3Com information in the front of this reference.







# SYNCHRONOUS OPERATIONS

This appendix includes:

- What is Synchronous Operation?
- General requirements
- V.25 *bis* requirements
- Online synchronous requirements
- Bell 208B operations

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## What is Synchronous Operation?

Synchronous data is not formatted with start/stop bits. Instead, the flow of data is controlled by the precise timing of transmit and receive clocks at both ends of the link. Transmit and Receive synchronous timing is implemented through three RS-232 pins. They are as follows:

| Pin # | Function                                                       |
|-------|----------------------------------------------------------------|
| 15    | Internal Data Communications Equipment (DCE) transmitter clock |
| 17    | DCE receiver clock                                             |
| 24    | External Data Terminal Clock (DTE transmitter clock).          |

Two methods the modem uses to operate in synchronous mode are:

### Operation Method #1 V.25 *bis*

The International Telecommunications Union - Telecommunications Standardization Section (ITU-T) standard V.25 *bis* protocol is used by mainframe operators and synchronous terminal users. V.25 *bis* acts as an interface between the mainframe and modem, sending synchronous responses between the modem and the mainframe. An asynchronous device or a "dumb" terminal is used to configure the modem before it dials out in synchronous mode.

**Operation Method #2** Dedicated Computer

Dedicate a Computer as a synchronous device by installing the proper hardware and software so it can communicate with a mainframe. The modem is configured and dials out in asynchronous mode, then switches to synchronous mode once a connection is made.



*HST modulation is not supported for synchronous communications.*

---

**General Requirements**

Modems in asynchronous mode adapt to many conditions of remote asynchronous modems. But synchronous connections to a mainframe require strict adherence to specific operating parameters. If the terminal being operated is designed for a particular network, the modem needs to be set properly before calling or answering.

**RS-232 Interface**

Transmit and Receive synchronous timing pins are required at the Electronic Industries Association (EIA) RS-232 interface. Either pin 15 or pin 24 is needed for Transmitter timing signals, depending on whether the modem (pin 15) or the DTE (pin 24) generates the signals. Pin 17 is also needed, for Receiver timing signals.

**Protocol Compatibility**

The devices at both ends of the link must use the same protocol. These protocols format data into blocks or frames and add control information.

If the modem is in V.25 *bis* mode, the link protocol must be High-Level Data Link Control (HDLC), or character oriented. If the modem is in Online Synchronous mode it may use HDLC, character oriented, or another protocol determined by the mainframe manufacturer.

## Connection Rates

| Command | Connection Rate    |
|---------|--------------------|
| AT&N0   | Variable (default) |
| AT&N1   | Reserved           |
| AT&N2   | 1200 bps           |
| AT&N3   | 2400 bps           |
| AT&N4   | 4800 bps           |
| AT&N5   | 7200 bps           |
| AT&N6   | 9600 bps           |
| AT&N7   | 12K bps            |
| AT&N8   | 14.4K bps          |
| AT&N9   | 16.8K bps          |
| AT&N10  | 19.2K bps          |
| AT&N11  | Reserved           |
| AT&N12  | 24K bps            |
| AT&N13  | 26.2K bps          |
| AT&N14  | 28.8K bps          |

### Data Rate Synchronization

During synchronous operations, transmit and receive clocks at both ends of the phone link control the precise timing of the data flow. The communications equipment at the remote DTE, and the host modem and DTE must all handle the data at the same speed.

The transmit clock timing signals setting, &X*n*, determines whether the modem or DTE will generate the timing signals. For Online synchronous operations, the source for this setting must be the same on both systems. For V.25 *bis* operations this is not necessary. See *Connection Rate (%N*n*, &N*n*)* under *V.25 bis Requirements* later in this appendix.

Most Online synchronous users will require the default setting, &X0. The &X1 and &X2 settings are only valid for the Quad Analog Modem and the

Quad Analog/Digital Modem in analog mode. The following table explains the function of each &Xn command:

| Command | Function                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&X0   | The modem is the source of the Transmit clock timing signals and sends them to the DTE over the RS-232 interface. The DTE rate will follow the connection rates. Default.                                                                                                                                                                                                                 |
| AT&X1   | The DTE is the source of the Transmit clock timing signals and sends them to the modem over the RS-232 interface. This setting is used typically in leased line multiplexed operations. (Multiplexors divide the phone channel so that the channel carries several calls at the same time.) The DTE ignores the modem's clock timing signals and negotiates the DTE and connection rates. |
| AT&X2   | The modem's Receiver clock is the source of the timing signals. The signals are looped to the Transmit clock and sent to the DTE over the RS-232 interface. This setting is only used in those systems that require synchronization of data flowing in both directions.                                                                                                                   |

V.25 *bis*  
Requirements

V.25 *bis* is an ITU-T standard that uses the HDLC or character-oriented protocols to format data.

Before attempting to connect to a synchronous network, the modem must be set in command (asynchronous) mode by using either an asynchronous device or dumb terminal. Once the modem is in synchronous mode, it no longer accepts asynchronous commands.

Setting the modem

Commands begin with a required AT prefix and end with a required Return (spaces have been added only for readability):

```
AT &I0 &H0 &R0 &S4 &M6 &X0 &W
```

This command causes the modem to:

- Disable XOn/XOff flow control of received data (&I0).
- Disable transmit data flow control (&H0).
- Pause between RTS and CTS (&R0).
- Set the modem to send the DSR signal to the DTE at the same time as Carrier Detect (&S4).

- Select character oriented as the synchronous link protocol (&M6).
- Set the modem as the source of the transmit timing signals (&X0).
- Save the settings to NVRAM (&W).

Verify that DIP switch 10 is Off so that the modem loads the settings stored in Nonvolatile Random Access Memory (NVRAM) when it powers on. Until settings are customized the settings in NVRAM are the same as the factory defaults.

**Connection Rate** Three phases to obtaining and maintaining a connection rate during synchronous communication are the following.

### **Phase One: Clock Speed Control**

The first phase is in deciding where the clock speed will be determined. See *Data Rate Synchronization*, under *General Requirements* earlier in this appendix.

### **Phase Two: Offline Host/Modem Clock Speed**

The second phase involves the data rate between the host computer or terminal and its modem during offline mode. The %Nn command sets the clock speed between the modem and host, but this speed is only during offline mode, before the synchronous connection.

The %Nn command works with &Xn. If the modem is set as the source of the Transmit clock timing signals (&X0—default), the %Nn commands set the computer or terminal-to-modem V.25 bis clock speed. If the modem is set to &X1, the computer is the source of the Transmit clock signals.

If %Nn is set to 0 or 1, an error message displays because they are not valid values. The %Nn rates are as follows:

| Command | Connection Rate |
|---------|-----------------|
| AT%N0   | Reserved        |
| AT%N1   | Reserved        |
| AT%N2   | 1200 bps        |
| AT%N3   | 2400 bps        |
| AT%N4   | 4800 bps        |
| AT%N5   | 7200 bps        |
| AT%N6   | 9600 bps        |
| AT%N7   | 12.2K bps       |
| AT%N8   | 14.4K bps       |
| AT%N9   | 16.8K bps       |
| AT%N10  | 19.2K bps       |
| AT%N11  | 21.6K bps       |
| AT%N12  | 24K bps         |
| AT%N13  | 26.4K bps       |
| AT%N14  | 28.8K bps       |

### Phase Three: Online Connection Rate

The third phase involves the data rate between the host computer or terminal and its modem during online mode. The &Nn command sets the data rate during the synchronous connection.

If &Nn is set for 2 – 10, the modem ignores the %Nn rate and follows the &Nn rate to determine the online connection rate. Refer to the Connection Rates table under General Requirements, for actual link speeds.

### Recommended Settings

When the connection is made and the data rate determined, host/modem rates may change dramatically to match the connection rate (when in online synchronous mode, the modem is transparent on the line). To avoid this dramatic rate switching, 3Com recommends setting the modem at a fixed rate between the computer and the modem (%Nn) and also to set the connection rate (&Nn) the same.

**Result Codes Xn**     The modem displays normal or extended synchronous result codes, depending on the setting of the Xn command. The modem displays extended result codes if X = 1–7. By default, the modem is set to X7. To change to normal result codes, set the modem to X0.

The normal result codes return messages such as VAL or INV (VALID or INVALID), whereas the extended codes offer explanations—INVPS (INVALID Parameter Syntax Error).

**Auto Answer**     When the modem is operating in V.25 bis mode, it ignores the DIP switch 5 setting, which controls Auto Answer. To set the modem to automatically answer incoming calls, enter the following command enabling Auto Answer:

**ATS0=1**

To disable Auto Answer, enter the following command:

**ATS0=0**

**Choosing a Synchronous Protocol**     Once you configure the &Xn, %Nn, &Nn, Xn, S0 commands, you must use the &Mn command to choose the HDLC or character-oriented link protocol so your synchronous software properly formats its commands. The following tables provides the available options:

| Command | Function                                                                                                                                                                                                                        |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&M6   | Use the character oriented protocol for synchronous communications. The local and remote modem must use the same eight bit data format. The character length must be 7 bits and either Odd or Even Parity, or 8 bits No Parity. |
| AT&M7   | Use the High-Level Data Link Control (HDLC), a ITU-T standard for synchronous communications. HDLC ignores Parity.                                                                                                              |

**V.25 bis Commands and Result Codes**     Supported V.25 bis commands and result codes are listed in the technical specifications section of the *Quad Modem Network Interface Card Documentation*.

**Hanging Up**     The modem remains online until the remote modem disconnects or the local DTE drops DTR. This is normally done with software.



### Returning from V.25 *bis* to Asynchronous Mode

You can switch V.25 *bis* communication sessions between synchronous and asynchronous modes by flipping DIP switch 10 On (fail-safe default template), then rebooting the card. Use the hardware flow control initialization string to maintain high performance.



*Factory defaults (fail-safe mode) do not have hardware flow control.*

---

### Online Synchronous Requirements

When the modem is set to Online Synchronous mode, it remains in command (asynchronous) mode until it makes a synchronous connection with a remote modem. Upon connection, the modem enters synchronous mode and sends synchronous timing signals to the DTE.

### Setting the Modem

Because the modem will not accept commands when it is in synchronous mode, it must be configured in asynchronous mode before trying to connect to a synchronous network. For example (spaces have been added only for readability):

**AT B0 &N0 &X0**

This command causes the modem to:

- Set the modulation type (B0).
- Set the connection rate (&N0).
- Choose a timing source (&X0).



*Be sure that DIP switch 1 is Off (factory default) for normal DTR operations. The Data Terminal Ready (DTR) override must be Off so that the modem detects when the DTE raises and lowers the DTR signal.*

### Modulation and Connection Rate

Use the following guidelines for your modem type.

If the modem is connecting with another 3Com modem, try setting both modems to B0 and to a variable connection rate, &N0. The modems should connect at the highest possible rate.

If the variable connection rate does not work, try a fixed connection rate such as &N6 (9600 bps) or &N3 (2400 bps).



*The Quad Modem does not support HST modulation for synchronous communications.*



*If the Quad Modem is set to a fixed rate, and the remote modem is not set to the same rate, the connection will fail.*

### Connection Rate

Use this command to set variable or fixed rates at the link interface. The default is &N0, variable rate. The local modem negotiates with the remote modem for the highest possible connection rate, depending on the capabilities of the remote modem. If &N0 does not work, try a fixed rate.



*The Quad Modem is not capable of connecting at 21.6K bps in synchronous mode.*

When the modem is set to a fixed rate it will only connect if the remote modem is operating at the same rate.

### Generating Clock Timing Signals

The &Xn setting specifies whether the modem or the DTE generates the Transmit clock timing signals for a synchronous call. Most users will require the default setting, &X0. See *Data Rate Synchronization* under *General Requirements* earlier in this appendix for more information.

### Dialing Out

If you have a computer capable of switching between synchronous and asynchronous modes, you can issue a standard dial command when the modem is configured for synchronous mode. The modem does not enter synchronous mode until the connection is established.

In many synchronous applications, the user's host port does not have the ability to switch to asynchronous mode. In this case, connect the modem to a computer that is capable of asynchronous operations, and store a number to be autodialed at a later time.

First store the phone number of the synchronous modem to be called at position 0 in NVRAM. Use the &Zn=s command, where *n* is the position in NVRAM and *s* is the phone number.

*Example*     **AT&Z=5551234**

The stored number can be dialed two ways: both require modifying the value of S-Register 13. Include the S-Register 13 setting in the same command string that initiates synchronous mode. Once the value of

S-Register 13 has been changed, the modem dials the stored number when the appropriate event occurs, as follows.

| Command  | Function                                                                                                                                              |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| ATS13=8  | The modem dials the number stored in NVRAM at position 0 when the DTE raises the DTR signal.                                                          |
| ATS13=16 | The modem dials the number stored in NVRAM at position 0 when it is powered on (that is, when the modem is pulled out from the rack and re-inserted). |

Auto Answer

The modem must be in Auto Answer mode, DIP switch 5 Off. Follow the instructions in the next section on issuing the &M1 command.

Initiating Online Synchronous Mode

The modem enters synchronous mode in response to the &M1 command. If the modem is to dial out, first store the number to be called in NVRAM as described previously under Dialing Out, earlier in this section. Then set the modem for synchronous operation by entering the following command string:

- AT S13=8 &N8 &M1
- S13=8 instructs the modem to dial the phone number stored in NVRAM at position 0 when the DTE raises the DTR signal.
  - &N8 optionally fixes the link rate at 14.4K bps.
  - &M1 instructs the modem to enter synchronous mode.

Hanging Up

The modem remains online until the remote modem disconnects or the local DTE drops DTR.

Testing and Inquiry Commands

The modem test commands, &T*n*, and Inquiry commands, *In*, cannot be used when the modem is operating in synchronous mode.

Bell 208B Operations

The Bell 208B standard defines a modulation scheme for 4800-bps, half-duplex, synchronous data transmission. Bell 208 modulation can be used in either V.25 *bis* or online synchronous mode. To enable these modes refer back to the respective sections in this chapter.

Bell 208 Training Sequence and Multimode Support

The Quad Modem can use Bell 208B modulation exclusively, or add Bell 208B modulation to the other modulations it attempts during negotiation with a remote modem.

To set the modem to accept Bell 208 calls in the multimode handshake:

- 1 Set the modem to answer with the V.25 answer sequence by entering the following command:

**ATB0**

- 2 Disable V.8 in the answering modem to allow the modem to fall back correctly from V.90 and V.34 training sequences by entering the following command:

**ATS54.7=1**

- 3 Enable the Bell 208B Multimode Handshake by entering the following command:

**ATS31.0=1**

This allows the modem to connect in V.32 terbo, V.32 *bis*, V.32, and also Bell 208 modulation schemes, although it takes slightly longer than if the modem uses Bell 208B exclusively.

## Setting the Modem

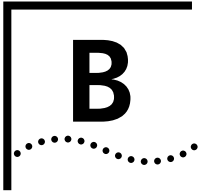
Commands begin with a required AT prefix and end by pressing Return (spaces have been added only for readability):

**AT B2 &R0 S26=15 &S1 &X0 &M1 &W**

This command causes the modem to:

- Select Bell 208 answer sequence (B2).
- Establish a delay between RTS and CTS signals (&R0).
- Set the delay duration between RTS and CTS (S26=15)
- Send the DSR signal to the DTE after detecting or sending an answer tone (&S1).
- Select the modem as the source of the transmit clock timing (&X0).
- Select online synchronous mode (&M1).
- Save the settings to NVRAM (&W).





# RESULT CODES

This appendix includes lists of the following:

- Basic result codes
- Digital result codes
- Extended result codes

## Result Codes

This table provides a list of basic Quad Modem result codes:

| Numeric | Alphanumeric     |
|---------|------------------|
| 0       | OK               |
| 1       | CONNECT          |
| 2       | RING             |
| 3       | NO CARRIER       |
| 4       | ERROR            |
| 5       | CONNECT 1200     |
| 6       | NO DIAL TONE     |
| 7       | BUSY             |
| 8       | NO ANSWER        |
| 9       | [Not used]       |
| 10      | CONNECT 2400     |
| 11      | RINGING          |
| 12      | VOICE            |
| 13      | CONNECT 9600     |
| 14      | CONNECT ARQ      |
| 15      | CONNECT 1200/ARQ |
| 16      | CONNECT 2400/ARQ |

(continued)

| Numeric | Alphanumeric          |
|---------|-----------------------|
| 23      | CONNECT 9600/HST      |
| 24      | CONNECT 7200/ARQ      |
| 25      | CONNECT 14400         |
| 26      | CONNECT 14400/ARQ     |
| 27      | CONNECT 9600/ARQ/HST  |
| 28      | CONNECT 4800/HST      |
| 29      | CONNECT 4800/ARQ/HST  |
| 30      | CONNECT 7200/HST      |
| 31      | CONNECT 12000/HST     |
| 32      | CONNECT 12000/ARQ/HST |
| 33      | CONNECT 9600/V32      |
| 34      | CONNECT 7200/ARQ/HST  |
| 35      | CONNECT 14400/HST     |
| 36      | CONNECT 14400/ARQ/HST |
| 37      | CONNECT 9600/ARQ/HST  |
| 38      | CONNECT 4800/V32      |
| 39      | CONNECT 4800/ARQ/V32  |

| <b>Numeric</b> | <b>Alphanumeric</b>   |
|----------------|-----------------------|
| 17             | CONNECT 9600/ARQ      |
| 18             | CONNECT 4800          |
| 19             | CONNECT 4800/ARQ      |
| 20             | CONNECT 7200          |
| 21             | CONNECT 12000         |
| 22             | CONNECT 12000/ARQ     |
| 46             | CONNECT 14400/ARQ/V32 |
| 47             | CONNECT 16800/ARQ     |
| 48             | CONNECT 75/1200       |
| 49             | CONNECT 1200/75       |
| 50             | ABORT                 |
| 51             | INCOMING CALL         |
| 52             | PHONE OFF HOOK        |
| 53             | CONNECT 16800/HST     |
| 54             | OFF HOOK RESTRICTED   |
| 55             | [Not used]            |
| 56             | [Not used]            |
| 57             | CONNECT 16800/ARQ/HST |
| 58             | COMMAND DENIED ...    |
| 59             | NUMBER BLACKLISTED    |
| 60             | Blocked List FULL     |
| 61             | WAITING               |
| 62             | DIALING DISABLED      |
| 63             | DATA                  |
| 64             | FAX                   |
| 65             | +FCO                  |
| 66             | +FVO                  |
| 67             | +FDM                  |
| 68             | +FHS:                 |
| 69             | +FCS:                 |
| 70             | +FIS:                 |
| 71             | +FTS:                 |
| 72             | +FPO                  |

(continued)

| <b>Numeric</b> | <b>Alphanumeric</b>   |
|----------------|-----------------------|
| 40             | CONNECT 7200/V32      |
| 41             | CONNECT 12000/V32     |
| 42             | CONNECT 12000/ARQ/V32 |
| 43             | CONNECT 16800         |
| 44             | CONNECT 7200/ARQ/V32  |
| 45             | CONNECT 14400/V32     |
| 79             | +FET:                 |
| 80             | +FPS:                 |
| 81             | +FHT:                 |
| 82             | +FHR                  |
| 83             | CONNECT 16800/V32     |
| 84             | CONNECT 16800/ARQ/V32 |
| 85             | CONNECT 19200         |
| 86             | CONNECT 19200/HST     |
| 87             | CONNECT 19200/V32     |
| 88             | CONNECT 19200/ARQ     |
| 89             | CONNECT 19200/ARQ/HST |
| 90             | CONNECT 19200/ARQ/V32 |
| 91             | CONNECT 21600         |
| 92             | CONNECT 21600/HST     |
| 93             | CONNECT 21600/V32     |
| 94             | CONNECT 21600/ARQ     |
| 95             | CONNECT 21600/ARQ/HST |
| 96             | CONNECT 21600/ARQ/V32 |
| 97             | CONNECT 21600/VFC     |
| 98             | CONNECT 21600/ARQ/VFC |
| 99             | CONNECT 24000         |
| 100            | CONNECT 24000/ARQ     |
| 101            | CONNECT 24000/VFC     |
| 102            | CONNECT 24000/ARQ/VFC |
| 103            | CONNECT 26400         |
| 104            | CONNECT 26400/ARQ     |
| 105            | CONNECT 26400/VFC     |

| <b>Numeric</b> | <b>Alphanumeric</b>   |
|----------------|-----------------------|
| 73             | +FTI:                 |
| 74             | +FCI:                 |
| 75             | +FPI:                 |
| 76             | +FNF:                 |
| 77             | +FNS:                 |
| 78             | +FNC:                 |
| 112            | CONNECT 21600/ARQ/V34 |
| 113            | CONNECT 24000/V34     |
| 114            | CONNECT 24000/ARQ/V34 |
| 115            | CONNECT 26400/V34     |
| 116            | CONNECT 26400/ARQ/V34 |
| 117            | CONNECT 28800/V34     |
| 118            | CONNECT 28800/ARQ/V34 |
| 119            | CONNECT 2400/VFC      |
| 120            | CONNECT 2400/V34      |
| 121            | CONNECT 2400/ARQ/VFC  |
| 122            | CONNECT 2400/ARQ/V34  |
| 123            | CONNECT 4800/VFC      |
| 124            | CONNECT 4800/V34      |
| 125            | CONNECT 4800/ARQ/VFC  |
| 126            | CONNECT 4800/ARQ/V34  |
| 127            | CONNECT 7200/VFC      |
| 128            | CONNECT 7200/V34      |
| 129            | CONNECT 7200/ARQ/VFC  |
| 130            | CONNECT 7200/ARQ/V34  |
| 131            | CONNECT 9600/VFC      |
| 132            | CONNECT 9600/V34      |
| 133            | CONNECT 9600/ARQ/VFC  |
| 134            | CONNECT 9600/ARQ/V34  |
| 135            | CONNECT 12000/VFC     |
| 136            | CONNECT 12000/V34     |
| 137            | CONNECT 12000/ARQ/VFC |
| 138            | CONNECT 12000/ARQ/V34 |

(continued)

| <b>Numeric</b> | <b>Alphanumeric</b>   |
|----------------|-----------------------|
| 106            | CONNECT 26400/ARQ/VFC |
| 107            | CONNECT 28800         |
| 108            | CONNECT 28800/ARQ     |
| 109            | CONNECT 28800/VFC     |
| 110            | CONNECT 28800/ARQ/VFC |
| 111            | CONNECT 21600/V34     |
| 145            | CONNECT 16800/ARQ/VFC |
| 146            | CONNECT 16800/ARQ/V34 |
| 147            | CONNECT 19200/VFC     |
| 148            | CONNECT 19200/V34     |
| 149            | CONNECT 19200/ARQ/VFC |
| 150            | CONNECT 19200/ARQ/V34 |
| 151            | CONNECT 31200         |
| 152            | CONNECT 31200/ARQ     |
| 153            | CONNECT 31200/V34     |
| 154            | CONNECT 31200/ARQ/V34 |
| 155            | CONNECT 33600         |
| 156            | CONNECT 33600/ARQ     |
| 157            | CONNECT 33600/V34     |
| 158            | CONNECT 33600/ARQ/V34 |
| 159            | SECURITY ERROR        |
| 160            | AT COMMAND DISABLED   |
| 161            | ONLY QUERY ALLOWED    |
| 162            | Used by Quad I-Modem  |
| 163            | Used by Quad I-Modem  |
| 164            | Used by Quad I-Modem  |
| 165            | Used by Quad I-Modem  |
| 166            | Used by Quad I-Modem  |
| 167            | Used by Quad I-Modem  |
| 168            | Used by Quad I-Modem  |
| 169            | Used by Quad I-Modem  |
| 170            | Reserved              |
| 171            | Reserved              |



| <b>Numeric</b> | <b>Alphanumeric</b>   |
|----------------|-----------------------|
| 139            | CONNECT 14400/VFC     |
| 140            | CONNECT 14400/V34     |
| 141            | CONNECT 14400/ARQ/VFC |
| 142            | CONNECT 14400/ARQ/V34 |
| 143            | CONNECT 16800/VFC     |
| 144            | CONNECT 16800/V34     |
| 178            | Reserved              |
| 179            | Reserved              |
| 180            | CONNECT 32000         |
| 181            | CONNECT 32000/ARQ     |
| 182            | CONNECT 32000/x2      |
| 183            | CONNECT 32000/ARQ/x2  |
| 184            | CONNECT 36000         |
| 185            | CONNECT 36000/ARQ     |
| 186            | CONNECT 36000/x2      |
| 187            | CONNECT 36000/ARQ/x2  |
| 188            | CONNECT 40000         |
| 189            | CONNECT 40000/ARQ     |
| 190            | CONNECT 40000/x2      |
| 191            | CONNECT 40000/ARQ/x2  |
| 192            | CONNECT 44000         |
| 193            | CONNECT 44000/ARQ     |
| 194            | CONNECT 44000/x2      |
| 195            | CONNECT 44000/ARQ/x2  |
| 196            | CONNECT 48000         |
| 197            | CONNECT 48000/ARQ     |
| 198            | CONNECT 48000/x2      |
| 199            | CONNECT 48000/ARQ/x2  |
| 200            | CONNECT 49333         |
| 201            | CONNECT 49333/ARQ     |
| 202            | CONNECT 49333/x2      |
| 203            | CONNECT 49333/ARQ/x2  |
| 204            | CONNECT 50666         |

(continued)

| <b>Numeric</b> | <b>Alphanumeric</b>  |
|----------------|----------------------|
| 172            | Reserved             |
| 173            | Reserved             |
| 174            | Reserved             |
| 175            | Reserved             |
| 176            | Reserved             |
| 177            | Reserved             |
| 211            | CONNECT 52000/ARQ/x2 |
| 212            | CONNECT 53333        |
| 213            | CONNECT 53333/ARQ    |
| 214            | CONNECT 53333/x2     |
| 215            | CONNECT 53333/ARQ/x2 |
| 216            | CONNECT 54666        |
| 217            | CONNECT 54666/ARQ    |
| 218            | CONNECT 54666/x2     |
| 219            | CONNECT 54666/ARQ/x2 |
| 220            | CONNECT 56000        |
| 221            | CONNECT 56000/ARQ    |
| 222            | CONNECT 56000/x2     |
| 223            | CONNECT 56000/ARQ/x2 |
| 224            | CONNECT 57333        |
| 225            | CONNECT 57333/ARQ    |
| 226            | CONNECT 57333/x2     |
| 227            | CONNECT 57333/ARQ/x2 |
| 228            | CONNECT 58666        |
| 229            | CONNECT 58666/ARQ    |
| 230            | CONNECT 58666/x2     |
| 231            | CONNECT 58666/ARQ/x2 |
| 232            | CONNECT 60000        |
| 233            | CONNECT 60000/ARQ    |
| 234            | CONNECT 60000/x2     |
| 235            | CONNECT 60000/ARQ/x2 |
| 236            | CONNECT 61333        |
| 237            | CONNECT 61333/ARQ    |

| Numeric | Alphanumeric         | Numeric | Alphanumeric         |
|---------|----------------------|---------|----------------------|
| 205     | CONNECT 50666/ARQ    | 238     | CONNECT 61333/x2     |
| 206     | CONNECT 50666/x2     | 239     | CONNECT 61333/ARQ/x2 |
| 207     | CONNECT 50666/ARQ/x2 | 240     | CONNECT 64000        |
| 208     | CONNECT 52000        | 241     | CONNECT 64000 ARQ    |
| 209     | CONNECT 52000/ARQ    | 242     | CONNECT 64000/x2     |
| 210     | CONNECT 52000/x2     | 243     | CONNECT 64000/ARQ/x2 |

## Digital Result Codes

The following tables include the digital result codes. The result codes are blocked into groups dependent on which AT&An command is entered.



*AT&A0 will not display ARQ Result Codes.*

### If AT&A0 is entered, the following Result Codes display:

| Numeric | Alphanumeric  |
|---------|---------------|
| 01      | Connect       |
| 05      | Connect 1200  |
| 10      | Connect 2400  |
| 18      | Connect 4800  |
| 13      | Connect 9600  |
| 85      | Connect 19200 |
| 162     | Connect 56000 |
| 166     | Connect 64000 |
| 177     | Connect 38400 |



*AT&A1 will display ARQ Result Codes*

### If AT&A1 is entered, the following Result Codes display:

| Numeric | Alphanumeric      |
|---------|-------------------|
| 163     | Connect 56000/ARQ |
| 01      | Connect           |
| 05      | Connect 1200      |
| 10      | Connect 2400      |
| 18      | Connect 4800      |

(continued)

|     |                   |
|-----|-------------------|
| 13  | Connect 9600      |
| 85  | Connect 19200     |
| 162 | Connect 56000     |
| 166 | Connect 64000     |
| 167 | Connect 64000/ARQ |
| 177 | Connect 38400     |



*AT&A2 displays ARQ, HST, V.32, V.FC, V.34 or Digital*

**If AT&A2 is entered, the following Result Codes display:**

| <b>Numeric</b> | <b>Alphanumeric</b>       |
|----------------|---------------------------|
| 164            | Connect 56000/DIGITAL     |
| 165            | Connect 56000/ARQ/DIGITAL |
| 168            | CONNECT 64000/DIGITAL     |
| 169            | CONNECT 64000/ARQ/DIGITAL |
| 170            | Connect 300/Digital       |
| 171            | Connect 1200/Digital      |
| 172            | Connect 2400/Digital      |
| 173            | Connect 4800/Digital      |
| 174            | Connect 9600/Digital      |
| 175            | Connect 19200/Digital     |
| 171            | Connect 38400/Digital     |



*AT&3 displays the same information as AT&A2 and includes error control indicators and Data Compression type*

**If AT&A3 is entered, the following Result Codes display:**

| <b>Numeric</b> | <b>Alphanumeric</b>    |
|----------------|------------------------|
| 165            | CONNECT 56000/ARQ/V110 |
| 169            | CONNECT 64000/ARQ/V110 |
| 165            | CONNECT 56000/ARQ/V120 |
| 169            | CONNECT 64000/ARQ/V120 |
| 165            | CONNECT 56000/ARQ/X.75 |
| 169            | CONNECT 64000/ARQ/X.75 |

(continued)

|     |                            |
|-----|----------------------------|
| 170 | Connect 300/Digital/V110   |
| 171 | Connect 1200/Digital/V110  |
| 172 | Connect 2400/Digital/V110  |
| 173 | Connect 4800/Digital/V110  |
| 174 | Connect 9600/Digital/V110  |
| 175 | Connect 19200/Digital/V110 |
| 176 | Connect 38400/Digital/V110 |

## Extended Result Codes

This table includes extended result codes:

| Extended Result code |                       |            |               |
|----------------------|-----------------------|------------|---------------|
| Numeric              | Alphanumeric          | Basic (x0) | non-ARQ (&A0) |
| 256                  | CONNECT 28000         | 1          | 256           |
| 257                  | CONNECT 28000/ARQ     | 14         | 256           |
| 258                  | CONNECT 28000/V90     | 1          | 256           |
| 259                  | CONNECT 28000/ARQ/V90 | 14         | 256           |
| 260                  | CONNECT 29333         | 1          | 260           |
| 261                  | CONNECT 29333/ARQ     | 14         | 260           |
| 262                  | CONNECT 29333/V90     | 1          | 260           |
| 263                  | CONNECT 29333/ARQ/V90 | 14         | 260           |
| 264                  | CONNECT 30666         | 1          | 264           |
| 265                  | CONNECT 30666/ARQ     | 14         | 264           |
| 266                  | CONNECT 30666/V90     | 1          | 264           |
| 267                  | CONNECT 3066/ARQ/V90  | 14         | 264           |
| 268                  | CONNECT 32000         | 1          | 268           |
| 269                  | CONNECT 32000/ARQ     | 14         | 268           |
| 270                  | CONNECT 32000/V90     | 1          | 268           |
| 271                  | CONNECT 32000/ARQ/V90 | 14         | 268           |
| 272                  | CONNECT 34666         | 1          | 272           |
| 273                  | CONNECT 34666/ARQ     | 14         | 272           |
| 274                  | CONNECT 34666/V90     | 1          | 272           |
| 275                  | CONNECT 34666/ARQ/V90 | 14         | 272           |
| 276                  | CONNECT 36000         | 1          | 276           |

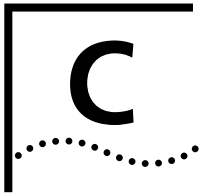
(continued)

| <b>Extended Result code</b> |                       |                   |                          |
|-----------------------------|-----------------------|-------------------|--------------------------|
| <b>Numeric</b>              | <b>Alphanumeric</b>   | <b>Basic (x0)</b> | <b>non-ARQ (&amp;A0)</b> |
| 277                         | CONNECT 36000/ARQ     | 14                | 276                      |
| 278                         | CONNECT 36000/V90     | 1                 | 276                      |
| 279                         | CONNECT 36000/ARQ/V90 | 14                | 276                      |
| 280                         | CONNECT 38666         | 1                 | 280                      |
| 281                         | CONNECT 38666/ARQ     | 14                | 280                      |
| 282                         | CONNECT 38666/V90     | 1                 | 280                      |
| 283                         | CONNECT 38666/ARQ/V90 | 14                | 280                      |
| 284                         | CONNECT 40000         | 1                 | 284                      |
| 285                         | CONNECT 40000/ARQ     | 14                | 284                      |
| 286                         | CONNECT 40000/V90     | 1                 | 284                      |
| 287                         | CONNECT 40000/ARQ/V90 | 14                | 284                      |
| 288                         | CONNECT 33333/V90     | 1                 | 180                      |
| 289                         | CONNECT 33333/ARQ/V90 | 14                | 180                      |
| 290                         | CONNECT 37333/V90     | 1                 | 184                      |
| 291                         | CONNECT 37333/ARQ/V90 | 14                | 184                      |
| 292                         | CONNECT 41333/V90     | 1                 | 188                      |
| 293                         | CONNECT 41333/ARQ/V90 | 14                | 188                      |
| 294                         | CONNECT 42666/V90     | 1                 | 192                      |
| 295                         | CONNECT 42666/ARQ/V90 | 14                | 192                      |
| 296                         | CONNECT 44000/V90     | 1                 | 196                      |
| 297                         | CONNECT 44000/ARQ/V90 | 14                | 196                      |
| 298                         | CONNECT 45333/V90     | 1                 | 200                      |
| 299                         | CONNECT 45333/ARQ/V90 | 14                | 200                      |
| 300                         | CONNECT 46666/V90     | 1                 | 204                      |
| 301                         | CONNECT 46666/ARQ/V90 | 14                | 204                      |
| 302                         | CONNECT 48000/V90     | 1                 | 208                      |
| 303                         | CONNECT 48000/ARQ/V90 | 14                | 208                      |
| 304                         | CONNECT 49333/V90     | 1                 | 212                      |
| 305                         | CONNECT 49333/ARQ/V90 | 14                | 212                      |
| 306                         | CONNECT 50666/V90     | 1                 | 216                      |
| 307                         | CONNECT 50666/ARQ/V90 | 14                | 216                      |
| 308                         | CONNECT 52000/V90     | 1                 | 220                      |

(continued)

| Extended Result code |                       |            |               |
|----------------------|-----------------------|------------|---------------|
| Numeric              | Alphanumeric          | Basic (x0) | non-ARQ (&A0) |
| 309                  | CONNECT 52000/ARQ/V90 | 14         | 220           |
| 310                  | CONNECT 53333/V90     | 1          | 224           |
| 311                  | CONNECT 53333/ARQ/V90 | 14         | 224           |
| 312                  | CONNECT 54666/V90     | 1          | 228           |
| 313                  | CONNECT 54666/ARQ/V90 | 14         | 228           |
| 314                  | CONNECT 56000/V90     | 1          | 232           |
| 315                  | CONNECT 56000/ARQ/V90 | 14         | 232           |





# S-REGISTERS

## Quad Modem S-Registers

The following table details S-Registers used to control the functionality of the Quad Modem. For additional information on using S-Registers, see the *Using AT Commands* chapter.

| Register | Default | Function                                                                                                                                                                                                                                                                                       |
|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S0       | 1       | Sets the number of rings on which to answer when in Auto Answer mode. Can be used to override the setting of DIP switch 5. S0 = 1 enables Auto Answer and the modem answers on the first ring. S0=0 disables Auto Answer, the same as DIP switch 5 On.<br>Setting S0 = 0 disables Auto Answer. |
| S1       | 0       | Counts and stores the number of rings from an incoming call.                                                                                                                                                                                                                                   |
| S2       | 43      | Stores the ASCII decimal code for the escape code character. Default character is "+". A value of 128-255 disables the escape code.                                                                                                                                                            |
| S3       | 13      | Stores the ASCII decimal code for the Return character. Valid range is 0-127.                                                                                                                                                                                                                  |
| S4       | 10      | Stores the ASCII decimal code for the Line Feed character. Valid range is 0-127.                                                                                                                                                                                                               |
| S5       | 8       | Stores the ASCII decimal code for the Backspace character. A value of 128-255 disables the Backspace key's delete function.                                                                                                                                                                    |
| S6       | 2       | Sets the number of seconds the modem waits before dialing. If set to X2,X4,X6,or X7, the modem dials as soon as it detects a dial tone (fast dial). If there is no dial tone, the modem observes the normal S6 time-out and returns a NO DIAL TONE Result Code.                                |
| S7       | 60      | Sets the number of seconds the modem waits for a carrier. May be set for much longer duration if, for example, the modem is originating an international connection.                                                                                                                           |
| S8       | 2       | Sets the duration, in seconds, for the pause (,) option in the Dial command and the pause between command re-executions (> and A> commands).                                                                                                                                                   |
| S9       | 6       | Sets the required duration, in tenths of a second, of the remote modem's carrier signal before recognition. The modem ignores this register above 2400 bps.                                                                                                                                    |

(continued)



| Register   | Default | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
|------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|---|--------------------------------------------------------------------------------------------------------------------------------|---|---|--------------------------------------------------------------------------------------------------------|---|---|--------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|--------------------------------------------------------------------|---|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-------------------------------------------------|---|-----|--------------------------|
| <b>S10</b> | 7       | <p>Sets the duration, in tenths of a second, that the modem waits after loss of carrier before hanging up. This guard time allows the modem to distinguish between a line hit, or other disturbance that momentarily breaks the connection, from a true disconnect (hanging up) by the remote modem.</p> <p>S10=255 causes the modem to remain off hook despite loss of carrier; it hangs up only if the DTR signal drops or the modem is returned to command mode and sent the ATH command.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| <b>S11</b> | 70      | Sets the duration and spacing, in ms, of dial tones.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| <b>S12</b> | 50      | Sets the duration, in fiftieths of a second, of the guard time for the escape code (+++) sequence. Default = 1 second.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| <b>S13</b> | 0       | <p>Bit-mapped register sets DTR, MNP, Auto Dial, HST and other options.</p> <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Reset to software defaults when DTR drops.</td></tr> <tr> <td>1</td><td>2</td><td>Reverse normal Auto Answer operation: on incoming RING, enter Originate Mode and look for Answer tone.</td></tr> <tr> <td>2</td><td>4</td><td>Disable 250 ms pause before Result Code display.</td></tr> <tr> <td>3</td><td>8</td><td>On DTR signal, Auto Dial the number stored in NVRAM at position 0.</td></tr> <tr> <td>4</td><td>16</td><td>At power on/reset, Auto Dial number stored in NVRAM at position 0.</td></tr> <tr> <td>5</td><td>32</td><td>Disable HST (used for testing V.32 <i>terbo</i> in Dual Standard modems). Allow V.34 and x2/V.90 connections only with x2/V.90 modems. Requires that S27.2 be set to On (S27.2=1).</td></tr> <tr> <td>6</td><td>64</td><td>Disable MNP Level 3 (used for testing Level 2).</td></tr> <tr> <td>7</td><td>128</td><td>Watchdog hardware reset.</td></tr> </table> | Bit | Value | Function | 0 | 1 | Reset to software defaults when DTR drops.                                                                                     | 1 | 2 | Reverse normal Auto Answer operation: on incoming RING, enter Originate Mode and look for Answer tone. | 2 | 4 | Disable 250 ms pause before Result Code display.                               | 3 | 8 | On DTR signal, Auto Dial the number stored in NVRAM at position 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4 | 16 | At power on/reset, Auto Dial number stored in NVRAM at position 0. | 5 | 32 | Disable HST (used for testing V.32 <i>terbo</i> in Dual Standard modems). Allow V.34 and x2/V.90 connections only with x2/V.90 modems. Requires that S27.2 be set to On (S27.2=1). | 6 | 64 | Disable MNP Level 3 (used for testing Level 2). | 7 | 128 | Watchdog hardware reset. |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 0          | 1       | Reset to software defaults when DTR drops.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 1          | 2       | Reverse normal Auto Answer operation: on incoming RING, enter Originate Mode and look for Answer tone.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 2          | 4       | Disable 250 ms pause before Result Code display.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 3          | 8       | On DTR signal, Auto Dial the number stored in NVRAM at position 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 4          | 16      | At power on/reset, Auto Dial number stored in NVRAM at position 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 5          | 32      | Disable HST (used for testing V.32 <i>terbo</i> in Dual Standard modems). Allow V.34 and x2/V.90 connections only with x2/V.90 modems. Requires that S27.2 be set to On (S27.2=1).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 6          | 64      | Disable MNP Level 3 (used for testing Level 2).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 7          | 128     | Watchdog hardware reset.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| <b>S14</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| <b>S15</b> | 0       | <p>Bit-mapped register</p> <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Disable the modem's extra high frequency equalization if problems occur on shorter link calls—Dual Standards in HST mode only.</td></tr> <tr> <td>1</td><td>2</td><td>Disable online fallback.</td></tr> <tr> <td>2</td><td>4</td><td>Disable 450 bps and force a 300 bps back channel rate—modems in HST mode only.</td></tr> <tr> <td>3</td><td>8</td><td> <p>Reset non-ARQ Transmit buffer from 1.5K byte to 128.</p> <p>The default 1.5K byte non-ARQ buffer allows data transfer with X and YMODEM file transfer protocols without using flow control.</p> <p>The 128-byte option allows remote users with slower modems to stop data you're transmitting from scrolling off their screens. When remote users send your computer an XOff (&lt;Ctrl-S&gt;) and you stop transmitting, the data in transit from your modem's buffer does not exceed the size of their screen.</p> </td></tr> </table>                                                       | Bit | Value | Function | 0 | 1 | Disable the modem's extra high frequency equalization if problems occur on shorter link calls—Dual Standards in HST mode only. | 1 | 2 | Disable online fallback.                                                                               | 2 | 4 | Disable 450 bps and force a 300 bps back channel rate—modems in HST mode only. | 3 | 8 | <p>Reset non-ARQ Transmit buffer from 1.5K byte to 128.</p> <p>The default 1.5K byte non-ARQ buffer allows data transfer with X and YMODEM file transfer protocols without using flow control.</p> <p>The 128-byte option allows remote users with slower modems to stop data you're transmitting from scrolling off their screens. When remote users send your computer an XOff (&lt;Ctrl-S&gt;) and you stop transmitting, the data in transit from your modem's buffer does not exceed the size of their screen.</p> |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 0          | 1       | Disable the modem's extra high frequency equalization if problems occur on shorter link calls—Dual Standards in HST mode only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 1          | 2       | Disable online fallback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 2          | 4       | Disable 450 bps and force a 300 bps back channel rate—modems in HST mode only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |
| 3          | 8       | <p>Reset non-ARQ Transmit buffer from 1.5K byte to 128.</p> <p>The default 1.5K byte non-ARQ buffer allows data transfer with X and YMODEM file transfer protocols without using flow control.</p> <p>The 128-byte option allows remote users with slower modems to stop data you're transmitting from scrolling off their screens. When remote users send your computer an XOff (&lt;Ctrl-S&gt;) and you stop transmitting, the data in transit from your modem's buffer does not exceed the size of their screen.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |   |                                                                                                                                |   |   |                                                                                                        |   |   |                                                                                |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |    |                                                                    |   |    |                                                                                                                                                                                    |   |    |                                                 |   |     |                          |

(continued)

| Register   | Default | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
|------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|----|-----------------------------------------------------------------------------------------------------------------------------------|---|----|-----------------------------------------------|---|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|----------------------------------|---|---|----------|---|---|----------|---|---|----------|---|---|----------|
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>4</td><td>16</td><td>Disable MNP Level 4; re-transmitting the larger Level 4 data blocks may be a problem if you expect numerous errors during a call.</td></tr> <tr> <td>5</td><td>32</td><td>Delete key acts as destructive Backspace key.</td></tr> <tr> <td>6</td><td>64</td><td>Some earlier 2400 bps MNP modems, not made by USR or Microcom, were not fully compatible with the MNP protocol. Difficulty making a 2400 bps MNP connection with a remote MNP modem may be due to this incompatibility. Set S-Register 15 to 64 and try to connect again.</td></tr> <tr> <td>7</td><td>128</td><td>Custom applications</td></tr> </table> | Bit | Value | Function | 4 | 16 | Disable MNP Level 4; re-transmitting the larger Level 4 data blocks may be a problem if you expect numerous errors during a call. | 5 | 32 | Delete key acts as destructive Backspace key. | 6 | 64 | Some earlier 2400 bps MNP modems, not made by USR or Microcom, were not fully compatible with the MNP protocol. Difficulty making a 2400 bps MNP connection with a remote MNP modem may be due to this incompatibility. Set S-Register 15 to 64 and try to connect again. | 7 | 128 | Custom applications              |   |   |          |   |   |          |   |   |          |   |   |          |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 4          | 16      | Disable MNP Level 4; re-transmitting the larger Level 4 data blocks may be a problem if you expect numerous errors during a call.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 5          | 32      | Delete key acts as destructive Backspace key.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 6          | 64      | Some earlier 2400 bps MNP modems, not made by USR or Microcom, were not fully compatible with the MNP protocol. Difficulty making a 2400 bps MNP connection with a remote MNP modem may be due to this incompatibility. Set S-Register 15 to 64 and try to connect again.                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 7          | 128     | Custom applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S16</b> | 0       | Bit-mapped test register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Analog Loopback</td></tr> <tr> <td>1</td><td>2</td><td>Dial test</td></tr> <tr> <td>2</td><td>4</td><td>Test pattern</td></tr> <tr> <td>3</td><td>8</td><td>Initiate Remote Digital Loopback</td></tr> <tr> <td>4</td><td>—</td><td>Reserved</td></tr> <tr> <td>5</td><td>—</td><td>Reserved</td></tr> <tr> <td>6</td><td>—</td><td>Reserved</td></tr> <tr> <td>7</td><td>—</td><td>Reserved</td></tr> </table>                                                                                                                                                                                                            | Bit | Value | Function | 0 | 1  | Analog Loopback                                                                                                                   | 1 | 2  | Dial test                                     | 2 | 4  | Test pattern                                                                                                                                                                                                                                                              | 3 | 8   | Initiate Remote Digital Loopback | 4 | — | Reserved | 5 | — | Reserved | 6 | — | Reserved | 7 | — | Reserved |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 0          | 1       | Analog Loopback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 1          | 2       | Dial test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 2          | 4       | Test pattern                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 3          | 8       | Initiate Remote Digital Loopback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 4          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 5          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 6          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| 7          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S17</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S18</b> | 0       | Test timer for software-initiated loopback testing (&Tn), disabled when S-Register 18 is set to 0. Sets the duration of testing, in seconds, before the modem automatically times out and terminates the test. For additional information, see the Modem Testing And Leased Line chapter.                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S19</b> | 0       | Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the phone line and at the timeout the modem hangs up. S19=0 disables the timer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S20</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S21</b> | 10      | Sets, in 10ms units, the length of Breaks sent from the modem to the computer or terminal. Applies to ARQ mode only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S22</b> | 17      | Stores the ASCII decimal code for the XOn character.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S23</b> | 19      | Stores the ASCII decimal code for the XOff character.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S24</b> | 150     | Sets the duration, in 20ms units, between pulsed DSR signals when the modem is set to &S2 or &S3. The default (and maximum value) is 3 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S25</b> | 5       | Sets the length, in 10ms units, of the minimum DTR pulse width. Default = .05 second.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |       |          |   |    |                                                                                                                                   |   |    |                                               |   |    |                                                                                                                                                                                                                                                                           |   |     |                                  |   |   |          |   |   |          |   |   |          |   |   |          |

(continued)

| Register   | Default | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
|------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|----------|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|--------------------------------------------------------------------------------------------------------------------------------|-----|----|------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----------------------------------------------------------------------------------------------------|---|----|-------------------------------------------------------|---|----|-------------------------------------------------------|---|----|----------|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>S26</b> | 1       | Sets the duration, in 10ms units, of the delay between RTS and the modem's CTS response once a synchronous connection is established. The maximum allowable value is 25 (250 ms).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| <b>S27</b> | 0       | Bit-mapped register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the modem answers Bell 103 and V.21 calls, but only originates V.21 calls.</td></tr> <tr> <td>1</td><td>2</td><td>Enable unencoded (non-trellis coded) modulation in V.32 mode; option is part of ITU-T V.32 recommendation, but is rarely used.</td></tr> <tr> <td>2</td><td>4</td><td>Disable V.32 modulation; used for testing HST modulation in Dual Standards.<br/>Allow V.34 and x2 / V.90 connections only with x2 / V.90 modems</td></tr> <tr> <td>3</td><td>8</td><td>Disable 2100 Hz answer tone to allow two V.42 modems to connect more quickly.</td></tr> <tr> <td>4</td><td>16</td><td>See below, <i>Error control handshaking options</i>.</td></tr> <tr> <td>5</td><td>32</td><td>See below, <i>Error control handshaking options</i>.</td></tr> <tr> <td>6</td><td>64</td><td>Reserved</td></tr> <tr> <td>7</td><td>128</td><td>Unusual software incompatibility. Some software may not accept certain Result Codes. This setting disables the codes and displays 9600 code instead. Call's true rate can be viewed with ATi6.</td></tr> </table> | Bit   | Value | Function | 0   | 1   | Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the modem answers Bell 103 and V.21 calls, but only originates V.21 calls. | 1  | 2   | Enable unencoded (non-trellis coded) modulation in V.32 mode; option is part of ITU-T V.32 recommendation, but is rarely used. | 2   | 4  | Disable V.32 modulation; used for testing HST modulation in Dual Standards.<br>Allow V.34 and x2 / V.90 connections only with x2 / V.90 modems | 3  | 8  | Disable 2100 Hz answer tone to allow two V.42 modems to connect more quickly.                      | 4 | 16 | See below, <i>Error control handshaking options</i> . | 5 | 32 | See below, <i>Error control handshaking options</i> . | 6 | 64 | Reserved | 7 | 128 | Unusual software incompatibility. Some software may not accept certain Result Codes. This setting disables the codes and displays 9600 code instead. Call's true rate can be viewed with ATi6. |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 0          | 1       | Enable ITU-T V.21 modulation at 300 bps for overseas calls. In V.21 mode, the modem answers Bell 103 and V.21 calls, but only originates V.21 calls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 1          | 2       | Enable unencoded (non-trellis coded) modulation in V.32 mode; option is part of ITU-T V.32 recommendation, but is rarely used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 2          | 4       | Disable V.32 modulation; used for testing HST modulation in Dual Standards.<br>Allow V.34 and x2 / V.90 connections only with x2 / V.90 modems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 3          | 8       | Disable 2100 Hz answer tone to allow two V.42 modems to connect more quickly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 4          | 16      | See below, <i>Error control handshaking options</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 5          | 32      | See below, <i>Error control handshaking options</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 6          | 64      | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| 7          | 128     | Unusual software incompatibility. Some software may not accept certain Result Codes. This setting disables the codes and displays 9600 code instead. Call's true rate can be viewed with ATi6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
|            |         | <i>Error control handshaking options: select the total values of bits 4 and 5.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
|            |         | <table> <tr> <th>Bit 4</th><th>Bit 5</th><th>Function</th></tr> <tr> <td>Off</td><td>Off</td><td>Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.</td></tr> <tr> <td>On</td><td>Off</td><td>Disable MNP.</td></tr> <tr> <td>Off</td><td>On</td><td>Disable V.42 Detection and LAPM.</td></tr> <tr> <td>On</td><td>On</td><td>Disable Detection phase, if you know that the remote modem does LAPM, but not the Detection phase.</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Bit 4 | Bit 5 | Function | Off | Off | Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.                                                                              | On | Off | Disable MNP.                                                                                                                   | Off | On | Disable V.42 Detection and LAPM.                                                                                                               | On | On | Disable Detection phase, if you know that the remote modem does LAPM, but not the Detection phase. |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| Bit 4      | Bit 5   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| Off        | Off     | Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| On         | Off     | Disable MNP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| Off        | On      | Disable V.42 Detection and LAPM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| On         | On      | Disable Detection phase, if you know that the remote modem does LAPM, but not the Detection phase.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |
| <b>S28</b> | 8       | <p>Sets the duration, in tenths of a second, of the extra 3000/600 Hz answer tones sent during V.32 handshaking. Default = .8 seconds. This gives V.32 modems additional time to connect in V.32 mode before timing out.</p> <p>If there is difficulty answering older, manually operated V.32 modems, for example, modems that require a button to be pushed in order to dial, try lengthening the duration of the extra tones.</p> <p>Setting S28 to zero eliminates the extra tones, resulting in a faster connect time if, for example, the modem is set to use V.21 modulation (300 bps) or V.23 modulation (1200 bps).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |          |     |     |                                                                                                                                                      |    |     |                                                                                                                                |     |    |                                                                                                                                                |    |    |                                                                                                    |   |    |                                                       |   |    |                                                       |   |    |          |   |     |                                                                                                                                                                                                |

(continued)

| Register                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Default | Function                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------------------------------------------------------|---|---|----------------------------------------------------------|---|---|----------|---|---|----------|---|---|----------|---|---|----------|
| <b>S29</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 20      | Sets the duration, in tenths of a second, of the answer tones sent during V.21 handshaking. Default = 2 seconds. This gives V.21 modems additional time to connect in V.21 mode before timing out. |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S30</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S31</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0       | Bit-mapped register                                                                                                                                                                                |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Enable Bell 208B modulation during multimode training sequence</td></tr> <tr> <td>1</td><td>–</td><td>Reserved</td></tr> <tr> <td>2</td><td>–</td><td>Reserved</td></tr> <tr> <td>3</td><td>–</td><td>Reserved</td></tr> <tr> <td>4</td><td>–</td><td>Reserved</td></tr> <tr> <td>5</td><td>–</td><td>Reserved</td></tr> <tr> <td>6</td><td>–</td><td>Reserved</td></tr> <tr> <td>7</td><td>–</td><td>Reserved</td></tr> </table>                                                                                                                               |         |                                                                                                                                                                                                    | Bit | Value | Function | 0 | 1 | Enable Bell 208B modulation during multimode training sequence                                                                                | 1 | – | Reserved                                                                                        | 2 | – | Reserved                                                                                                          | 3 | – | Reserved                                                 | 4 | – | Reserved | 5 | – | Reserved | 6 | – | Reserved | 7 | – | Reserved |
| Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Value   | Function                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1       | Enable Bell 208B modulation during multimode training sequence                                                                                                                                     |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S32</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9       | Reserved at the required default of 9                                                                                                                                                              |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S33</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0       | Bit-mapped register                                                                                                                                                                                |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>–</td><td>Reserved</td></tr> <tr> <td>1</td><td>2</td><td>Reduce the packet size. May be required for HST Cellular mode. For Dual Standard modems only.</td></tr> <tr> <td>2</td><td>–</td><td>Reserved</td></tr> <tr> <td>3</td><td>–</td><td>Reserved</td></tr> <tr> <td>4</td><td>–</td><td>Reserved</td></tr> <tr> <td>5</td><td>–</td><td>Reserved</td></tr> <tr> <td>6</td><td>–</td><td>Reserved</td></tr> <tr> <td>7</td><td>–</td><td>Reserved</td></tr> </table>                                                                                                |         |                                                                                                                                                                                                    | Bit | Value | Function | 0 | – | Reserved                                                                                                                                      | 1 | 2 | Reduce the packet size. May be required for HST Cellular mode. For Dual Standard modems only.   | 2 | – | Reserved                                                                                                          | 3 | – | Reserved                                                 | 4 | – | Reserved | 5 | – | Reserved | 6 | – | Reserved | 7 | – | Reserved |
| Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Value   | Function                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2       | Reduce the packet size. May be required for HST Cellular mode. For Dual Standard modems only.                                                                                                      |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | –       | Reserved                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S34</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0       | Bit-mapped register                                                                                                                                                                                |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Disable V.32 <i>bis</i>. Used for troubleshooting; 3Com Technical Support may require that you disable V.32 <i>bis</i> for testing purposes.</td></tr> <tr> <td>1</td><td>2</td><td>Disable the modem's enhanced, proprietary V.32 <i>bis</i> modulation. Used for troubleshooting.</td></tr> <tr> <td>2</td><td>4</td><td>Disable the faster retrains that occur during proprietary V.32 <i>terbo</i> modulation. Used for troubleshooting.</td></tr> <tr> <td>3</td><td>8</td><td>Enable V.23 Required for some International connections.</td></tr> </table> |         |                                                                                                                                                                                                    | Bit | Value | Function | 0 | 1 | Disable V.32 <i>bis</i> . Used for troubleshooting; 3Com Technical Support may require that you disable V.32 <i>bis</i> for testing purposes. | 1 | 2 | Disable the modem's enhanced, proprietary V.32 <i>bis</i> modulation. Used for troubleshooting. | 2 | 4 | Disable the faster retrains that occur during proprietary V.32 <i>terbo</i> modulation. Used for troubleshooting. | 3 | 8 | Enable V.23 Required for some International connections. |   |   |          |   |   |          |   |   |          |   |   |          |
| Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Value   | Function                                                                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1       | Disable V.32 <i>bis</i> . Used for troubleshooting; 3Com Technical Support may require that you disable V.32 <i>bis</i> for testing purposes.                                                      |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2       | Disable the modem's enhanced, proprietary V.32 <i>bis</i> modulation. Used for troubleshooting.                                                                                                    |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4       | Disable the faster retrains that occur during proprietary V.32 <i>terbo</i> modulation. Used for troubleshooting.                                                                                  |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 8       | Enable V.23 Required for some International connections.                                                                                                                                           |     |       |          |   |   |                                                                                                                                               |   |   |                                                                                                 |   |   |                                                                                                                   |   |   |                                                          |   |   |          |   |   |          |   |   |          |   |   |          |

(continued)

| Register   | Default | Function                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
|------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|----|-----------------------------------------------------------------------------------------------------------------------------------------------|---|----|-------------------------------------|---|----|-----------------------------------------|---|-----|-----------------------------|
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>4</td><td>16</td><td>Reserved</td></tr> <tr> <td>5</td><td>32</td><td>Enable MI/MIC (if supported).</td></tr> <tr> <td>6</td><td>64</td><td>Disable the remote access busy message.</td></tr> <tr> <td>7</td><td>128</td><td>Disable V.32 <i>terbo</i>.</td></tr> </table>                                                                                    | Bit | Value | Function | 4 | 16 | Reserved                                                                                                                                      | 5 | 32 | Enable MI/MIC (if supported).       | 6 | 64 | Disable the remote access busy message. | 7 | 128 | Disable V.32 <i>terbo</i> . |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 4          | 16      | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 5          | 32      | Enable MI/MIC (if supported).                                                                                                                                                                                                                                                                                                                                                                                                        |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 6          | 64      | Disable the remote access busy message.                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 7          | 128     | Disable V.32 <i>terbo</i> .                                                                                                                                                                                                                                                                                                                                                                                                          |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S35</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S36</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S37</b> | 0       | Unusual software compatibility.                                                                                                                                                                                                                                                                                                                                                                                                      |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S38</b> | 0       | Sets the duration, in seconds, before a forced hang-up and clearing of the Transmit buffer, when DTR drops during an ARQ call. This allows time for a remote modem to acknowledge receipt of all transmitted data. Default = 0. The modem immediately hangs up when DTR drops. If the modem is in Smart mode and receives the ATH command, it ignores S38 and immediately hangs up.                                                  |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S39</b> | 11      | Adjusts the transmitter level to provide optimal performance for most analog sources. Ranges: -9 to -20 dBm for analog line sources and -3 to -30 dBm for digital T1 line sources. A setting of -13 dBm (S39=13) is recommended for calls over digital T1 or PRI lines.                                                                                                                                                              |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S40</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S41</b> | 0       | Sets the number of allowable remote access login attempts—enabling or disabling remote access. The default setting of zero allows no remote login attempts—disabling remote access. A value of 1 or greater enables remote access. If the number of unsuccessful login attempts exceeds the limit set by this register, the modem returns online and any further login attempts during the remainder of that connection are refused. |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S42</b> | 126     | Stores the ASCII decimal code for the remote access escape character. The default character is a tilde (~).                                                                                                                                                                                                                                                                                                                          |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S43</b> | 200     | Sets the duration, in fiftieths of a second, of the guard time for the remote access (~~~~) sequence.                                                                                                                                                                                                                                                                                                                                |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S44</b> | 15      | Sets the duration, in seconds, of the delay between when the modem senses loss of carrier and when it attempts to reestablish a leased-line connection.                                                                                                                                                                                                                                                                              |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S45</b> | 0       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S46</b> | 255     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| <b>S47</b> | 0       | Bit-mapped register. Regulates aspects of a digital T1 line. Applies only to Quad Digital Modems or Quad Analog/Digital in digital mode. See also S62 and S63.                                                                                                                                                                                                                                                                       |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>No call setup procedures are followed to request a T1 dial-out or dial-in line. Assumes that dedicated (leased) DS0 is assigned to the modem.</td></tr> <tr> <td>1</td><td>2</td><td>Dialout signaling using DTMF tones.</td></tr> <tr> <td>2</td><td>4</td><td>No KP or STMF tones are transmitted.</td></tr> </table>                   | Bit | Value | Function | 0 | 1  | No call setup procedures are followed to request a T1 dial-out or dial-in line. Assumes that dedicated (leased) DS0 is assigned to the modem. | 1 | 2  | Dialout signaling using DTMF tones. | 2 | 4  | No KP or STMF tones are transmitted.    |   |     |                             |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 0          | 1       | No call setup procedures are followed to request a T1 dial-out or dial-in line. Assumes that dedicated (leased) DS0 is assigned to the modem.                                                                                                                                                                                                                                                                                        |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 1          | 2       | Dialout signaling using DTMF tones.                                                                                                                                                                                                                                                                                                                                                                                                  |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |
| 2          | 4       | No KP or STMF tones are transmitted.                                                                                                                                                                                                                                                                                                                                                                                                 |     |       |          |   |    |                                                                                                                                               |   |    |                                     |   |    |                                         |   |     |                             |

(continued)

| Register   | Default | Function                                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------|---------|----------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |         | Bit                                                | Value | Function                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 3                                                  | 8     | Disable auto-configuration of modem settings based on Feature Group B/D.                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 4                                                  | 16    | Use auto configuration based on ANI (instead of DNIS).                                                                                                                                                                                                                                                                                                                                                                   |
|            |         | 5                                                  | 32    | Force Gateway NAC routing.<br><br>Set this bit only if the Quad modem will never need to route to an RS-232 NIC.<br><br>When this bit is set, the modem directs all output to the Packet Bus. If the operational mode is not set to route calls to a gateway card (as indicated by the ATi4 screen "DTE=packet bus" status message), the Quad modem will not respond to call setup requests to or from the T1 span line. |
|            |         | 6                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 7                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | Bit-mapped register Selective modulation disable   |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |         |                                                    |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>S48</b> | 0       | Bit                                                | Value | Function                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 0                                                  | 1     | Disable 300 bps                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |         | 1                                                  | 2     | Disable 1200 bps                                                                                                                                                                                                                                                                                                                                                                                                         |
|            |         | 2                                                  | 4     | Disable 2400 bps                                                                                                                                                                                                                                                                                                                                                                                                         |
|            |         | 3                                                  | 8     | Disable high speed                                                                                                                                                                                                                                                                                                                                                                                                       |
|            |         | 4                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 5                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 6                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 7                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>S49</b> | 16      | Additional answer tone duration, 1/10 second units |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>S50</b> | 100     | Extended billing delay duration, 1/50 second units |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>S51</b> | 0       | Bit-mapped register                                |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |         |                                                    |       |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|            |         | Bit                                                | Value | Function                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 0                                                  | 1     | Disable MNP/ V.42 for V.22 (1200 bps).                                                                                                                                                                                                                                                                                                                                                                                   |
|            |         | 1                                                  | 2     | Disable MNP/ V.42 for V.22 <i>bis</i> (2400 bps).                                                                                                                                                                                                                                                                                                                                                                        |
|            |         | 2                                                  | 4     | Disable MNP/V.42 for V.32 / V.32 <i>bis</i> / V.32 <i>terbo</i> (9600/14,400/19,200/21,600 bps).                                                                                                                                                                                                                                                                                                                         |
|            |         | 3                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 4                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |
|            |         | 5                                                  | –     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                 |

(continued)

| Register   | Default | Function                                                                                                       |              |                                           |
|------------|---------|----------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------|
|            |         | <b>Bit</b>                                                                                                     | <b>Value</b> | <b>Function</b>                           |
|            |         | 6                                                                                                              | 64           | Disable Selective Reject                  |
|            |         | 7                                                                                                              | 128          | Custom applications.                      |
| <b>S52</b> | 5       | Sets the duration in seconds, of the MNP link request timeout.                                                 |              |                                           |
| <b>S53</b> | 0       | Bit-mapped register                                                                                            |              |                                           |
|            |         | <b>Bit</b>                                                                                                     | <b>Value</b> | <b>Function</b>                           |
|            |         | 0                                                                                                              | 1            | Link Security enabled.                    |
|            |         | 1                                                                                                              | 2            | Fallback prompting enabled.               |
|            |         | 2                                                                                                              | 4            | Local-access password protection enabled. |
|            |         | 3                                                                                                              | 8            | Forced prompting enabled.                 |
|            |         | 4                                                                                                              | —            | Reserved                                  |
|            |         | 5                                                                                                              | —            | Reserved                                  |
|            |         | 6                                                                                                              | —            | Reserved                                  |
|            |         | 7                                                                                                              | —            | Reserved                                  |
| <b>S54</b> | 0       | Symbol rate bit-mapped register used primarily by 3Com Technical Support for debugging purposes. Default = 64. |              |                                           |
|            |         | <b>Bit</b>                                                                                                     | <b>Value</b> | <b>Function</b>                           |
|            |         | 0                                                                                                              | 1            | Disable 2400 symbol rate.                 |
|            |         | 1                                                                                                              | 2            | Disable 2743 symbol rate.                 |
|            |         | 2                                                                                                              | 4            | Disable 2800 symbol rate.                 |
|            |         | 3                                                                                                              | 8            | Disable 3000 symbol rate.                 |
|            |         | 4                                                                                                              | 16           | Disable 3200 symbol rate.                 |
|            |         | 5                                                                                                              | 32           | Disable 3429 symbol rate.                 |
|            |         | 6                                                                                                              | 64           | Disable Call Indicate (CI).               |
|            |         | 7                                                                                                              | 128          | Disable V.8.                              |
| <b>S55</b> | 0       | Trellis code bit-mapped register used primarily by 3Com Technical Support for debugging purposes. Default = 0. |              |                                           |
|            |         | <b>Bit</b>                                                                                                     | <b>Value</b> | <b>Function</b>                           |
|            |         | 0                                                                                                              | 1            | Disable 8S-2D mapping.                    |
|            |         | 1                                                                                                              | 2            | Disable 16S-4D mapping.                   |
|            |         | 2                                                                                                              | 4            | Disable 32S-2D mapping.                   |
|            |         | 3                                                                                                              | 8            | Disable 64S-4D mapping.                   |
|            |         | 4                                                                                                              | —            | Reserved                                  |

(continued)

| Register   | Default | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
|------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|---|----------------------------|---|---|-----------------------------|---|---|-----------------------|---|---|--------------------|---|----|---------------------------------------------------------------------------------------------------------------|---|----|----------------------------------------------------------------------------------------------------|---|----|---------------|---|-----|---------------|
|            |         | <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>5</td><td>—</td><td>Reserved</td></tr> <tr> <td>6</td><td>—</td><td>Reserved</td></tr> <tr> <td>7</td><td>—</td><td>Reserved</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bit | Value | Function | 5 | — | Reserved                   | 6 | — | Reserved                    | 7 | — | Reserved              |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 5          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 6          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 7          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| <b>S56</b> | 0       | <p>Bit-mapped register primarily used by 3Com Technical Support for debugging purposes. Default = 0.</p> <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>1</td><td>Disable non-linear coding.</td></tr> <tr> <td>1</td><td>2</td><td>Disable TX level deviation.</td></tr> <tr> <td>2</td><td>4</td><td>Disable pre-emphasis.</td></tr> <tr> <td>3</td><td>8</td><td>Disable precoding.</td></tr> <tr> <td>4</td><td>16</td><td>Disable shaping.</td></tr> <tr> <td>5</td><td>32</td><td>Disable ability to connect at 31.2 Kbps and 33.6 Kbps.</td></tr> <tr> <td>6</td><td>64</td><td>Disable V.34.</td></tr> <tr> <td>7</td><td>128</td><td>Disable V.FC.</td></tr> </table>                                                    | Bit | Value | Function | 0 | 1 | Disable non-linear coding. | 1 | 2 | Disable TX level deviation. | 2 | 4 | Disable pre-emphasis. | 3 | 8 | Disable precoding. | 4 | 16 | Disable shaping.                                                                                              | 5 | 32 | Disable ability to connect at 31.2 Kbps and 33.6 Kbps.                                             | 6 | 64 | Disable V.34. | 7 | 128 | Disable V.FC. |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 0          | 1       | Disable non-linear coding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 1          | 2       | Disable TX level deviation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 2          | 4       | Disable pre-emphasis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 3          | 8       | Disable precoding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 4          | 16      | Disable shaping.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 5          | 32      | Disable ability to connect at 31.2 Kbps and 33.6 Kbps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 6          | 64      | Disable V.34.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 7          | 128     | Disable V.FC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| <b>S60</b> | 0       | When set for MNP10 Negotiation (60.0=1), the modems answer MNP10EC calls, but originate using V.34. To originate MNP10 or MNP10EC calls, set the modem with one of the S61 settings discussed below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| <b>S61</b> | 0       | <p>Sets the modem to originate MNP10 and MNP10EC calls.</p> <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>—</td><td>Reserved</td></tr> <tr> <td>1</td><td>—</td><td>Reserved</td></tr> <tr> <td>2</td><td>—</td><td>Reserved</td></tr> <tr> <td>3</td><td>—</td><td>Reserved</td></tr> <tr> <td>4</td><td>16</td><td>           Originate the call using MNP10.<br/>           S-Register 61.5 must be set to 0, other wise the modem originates MNP10EC.         </td></tr> <tr> <td>5</td><td>32</td><td>Originate the call using MNP10EC. Falls back to MNP10 if answering modem does not support MNP10EC.</td></tr> <tr> <td>6</td><td>—</td><td>Reserved</td></tr> <tr> <td>7</td><td>—</td><td>Reserved</td></tr> </table> | Bit | Value | Function | 0 | — | Reserved                   | 1 | — | Reserved                    | 2 | — | Reserved              | 3 | — | Reserved           | 4 | 16 | Originate the call using MNP10.<br>S-Register 61.5 must be set to 0, other wise the modem originates MNP10EC. | 5 | 32 | Originate the call using MNP10EC. Falls back to MNP10 if answering modem does not support MNP10EC. | 6 | —  | Reserved      | 7 | —   | Reserved      |
| Bit        | Value   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 0          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 1          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 2          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 3          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 4          | 16      | Originate the call using MNP10.<br>S-Register 61.5 must be set to 0, other wise the modem originates MNP10EC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 5          | 32      | Originate the call using MNP10EC. Falls back to MNP10 if answering modem does not support MNP10EC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 6          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| 7          | —       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |
| <b>S62</b> | 0       | When S-Register 47 is set for ANI (see S-Register 47), the number of digits programmed here indicates how many ANI digits the modem should expect for an incoming call. Maximum is 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |       |          |   |   |                            |   |   |                             |   |   |                       |   |   |                    |   |    |                                                                                                               |   |    |                                                                                                    |   |    |               |   |     |               |

(continued)



| Register                                                                                                                                                                                                                                                                                                | Default           | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------|----------|-------------------|---|-----------------------------------------------------------------------------------------|---|----------|---------------------------|----------|---|--------------------------------------------------|---|------------|----------|---|----|---------------------------------------|---|---|----------|---|---|----------|---|---|----------|
| S63                                                                                                                                                                                                                                                                                                     | 0                 | When S-Register 47 is set for DNIS (see S-Register 47), the number of digits programmed here indicates how many DNIS digits the modem should expect for an incoming call. Maximum is 12.                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| S64                                                                                                                                                                                                                                                                                                     | 0                 | Sets the ETC maximum link rate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| <table><tr><th>Setting</th><th>Maximum Link Rate</th></tr><tr><td>0</td><td>Maximum Link Rate</td></tr><tr><td>4</td><td>4800 bps</td></tr><tr><td>5</td><td>7200 bps</td></tr><tr><td>6</td><td>9600 bps</td></tr><tr><td>7</td><td>12,000 bps</td></tr><tr><td>8</td><td>14,400 bps</td></tr></table> |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Setting | Maximum Link Rate                                                                       | 0        | Maximum Link Rate | 4 | 4800 bps                                                                                | 5 | 7200 bps | 6                         | 9600 bps | 7 | 12,000 bps                                       | 8 | 14,400 bps |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| Setting                                                                                                                                                                                                                                                                                                 | Maximum Link Rate |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 0                                                                                                                                                                                                                                                                                                       | Maximum Link Rate |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 4                                                                                                                                                                                                                                                                                                       | 4800 bps          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 5                                                                                                                                                                                                                                                                                                       | 7200 bps          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 6                                                                                                                                                                                                                                                                                                       | 9600 bps          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 7                                                                                                                                                                                                                                                                                                       | 12,000 bps        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 8                                                                                                                                                                                                                                                                                                       | 14,400 bps        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| S65                                                                                                                                                                                                                                                                                                     | 0                 | Sets ETC Transmit level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| S66                                                                                                                                                                                                                                                                                                     | 0                 | Sets ETC protocol options.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| S67                                                                                                                                                                                                                                                                                                     | 0                 | Bit-mapped register Controls V.110 connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | <table><tr><th>Bit</th><th>Value</th><th>Function</th></tr><tr><td>0</td><td>1</td><td>Enable V.110 fallback while originating or answering, when Modem is set to auto detect.</td></tr><tr><td>1</td><td>2</td><td>Use a fixed network rate.</td></tr><tr><td>2</td><td>4</td><td>Fix the network rate at (1:64 Kbps; 0: 56 Kbps).</td></tr><tr><td>3</td><td>—</td><td>Reserved</td></tr><tr><td>4</td><td>—</td><td>Reserved</td></tr><tr><td>5</td><td>—</td><td>Reserved</td></tr><tr><td>6</td><td>—</td><td>Reserved</td></tr><tr><td>7</td><td>—</td><td>Reserved</td></tr></table> | Bit     | Value                                                                                   | Function | 0                 | 1 | Enable V.110 fallback while originating or answering, when Modem is set to auto detect. | 1 | 2        | Use a fixed network rate. | 2        | 4 | Fix the network rate at (1:64 Kbps; 0: 56 Kbps). | 3 | —          | Reserved | 4 | —  | Reserved                              | 5 | — | Reserved | 6 | — | Reserved | 7 | — | Reserved |
|                                                                                                                                                                                                                                                                                                         |                   | Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Value   | Function                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1       | Enable V.110 fallback while originating or answering, when Modem is set to auto detect. |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2       | Use a fixed network rate.                                                               |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4       | Fix the network rate at (1:64 Kbps; 0: 56 Kbps).                                        |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —       | Reserved                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —       | Reserved                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —       | Reserved                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 6                                                                                                                                                                                                                                                                                                       | —                 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 7                                                                                                                                                                                                                                                                                                       | —                 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| S68                                                                                                                                                                                                                                                                                                     | 0                 | Bit-mapped register. Controls digital connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | <table><tr><th>Bit</th><th>Value</th><th>Function</th></tr><tr><td>0</td><td>1</td><td>Prevent analog calls over digital data connections.</td></tr><tr><td>1</td><td>—</td><td>Reserved</td></tr><tr><td>2</td><td>—</td><td>Reserved</td></tr><tr><td>3</td><td>—</td><td>Reserved</td></tr><tr><td>4</td><td>16</td><td>Disable asynchronous/synchronous PPP.</td></tr></table>                                                                                                                                                                                                          | Bit     | Value                                                                                   | Function | 0                 | 1 | Prevent analog calls over digital data connections.                                     | 1 | —        | Reserved                  | 2        | — | Reserved                                         | 3 | —          | Reserved | 4 | 16 | Disable asynchronous/synchronous PPP. |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | Bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Value   | Function                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1       | Prevent analog calls over digital data connections.                                     |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —       | Reserved                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
|                                                                                                                                                                                                                                                                                                         |                   | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —       | Reserved                                                                                |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 3                                                                                                                                                                                                                                                                                                       | —                 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |
| 4                                                                                                                                                                                                                                                                                                       | 16                | Disable asynchronous/synchronous PPP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                                                                                         |          |                   |   |                                                                                         |   |          |                           |          |   |                                                  |   |            |          |   |    |                                       |   |   |          |   |   |          |   |   |          |

(continued)

| Register   | Default                                 | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
|------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|----------|---|---|----------|---|---|----------|---|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----------|---|---|----------|---|---|----------|---|---|----------|---|---|----------|
|            |                                         | 5      32      Disable X.75.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
|            |                                         | 6      64      Disable V.120.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
|            |                                         | 7      —      Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S71</b> | 1 - North America, Japan<br>84 - Europe | <p>Allows the idle/disconnect pattern used over the chassis TDM bus between the modem and a T1 card to be changed during call setup and teardown.</p> <p>This setting should not be changed except in situations where the modem is misinterpreting stray in-band characters as the idle/disconnect pattern, causing unexpected modem disconnects. Please consult 3Com Technical Support before changing this setting.</p> <p><b>WARNING:</b> The T1 card must be set for the same value. Do not change this value without also setting the T1 card for the same value. Requires a T1 card compatible with this feature.</p> <p>Range: 0..255</p> <p>Reserved Patterns: 0,2,3,4,5,6, 121,128, 129, 130, 133, 134, and 255</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| <b>S72</b> | 0                                       | <p>Bit-mapped S-Register sets the modem response to an ATZ (reset) command sent via gateway cards over the packet bus. Valid settings:</p> <ul style="list-style-type: none"> <li>■ n=0: Normal--modem resets and packet bus connection is broken</li> <li>■ n=1: Ignore--modem ignores the ATZ command and sends OK response</li> <li>■ n=2: Load NVRAM--modem loads settings from NVRAM, but does not reset</li> </ul> <table> <tr> <th>Bit</th><th>Value</th><th>Function</th></tr> <tr> <td>0</td><td>—</td><td>Reserved</td></tr> <tr> <td>1</td><td>—</td><td>Reserved</td></tr> <tr> <td>2</td><td>4</td><td> <p>Defines the DTMF (%T) extended support function for remote users.</p> <p>When extended support is enabled, the modem generates three beeps in one of two instances:</p> <ul style="list-style-type: none"> <li>■ Upon receipt of the %T command on the EIA-232 line</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>■ When the end user presses the pound (#) key. These beeps offer the remote user assistance with automated call-routing systems.</li> </ul> <p>n=0: Extended support disabled.</p> <p>n=1: Extended support enabled.</p> </td></tr> <tr> <td>3</td><td>—</td><td>Reserved</td></tr> <tr> <td>4</td><td>—</td><td>Reserved</td></tr> <tr> <td>5</td><td>—</td><td>Reserved</td></tr> <tr> <td>6</td><td>—</td><td>Reserved</td></tr> <tr> <td>7</td><td>—</td><td>Reserved</td></tr> </table> | Bit | Value | Function | 0 | — | Reserved | 1 | — | Reserved | 2 | 4 | <p>Defines the DTMF (%T) extended support function for remote users.</p> <p>When extended support is enabled, the modem generates three beeps in one of two instances:</p> <ul style="list-style-type: none"> <li>■ Upon receipt of the %T command on the EIA-232 line</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>■ When the end user presses the pound (#) key. These beeps offer the remote user assistance with automated call-routing systems.</li> </ul> <p>n=0: Extended support disabled.</p> <p>n=1: Extended support enabled.</p> | 3 | — | Reserved | 4 | — | Reserved | 5 | — | Reserved | 6 | — | Reserved | 7 | — | Reserved |
| Bit        | Value                                   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 0          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 1          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 2          | 4                                       | <p>Defines the DTMF (%T) extended support function for remote users.</p> <p>When extended support is enabled, the modem generates three beeps in one of two instances:</p> <ul style="list-style-type: none"> <li>■ Upon receipt of the %T command on the EIA-232 line</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>■ When the end user presses the pound (#) key. These beeps offer the remote user assistance with automated call-routing systems.</li> </ul> <p>n=0: Extended support disabled.</p> <p>n=1: Extended support enabled.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 3          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 4          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 5          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 6          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |
| 7          | —                                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |       |          |   |   |          |   |   |          |   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |   |          |   |   |          |   |   |          |   |   |          |   |   |          |

(continued)

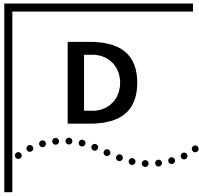
| Register | Default                                                                                                  | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
|----------|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------|---|----------------------------------------------------------------------------------------------------------|---|---------------------------------------------|---|---------------------------------------------|---|---------------------------------------------|---|---------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|---|----------------------------------------------|----|----------------------------------------------|----|----------------------------------------------|----|----------------------------------------------|----|----------------------------------------------|----|----------------------------------------------|
| S73      | 1                                                                                                        | <p>Sets the default slot for the PRI card used to initiate an outgoing call.</p> <p>When a user requests a dialout, the modem initiates an outgoing call with the default outgoing PRI card as set in the modem. If no channels are available on the default PRI card, the modem uses the first available channel on an alternate PRI card in the chassis for the outgoing call (if NMC is present).</p> <p>If the default PRI card is not available, the modem cannot initiate an outgoing PRI call when NMC is not present.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| S74      | 0                                                                                                        | <p>Controls the low-speed direction minimum speed. Low-speed direction is the V.34 back channel used during an x2 / V.90 connection; minimum speed goes in the direction from client x2 / V.90 modem to server x2 / V.90 modem.</p> <table><tr><th>Setting</th><th>Minimum Link Speed</th></tr><tr><td>0</td><td>Set no lower limit for the V.34 back channel.<br/>The modem connects at the speed set in S75 (see below).</td></tr><tr><td>1</td><td>Set the lower limit to connect at 2400 bps.</td></tr><tr><td>2</td><td>Set the lower limit to connect at 4800 bps.</td></tr><tr><td>3</td><td>Set the lower limit to connect at 7200 bps.</td></tr><tr><td>4</td><td>Set the lower limit to connect at 9600 bps.</td></tr><tr><td>5</td><td>Set the lower limit to connect at 12000 bps.</td></tr><tr><td>6</td><td>Set the lower limit to connect at 14.4 Kbps.</td></tr><tr><td>7</td><td>Set the lower limit to connect at 16.8 Kbps.</td></tr><tr><td>8</td><td>Set the lower limit to connect at 19.2 Kbps.</td></tr><tr><td>9</td><td>Set the lower limit to connect at 21.6 Kbps.</td></tr><tr><td>10</td><td>Set the lower limit to connect at 24.0 Kbps.</td></tr><tr><td>11</td><td>Set the lower limit to connect at 26.4 Kbps.</td></tr><tr><td>12</td><td>Set the lower limit to connect at 28.8 Kbps.</td></tr><tr><td>13</td><td>Set the lower limit to connect at 31.2 Kbps.</td></tr><tr><td>14</td><td>Set the lower limit to connect at 33.6 Kbps.</td></tr></table> | Setting | Minimum Link Speed | 0 | Set no lower limit for the V.34 back channel.<br>The modem connects at the speed set in S75 (see below). | 1 | Set the lower limit to connect at 2400 bps. | 2 | Set the lower limit to connect at 4800 bps. | 3 | Set the lower limit to connect at 7200 bps. | 4 | Set the lower limit to connect at 9600 bps. | 5 | Set the lower limit to connect at 12000 bps. | 6 | Set the lower limit to connect at 14.4 Kbps. | 7 | Set the lower limit to connect at 16.8 Kbps. | 8 | Set the lower limit to connect at 19.2 Kbps. | 9 | Set the lower limit to connect at 21.6 Kbps. | 10 | Set the lower limit to connect at 24.0 Kbps. | 11 | Set the lower limit to connect at 26.4 Kbps. | 12 | Set the lower limit to connect at 28.8 Kbps. | 13 | Set the lower limit to connect at 31.2 Kbps. | 14 | Set the lower limit to connect at 33.6 Kbps. |
| Setting  | Minimum Link Speed                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 0        | Set no lower limit for the V.34 back channel.<br>The modem connects at the speed set in S75 (see below). |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 1        | Set the lower limit to connect at 2400 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 2        | Set the lower limit to connect at 4800 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 3        | Set the lower limit to connect at 7200 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 4        | Set the lower limit to connect at 9600 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 5        | Set the lower limit to connect at 12000 bps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 6        | Set the lower limit to connect at 14.4 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 7        | Set the lower limit to connect at 16.8 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 8        | Set the lower limit to connect at 19.2 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 9        | Set the lower limit to connect at 21.6 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 10       | Set the lower limit to connect at 24.0 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 11       | Set the lower limit to connect at 26.4 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 12       | Set the lower limit to connect at 28.8 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 13       | Set the lower limit to connect at 31.2 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 14       | Set the lower limit to connect at 33.6 Kbps.                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| S75      |                                                                                                          | <p>Controls the low-speed direction maximum speed. Low-speed direction is the V.34 back channel used during an x2 / V.90 connection; maximum speed goes in the direction from client x2 / V.90 modem to server x2 / V.90 modem.</p> <table><tr><th>Setting</th><th>Maximum Link Speed</th></tr><tr><td>0</td><td>Set no lower limit for the V.34 back channel.<br/>The modem connects at the speed set in S74 (see above).</td></tr><tr><td>1</td><td>Set the lower limit to connect at 2400 bps.</td></tr><tr><td>2</td><td>Set the lower limit to connect at 4800 bps.</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Setting | Maximum Link Speed | 0 | Set no lower limit for the V.34 back channel.<br>The modem connects at the speed set in S74 (see above). | 1 | Set the lower limit to connect at 2400 bps. | 2 | Set the lower limit to connect at 4800 bps. |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| Setting  | Maximum Link Speed                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 0        | Set no lower limit for the V.34 back channel.<br>The modem connects at the speed set in S74 (see above). |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 1        | Set the lower limit to connect at 2400 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |
| 2        | Set the lower limit to connect at 4800 bps.                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |                    |   |                                                                                                          |   |                                             |   |                                             |   |                                             |   |                                             |   |                                              |   |                                              |   |                                              |   |                                              |   |                                              |    |                                              |    |                                              |    |                                              |    |                                              |    |                                              |

(continued)

| Register   | Default | Function                                                     |
|------------|---------|--------------------------------------------------------------|
|            |         | <b>Setting    Maximum Link Speed</b>                         |
|            |         | 3      Set the lower limit to connect at 7200 bps.           |
|            |         | 4      Set the lower limit to connect at 9600 bps.           |
|            |         | 5      Set the lower limit to connect at 12.0 Kbps.          |
|            |         | 6      Set the lower limit to connect at 14.4 Kbps.          |
|            |         | 7      Set the lower limit to connect at 16.8 Kbps.          |
|            |         | 8      Set the lower limit to connect at 19.2 Kbps.          |
|            |         | 9      Set the lower limit to connect at 21.6 Kbps.          |
|            |         | 10     Set the lower limit to connect at 24.0 Kbps.          |
|            |         | 11     Set the lower limit to connect at 26.4 Kbps.          |
|            |         | 12     Set the lower limit to connect at 28.8 Kbps.          |
|            |         | 13     Set the lower limit to connect at 31.2 Kbps.          |
|            |         | 14     Set the lower limit to connect at 33.6 Kbps.          |
| <b>S76</b> | 0       | Controls general x2 operation.                               |
|            |         | <b>Bit      Value      Function</b>                          |
|            |         | 0      1      Disable Client Mode.                           |
|            |         | 1      2      Disable Server Mode.                           |
|            |         | 2      4      Disable Symmetric Mode.                        |
|            |         | 3      8      Reserved                                       |
|            |         | 4      16     Force Robbed-bit Signaling Operation.          |
|            |         | 5      32     Disable non-linear encoding.                   |
|            |         | 6      64     Disable reduced constellation.                 |
|            |         | 7      128    Disable reduced transmit power.                |
|            |         |                                                              |
| <b>S77</b> |         | Controlling the Low-Speed Channel of Asymmetric Connections. |
|            |         | <b>Bit      Value      Function</b>                          |
|            |         | 0      1      Disable 2743 symbol rate.                      |
|            |         | 1      2      Disable 2800 symbol rate.                      |
|            |         | 2      4      Disable 3429 symbol rate.                      |
|            |         | 3      8      Disable Low carrier 3000.                      |
|            |         | 4      16     Disable High carrier 3000.                     |
|            |         | 5      32     Disable Low carrier 3200.                      |
|            |         | 6      64     Disable High carrier 3200.                     |

(continued)

| Register   | Default | Function                                                                                                                                                                                                                                                                                                                       |              |                                                                        |
|------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------|
| <b>S81</b> | 0       | <b>Bit</b>                                                                                                                                                                                                                                                                                                                     | <b>Value</b> | <b>Function</b>                                                        |
|            |         | 7                                                                                                                                                                                                                                                                                                                              | 128          | Disable 3429 remote transmitter symbol rate.                           |
|            |         | Bit-mapped S-Register Designates where to apply the V.90 transmit power limit and enables or disables the digital interface.                                                                                                                                                                                                   |              |                                                                        |
|            |         | The output of the server modem or to the input of the far-end CODEC.                                                                                                                                                                                                                                                           |              |                                                                        |
|            |         | <b>Bit</b>                                                                                                                                                                                                                                                                                                                     | <b>Value</b> | <b>Function</b>                                                        |
|            |         | 0                                                                                                                                                                                                                                                                                                                              | 1            | Apply the V.90 transmit power limit to the input of the far-end CODEC. |
|            |         | 1                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
|            |         | 2                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
|            |         | 3                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
|            |         | 4                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
|            |         | 5                                                                                                                                                                                                                                                                                                                              | 32           | Enable V.90 modulation.                                                |
|            |         | 6                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
|            |         | 7                                                                                                                                                                                                                                                                                                                              | —            | Reserved                                                               |
| <b>S82</b> | 12      | Sets the server's transmit power limit. The value of this register is interpreted as negative dBm. The default is set according to the country code in the modem as follows:                                                                                                                                                   |              |                                                                        |
|            |         | <ul style="list-style-type: none"> <li>■ 6 --Default for Quad Modems with the country code set to either France, the U.K., or Africa)</li> <li>■ 12 --Default for Quad Modems with the country code set to USA or other small countries</li> <li>■ 15 -- Default for Quad Modems with the country code set to Japan</li> </ul> |              |                                                                        |



# AT COMMANDS

**Basic Command Set**    The following table provides the Basic AT Command Set:

| Command | Function                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------|
| AT\$    | Displays Basic Command Set help.                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| AT&\$   | Displays Ampersand Command Set help.                                                                                                                                                                                                                                                                                                                                                                                                                   |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| AT%\$   | Displays Percent Command Set help.                                                                                                                                                                                                                                                                                                                                                                                                                     |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| ATD\$   | Displays Dial Command Set help.                                                                                                                                                                                                                                                                                                                                                                                                                        |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| ATS\$   | Displays S-Register Set help.                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| AT*\$   | Displays Asterisk Command Set help.                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| A/      | Repeat last command. Do not type AT or press Enter.                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| A>      | Repeat last command continuously until canceled by pressing any key. Do not type AT or press Enter.                                                                                                                                                                                                                                                                                                                                                    |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| AT      | Command Mode prefix: informs a modem that a command is coming. AT must precede all commands except A/, A>, and +++.                                                                                                                                                                                                                                                                                                                                    |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| ATA     | Force a modem to answer when it is not receiving an incoming call.                                                                                                                                                                                                                                                                                                                                                                                     |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| ATBn    | Set handshaking options. <table><tr><td>n = 0</td><td>ITU-T V.25 answer sequence; required to answer all V.34-type and overseas calls.</td></tr><tr><td>n = 1</td><td>Bell answer tone. This setting selects HST modulation, but use it only if the modem is not required to answer V.34-type calls.</td></tr><tr><td>n = 2</td><td>Sets the modem to connect only with remote Bell 208B modems using the Bell 208B answer Sequence.</td></tr></table> | n = 0 | ITU-T V.25 answer sequence; required to answer all V.34-type and overseas calls. | n = 1 | Bell answer tone. This setting selects HST modulation, but use it only if the modem is not required to answer V.34-type calls. | n = 2 | Sets the modem to connect only with remote Bell 208B modems using the Bell 208B answer Sequence. |
| n = 0   | ITU-T V.25 answer sequence; required to answer all V.34-type and overseas calls.                                                                                                                                                                                                                                                                                                                                                                       |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| n = 1   | Bell answer tone. This setting selects HST modulation, but use it only if the modem is not required to answer V.34-type calls.                                                                                                                                                                                                                                                                                                                         |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| n = 2   | Sets the modem to connect only with remote Bell 208B modems using the Bell 208B answer Sequence.                                                                                                                                                                                                                                                                                                                                                       |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| ATCn    | Enable or disable the transmitter. <table><tr><td>n = 0</td><td>Transmitter disabled for receive only.</td></tr><tr><td>n = 1</td><td>Transmitter enabled.</td></tr></table>                                                                                                                                                                                                                                                                           | n = 0 | Transmitter disabled for receive only.                                           | n = 1 | Transmitter enabled.                                                                                                           |       |                                                                                                  |
| n = 0   | Transmitter disabled for receive only.                                                                                                                                                                                                                                                                                                                                                                                                                 |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |
| n = 1   | Transmitter enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |                                                                                  |       |                                                                                                                                |       |                                                                                                  |

(continued)

| Command   | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------------|-------|-----------------------------------------------------|---|---------------|---|------------------------------------------------------------------------------|---|------------------------------------------------------------------|---|---------------------------------------------------|---|---------------|---|--------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------|---|---------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------|----|---------------------------------|---|------------------------------|----|-----------------------------------------------------------------------------------------------------------------|
| ATDn      | <p>Dial a phone number and issue other optional commands.</p> <p>The numbers 0-9 are accepted. The maximum number of characters allowed is 36, including the AT prefix, punctuation, and spaces.</p> <p>The following optional parameters are available:</p> <table> <tr> <th>Parameter</th><th>Function</th></tr> <tr> <td>P</td><td>Pulse Dialing.</td></tr> <tr> <td>T</td><td>Tone Dialing.</td></tr> <tr> <td>.</td><td>(Period) Send inband DTMF tones after a connection to an analog destination.</td></tr> <tr> <td>,</td><td>(Comma) Pause for two seconds (or the time set in S-Register 8).</td></tr> <tr> <td>;</td><td>(Semicolon) Remain in Command Mode after dialing.</td></tr> <tr> <td>"</td><td>Dial Letters.</td></tr> <tr> <td>W</td><td>Wait for a second dial tone before continuing dialing (with X3 or higher). Accepted but ignored.</td></tr> <tr> <td>@</td><td>Wait for an answer (with X3, X4, or X7). Accepted but ignored.</td></tr> <tr> <td>/</td><td>Pause for 125 milliseconds. Accepted but ignored.</td></tr> <tr> <td>R</td><td>Reverse frequencies. Use this command when calling an originate-only modem. It forces the modem to dial out at the answer frequency.</td></tr> <tr> <td>L?</td><td>Display the last-dialed number.</td></tr> <tr> <td>L</td><td>Dial the last-dialed number.</td></tr> <tr> <td>Sn</td><td>Dial the number stored in memory at position n, where n = 0-9. Store the number in memory using the &amp;Z command.</td></tr> </table> | Parameter | Function                                                    | P     | Pulse Dialing.                                      | T | Tone Dialing. | . | (Period) Send inband DTMF tones after a connection to an analog destination. | , | (Comma) Pause for two seconds (or the time set in S-Register 8). | ; | (Semicolon) Remain in Command Mode after dialing. | " | Dial Letters. | W | Wait for a second dial tone before continuing dialing (with X3 or higher). Accepted but ignored. | @ | Wait for an answer (with X3, X4, or X7). Accepted but ignored. | / | Pause for 125 milliseconds. Accepted but ignored. | R | Reverse frequencies. Use this command when calling an originate-only modem. It forces the modem to dial out at the answer frequency. | L? | Display the last-dialed number. | L | Dial the last-dialed number. | Sn | Dial the number stored in memory at position n, where n = 0-9. Store the number in memory using the &Z command. |
| Parameter | Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| P         | Pulse Dialing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| T         | Tone Dialing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| .         | (Period) Send inband DTMF tones after a connection to an analog destination.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| ,         | (Comma) Pause for two seconds (or the time set in S-Register 8).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| ;         | (Semicolon) Remain in Command Mode after dialing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| "         | Dial Letters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| W         | Wait for a second dial tone before continuing dialing (with X3 or higher). Accepted but ignored.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| @         | Wait for an answer (with X3, X4, or X7). Accepted but ignored.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| /         | Pause for 125 milliseconds. Accepted but ignored.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| R         | Reverse frequencies. Use this command when calling an originate-only modem. It forces the modem to dial out at the answer frequency.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| L?        | Display the last-dialed number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| L         | Dial the last-dialed number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| Sn        | Dial the number stored in memory at position n, where n = 0-9. Store the number in memory using the &Z command.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| ATEn      | <p>Command Mode Echo Enables or Disables the display of typed commands. If double characters appear on the screen, both the modem's local echo and the software's local echo are on.</p> <table> <tr> <td>n = 0</td><td>Command Mode Echo Off, characters do not display on screen.</td></tr> <tr> <td>n = 1</td><td>Command Mode Echo On, characters display on screen.</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | n = 0     | Command Mode Echo Off, characters do not display on screen. | n = 1 | Command Mode Echo On, characters display on screen. |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 0     | Command Mode Echo Off, characters do not display on screen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 1     | Command Mode Echo On, characters display on screen.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| ATFn      | <p>Online Local Echo If On, the Quad modem displays the data that it is transmitting to another modem.</p> <table> <tr> <td>n = 0</td><td>Online echo On (Sometimes called half duplex.).</td></tr> <tr> <td>n = 1</td><td>Online echo Off (Sometimes called full duplex.).</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | n = 0     | Online echo On (Sometimes called half duplex.).             | n = 1 | Online echo Off (Sometimes called full duplex.).    |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 0     | Online echo On (Sometimes called half duplex.).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 1     | Online echo Off (Sometimes called full duplex.).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| ATHn      | <p>Go On or Off hook.</p> <table> <tr> <td>n = 0</td><td>Go On hook (hang up).</td></tr> <tr> <td>n = 1</td><td>Go Off Hook (answer).</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | n = 0     | Go On hook (hang up).                                       | n = 1 | Go Off Hook (answer).                               |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 0     | Go On hook (hang up).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |
| n = 1     | Go Off Hook (answer).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |                                                             |       |                                                     |   |               |   |                                                                              |   |                                                                  |   |                                                   |   |               |   |                                                                                                  |   |                                                                |   |                                                   |   |                                                                                                                                      |    |                                 |   |                              |    |                                                                                                                 |

(continued)

| Command | Function                                                                                  |
|---------|-------------------------------------------------------------------------------------------|
| ATIn    | Query Commands                                                                            |
| n = 0   | Display the four-digit product code.                                                      |
| n = 1   | Display results of ROM checksum test (factory test).                                      |
| n = 2   | Display results of RAM test.                                                              |
| n = 3   | Displays the banner (product name).                                                       |
| n = 4   | Display current modem settings.                                                           |
| n = 5   | Displays NVRAM Settings.                                                                  |
| n = 6   | Displays Link diagnostics.                                                                |
| n = 7   | Display product configuration.                                                            |
| n = 8   | Reserved                                                                                  |
| n = 9   | Display Standard Feature Group B settings.                                                |
| n = 10  | Display Dial Security account status information.                                         |
| n = 11  | Display connection report (contains symbol rates).                                        |
| n = 12  | Reserved                                                                                  |
| n = 13  | Displays MNP 10 diagnostics.                                                              |
| n = 14  | Displays ETC diagnostic.                                                                  |
| n = 15  | Displays Remote modem management information.                                             |
| ATY15   | Displays current DIP Switch settings.                                                     |
| ATKn    | Control the modem clock. ATi6 displays the time.                                          |
| n = 0   | Call Duration Mode .                                                                      |
| n = 1   | Real Time Clock Mode Set the Real Time Clock using: ATi3=HH:MM:SS K1.                     |
| ATOn    | Return online. Use with the escape code (+++) to toggle between command and online modes. |
| n = 0   | Return online (normal).                                                                   |
| n = 1   | Return online and retrain. Use O1 if there were errors in a non-ARQ data transfer.        |
| n = 2   | Return online and speed shift.                                                            |
| ATQn    | Enable or disable Result Code Display.                                                    |
| n = 0   | Display Result Codes.                                                                     |
| n = 1   | Suppress Result Codes (quiet).                                                            |
| n = 2   | Suppress Result Codes when answering.                                                     |
| ATSr=n  | Set S-Register value: r is any S-Register; n must be a decimal number between 0 and 255.  |
| ATSr?   | Query contents of S-register r.                                                           |

(continued)



| Command | Function                                                                                                                                                                                                                   |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ATVn    | Display Result Codes in words or numbers.                                                                                                                                                                                  |
|         | n = 0          Display Result Codes in numeric form.                                                                                                                                                                       |
|         | n = 1          Display Result Codes in verbal form.                                                                                                                                                                        |
| ATXn    | Control the amount of information displayed in the result codes. The default is X7 (all codes except 12/VOICE).                                                                                                            |
|         | n = 0          Basic Result Codes.                                                                                                                                                                                         |
|         | n = 1          Extended Result Codes.                                                                                                                                                                                      |
|         | n = 2-7       Advanced Result Codes.                                                                                                                                                                                       |
| ATZ     | Software reset. If DIP Switch 1 is ON (factory setting), revert to the settings in NVRAM. If DIP switch 1 is OFF, reset to the &F0 configuration template (no flow control).                                               |
| Z!      | Hardware reset (equivalent to powering off and then back on). If DIP Switch 1 is ON (factory setting), revert to the settings in NVRAM. If DIP switch 1 is OFF, reset to the &F0 configuration template (no flow control). |
| +++     | Escape Code                                                                                                                                                                                                                |

Ampersand Command Set

The following table includes the Ampersand AT Command Set:

| Command | Function                                                                                                                                                                                     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&\$   | Displays Ampersand Command Set help.                                                                                                                                                         |
| AT&An   | Enable or disable the display of additional Result Code subsets. (Also, see the Xn command.)                                                                                                 |
|         | n = 0          Do not display ARQ Result Codes.                                                                                                                                              |
|         | n = 1          Display ARQ Result Codes.                                                                                                                                                     |
|         | n = 2          In addition to ARQ Result Codes, display HST, V.32, V.FC, V.34, or DIGITAL modulation indicator.                                                                              |
|         | n = 3          In addition to ARQ and modulation indicators, display an error control indicator (LAPM, HST, MNP, SYNC, V.120, or NONE) and a data compression type (V42 <i>bis</i> or MNP5). |
| AT&Bn   | Set the DTE serial port rate to variable or fixed.                                                                                                                                           |
|         | n = 0          Variable: The serial port rate adapts to match the speed of the connection.                                                                                                   |
|         | n = 1          Fixed: The modem always communicates with your computer at the rate at which you have set, regardless of the connection rate.                                                 |
|         | n = 2          When answering calls, use the fixed rate for ARQ calls and variable rates for non-ARQ calls.                                                                                  |

(continued)

| Command | Function                                                                                                                               |
|---------|----------------------------------------------------------------------------------------------------------------------------------------|
| AT&Cn   | Control how the modem sends a CD signal to your computer.                                                                              |
|         | n = 0      CD always On, even if the modem is not on-line.                                                                             |
|         | n = 1      Normal operations. The modem sends a CD signal when it connects with another modem and drops the CD when it disconnects.    |
| AT&Dn   | Control how the modem responds to DTR signals.                                                                                         |
|         | n = 0      DTR is always On (ignored).                                                                                                 |
|         | n = 1      Online Command Mode.                                                                                                        |
|         | n = 2      Normal DTR operations (DTE controls DTR).                                                                                   |
| AT&Fn   | Loads Configuration Templates .                                                                                                        |
|         | n = 0      Load No Flow Control template settings.                                                                                     |
|         | n = 1      Load Hardware Flow Control template settings.                                                                               |
|         | n = 2      Load Software Flow Control template settings.                                                                               |
|         | n = 3      HST/Cellular with Hardware Flow Configuration.                                                                              |
|         | n = 4      MNP 10 Configuration .                                                                                                      |
|         | n = 5      ETC Mobile Configuration.                                                                                                   |
|         | n = 6      ETC Fixed Site Configuration.                                                                                               |
| AT&Gn   | Load with NVRAM Configuration.                                                                                                         |
|         | Sets Guard Tones for international calls.                                                                                              |
|         | n = 0      No guard tone Use this in the United States and Canada.                                                                     |
|         | n = 1      Sets a 550 Hz Guard Tone, used in some European countries.                                                                  |
| AT&Hn   | n = 2      Sets an 1800 Hz guard tone, used in the U.K. and some Commonwealth countries<br>AT&G2 requires the ATB0 setting.            |
|         | Transmit Data Flow Control Prevents the modem's buffer overflow.                                                                       |
|         | n = 0      Disable Transmit Data Flow Control.                                                                                         |
|         | n = 1      Use Hardware Flow Control Requires that your computer and software support Clear to Send (CTS) at the EIA RS-232 interface. |
|         | n = 2      Use Software Flow Control. Requires that your software support XOn/XOff signaling.                                          |
|         | n = 3      Use both Hardware and Software Flow Control. If you are unsure about what your equipment supports, select this option.      |

(continued)

| Command | Function                                                                                                                                                                                                                                                                                                                                         |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&In   | Received Data Software Flow (XOn/XOff) Control.                                                                                                                                                                                                                                                                                                  |
|         | n = 0      Disables XON/XOFF flow control of received data.                                                                                                                                                                                                                                                                                      |
|         | n = 1      The modem acts on your typed XOn/XOff commands, Ctrl-S or Ctrl-Q, and passes them to the remote device.                                                                                                                                                                                                                               |
|         | n = 2      The modem acts on your XOn/XOff commands, but removes them from the data stream instead of passing them to the remote device. This is the recommended setting for ARQ mode.                                                                                                                                                           |
|         | n = 3      Hewlett Packard-Host mode. Applies only to modems attached to an HP mainframe that uses the ENQ/ACK protocol. Use in ARQ mode only.                                                                                                                                                                                                   |
|         | n = 4      Hewlett Packard-Terminal mode. Applies only to modems attached to terminals in an HP system that uses the ENQ/ACK protocol. Use in ARQ mode only.                                                                                                                                                                                     |
|         | n = 5      This setting is designed to enable flow control on the phone link when the connection is not under error control. For this to work, the remote device must have &I5 capability.                                                                                                                                                       |
| AT&Kn   | Enable or disable Data Compression.                                                                                                                                                                                                                                                                                                              |
|         | n = 0      Disable Data Compression.                                                                                                                                                                                                                                                                                                             |
|         | n = 1      Use auto-enable/disable. The modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0) because compression offers no throughput advantage when the serial port and connection rates are equal; in fact, compression may degrade throughput. |
|         | n = 2      Enable Data Compression.                                                                                                                                                                                                                                                                                                              |
|         | n = 3      Selective Data Compression The modem negotiates only for V.42 <i>bis</i> compression, and disables MNP Level 5 (MNP5) compression. Use this setting to transfer compressed files.                                                                                                                                                     |
| AT&Ln   | Set Cellular and Leased Lines.                                                                                                                                                                                                                                                                                                                   |
|         | n = 0      Disable Leased Lines.                                                                                                                                                                                                                                                                                                                 |
|         | n = 1      Enable Leased Lines.                                                                                                                                                                                                                                                                                                                  |
|         | n = 2      Enable Cellular.                                                                                                                                                                                                                                                                                                                      |
| AT&Mn   | Enable ARQ (error control) or synchronous protocols.                                                                                                                                                                                                                                                                                             |
|         | n = 0      Normal mode, no error control. Due to the nature of phone line channels, this is never recommended for calls above 2400 bps.                                                                                                                                                                                                          |
|         | n = 1      Use for online synchronous mode without V.25 <i>bis</i> . This setting is exclusive of the modems' error control.                                                                                                                                                                                                                     |
|         | n = 4      Normal/ARQ mode. If an ARQ connection isn't made, the modem operates in Normal mode as though it were set to &M0.                                                                                                                                                                                                                     |
|         | n = 5      ARQ asynchronous mode. The modem hangs up if an ARQ connection cannot be made.                                                                                                                                                                                                                                                        |

(continued)

| Command | Function                                                                                                                                                       |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | n = 6 V.25 <i>bis</i> synchronous mode using a character-oriented link protocol similar to BISYNC.                                                             |
|         | n = 7 V.25 <i>bis</i> synchronous mode using the HDLC link protocol.                                                                                           |
| AT&Nn   | Connection rate variable or fixed (analog connections only).                                                                                                   |
|         | n = 0 Variable rate. The modem negotiates with the remote device for the highest possible connection rate, depending on the capabilities of the remote device. |
|         | n = 1 300 bps                                                                                                                                                  |
|         | n = 2 1200 bps                                                                                                                                                 |
|         | n = 3 2400 bps                                                                                                                                                 |
|         | n = 4 4800 bps                                                                                                                                                 |
|         | n = 5 7200 bps                                                                                                                                                 |
|         | n = 6 9600 bps                                                                                                                                                 |
|         | n = 7 12.0 Kbps                                                                                                                                                |
|         | n = 8 14.4 Kbps                                                                                                                                                |
|         | n = 9 16.8 Kbps                                                                                                                                                |
|         | n = 10 19.2 Kbps                                                                                                                                               |
|         | n = 11 21.6 Kbps                                                                                                                                               |
|         | n = 12 24.0 Kbps                                                                                                                                               |
|         | n = 13 26.4 Kbps                                                                                                                                               |
|         | n = 14 28.8 Kbps                                                                                                                                               |
|         | n = 15 31.2 Kbps                                                                                                                                               |
|         | n = 16 33.6 Kbps                                                                                                                                               |
|         | n = 17 28.0 Kbps                                                                                                                                               |
|         | n = 18 29333 bps                                                                                                                                               |
|         | n = 19 30666 bps                                                                                                                                               |
|         | n = 20 32.0 Kbps                                                                                                                                               |
|         | n = 21 33333 bps                                                                                                                                               |
|         | n = 22 34666 bps                                                                                                                                               |
|         | n = 23 36.0 Kbps                                                                                                                                               |
|         | n = 24 37333 bps                                                                                                                                               |
|         | n = 25 38666 bps                                                                                                                                               |
|         | n = 26 40.0 Kbps                                                                                                                                               |
|         | n = 27 41333 bps                                                                                                                                               |

(continued)

| Command | Function                                                                                                                            |
|---------|-------------------------------------------------------------------------------------------------------------------------------------|
|         | n = 28      42666 bps                                                                                                               |
|         | n = 29      44.0 Kbps                                                                                                               |
|         | n = 30      45333 bps                                                                                                               |
|         | n = 31      46666 bps                                                                                                               |
|         | n = 32      48.0 Kbps                                                                                                               |
|         | n = 33      49333 bps                                                                                                               |
|         | n = 34      50666 bps                                                                                                               |
|         | n = 35      52.0 Kbps                                                                                                               |
|         | n = 36      53333 bps                                                                                                               |
|         | n = 37      54666 bps                                                                                                               |
|         | n = 38      56.0 Kbps                                                                                                               |
|         | n = 39      57333 bps                                                                                                               |
|         | n = 40      58666 bps                                                                                                               |
|         | n = 41      60.0 Kbps                                                                                                               |
|         | n = 42      61333 bps                                                                                                               |
|         | n = 43      62666 bps                                                                                                               |
|         | n = 44      64.0 Kbps                                                                                                               |
| AT&Pn   | Sets the Pulse Dial.                                                                                                                |
|         | n = 0      North American Pulse Dial.                                                                                               |
|         | n = 1      UK Pulse Dial.                                                                                                           |
| AT&Rn   | Received data (RTS) Hardware Flow Control.                                                                                          |
|         | n = 0      Delay Clear to Send (CTS) response after Request to Send (RTS).                                                          |
|         | n = 1      Ignore RTS. This setting is required if your computer or terminal or software does not support RTS.                      |
|         | n = 2      Enable hardware flow control of received data. The modem sends data to the computer only upon receipt of the RTS signal. |
| AT&Sn   | Send DSR signal via the EIA RS-232 interface.                                                                                       |
|         | n = 0      DSR is always On.                                                                                                        |
|         | n = 1      Modem Controls DSR.                                                                                                      |
|         | n = 2      Pulse DSR, CTS=CD.                                                                                                       |
|         | n = 3      Pulse DSR.                                                                                                               |
|         | n = 4      DSR = CD.                                                                                                                |
|         | &S5      Send DSR normally, and follow CTS with CD.                                                                                 |

(continued)

| Command | Function                                                                                                                                                                                                                                                                                                                        |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT&Tn   | Test the modem.                                                                                                                                                                                                                                                                                                                 |
| n = 0   | End test.                                                                                                                                                                                                                                                                                                                       |
| n = 1   | Analog Loopback (ALB).                                                                                                                                                                                                                                                                                                          |
| n = 3   | Digital Loopback (DLB).                                                                                                                                                                                                                                                                                                         |
| n = 4   | Grant Remote DLB.                                                                                                                                                                                                                                                                                                               |
| n = 5   | Deny Remote DLB.                                                                                                                                                                                                                                                                                                                |
| n = 6   | Remote Digital Loopback.                                                                                                                                                                                                                                                                                                        |
| n = 7   | Remote DLB with Self Test.                                                                                                                                                                                                                                                                                                      |
| n = 8   | ALB with Self Test.                                                                                                                                                                                                                                                                                                             |
| AT&U    | Sets the minimum link speed (See AT&N for possible values).                                                                                                                                                                                                                                                                     |
| AT&W    | Saves configuration changes to the NVRAM.                                                                                                                                                                                                                                                                                       |
| AT&Xn   | Sets Synchronous Clock Source.                                                                                                                                                                                                                                                                                                  |
| n = 0   | DCE Synchronous clock.                                                                                                                                                                                                                                                                                                          |
| n = 1   | DTE Synchronous clock.                                                                                                                                                                                                                                                                                                          |
| n = 2   | Receive Transmit is Synchronous clock.                                                                                                                                                                                                                                                                                          |
| AT&Yn   | Break handling This command lets you send a break to stop data transfer without disconnecting. If the call is under MNP5 data compression, destructive breaks cause both modems to reset their data compression tables. When transmission resumes, the modems build new tables, and the result is lower-than-normal throughput. |
| n = 0   | Destructive, do not send break.                                                                                                                                                                                                                                                                                                 |
| n = 1   | Destructive, expedited.                                                                                                                                                                                                                                                                                                         |
| n = 2   | Nondestructive, expedited.                                                                                                                                                                                                                                                                                                      |
| n = 3   | Nondestructive, unexpedited; the modem sends a break-in-sequence with data received from your computer or terminal.                                                                                                                                                                                                             |
| AT&Zn=s | Store up to 10 numbers in NVRAM, where <b>n</b> is the position 0-9 in NVRAM, and <b>s</b> is the phone number string. The &Zn=s command functions differently when Dial Security is enabled.                                                                                                                                   |
| AT&Zn=L | Store last phone number in position <b>n</b> on NVRAM.                                                                                                                                                                                                                                                                          |
| AT&Zn?  | Display stored phone number in position <b>n</b> .                                                                                                                                                                                                                                                                              |

Percent Command Set

The following table includes the Percent AT Command Set:

| Command | Function                                                                                                                                                                                        |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT%\$   | Display the help panels for the percent (%) command set.                                                                                                                                        |
| AT%An   | Security Account Information Structure.                                                                                                                                                         |
| AT%An   | = PW, ACCT E, DIAL B, NEW#, PH#                                                                                                                                                                 |
| AT%Bn   | Remotely configure a modem's serial port rate.                                                                                                                                                  |
|         | n = 0                      110 bps                                                                                                                                                              |
|         | n = 1                      300 bps                                                                                                                                                              |
|         | n = 2                      600 bps                                                                                                                                                              |
|         | n = 3                      1200 bps                                                                                                                                                             |
|         | n = 4                      2400 bps                                                                                                                                                             |
|         | n = 5                      4800 bps                                                                                                                                                             |
|         | n = 6                      9600 bps                                                                                                                                                             |
|         | n = 7                      19.2 Kbps                                                                                                                                                            |
|         | n = 8                      38.4 Kbps                                                                                                                                                            |
|         | n = 9                      57.6 Kbps                                                                                                                                                            |
|         | n = 10                    115.2 Kbps                                                                                                                                                            |
| AT%Cn   | Remote configuration control.                                                                                                                                                                   |
|         | n = 0                      Defer configuration changes until the call is ended. Changes take effect for ensuing connections.                                                                    |
|         | n = 1                      Cancel configuration changes and restore the original configuration.<br>Using%C1 will not reverse any changes that you wrote to NVRAM (with &W) or forced (with%C2). |
|         | n = 2                      Force configuration changes to take effect immediately.                                                                                                              |
| AT%Dn   | Line Interface Options.                                                                                                                                                                         |
|         | n = 0                      Standard Analog (POTS).                                                                                                                                              |
|         | n = 1                      T1 Mode (DSO).                                                                                                                                                       |
|         | n = 2                      ISDN PRI Mode.                                                                                                                                                       |

(continued)

| Command  | Function                                                                                            |
|----------|-----------------------------------------------------------------------------------------------------|
| AT%E=n   | Erase security settings.                                                                            |
| n = 1    | Erase local-access password.                                                                        |
| n = 2    | Erase Autopass password.                                                                            |
| n = 3    | Erase passwords in accounts 0-9.                                                                    |
| n = 4    | Erase phone numbers in accounts 0-9.                                                                |
| n = 5    | Disable Account, Dialback, and New Number fields in accounts 0-9.                                   |
| AT%Fn    | Remotely configure another device's data format.                                                    |
| n = 0    | No parity, 8 data bits.                                                                             |
| n = 1    | Mark parity, 7 data bits.                                                                           |
| n = 2    | Odd parity, 7 data bits.                                                                            |
| n = 3    | Even parity, 7 data bits.                                                                           |
| AT%L=    | Set a local-access password.                                                                        |
| AT%Nn    | Set the V.25 <i>bis</i> Synchronous Clock Rate.                                                     |
| n = 0    | Reserved                                                                                            |
| n = 1    | Reserved                                                                                            |
| n = 2    | 1200 bps                                                                                            |
| n = 3    | 2400 bps                                                                                            |
| n = 4    | 4800 bps                                                                                            |
| n = 5    | 7200 bps                                                                                            |
| n = 6    | 9600 bps                                                                                            |
| n = 7    | 12000 bps                                                                                           |
| n = 8    | 14400 bps                                                                                           |
| n = 9    | 16800 bps                                                                                           |
| n = 10   | 19200 bps                                                                                           |
| AT%Pn=s  | Store Remote Access Password.                                                                       |
| n = 0    | Query Access only.                                                                                  |
| n = 1    | Full configuration.                                                                                 |
| AT%Pn?   | Query Remote Access Password.                                                                       |
| n = 0    | Query Access only.                                                                                  |
| n = 1    | Full configuration.                                                                                 |
| AT%S=    | Set password to grant Local Access.                                                                 |
| AT%T     | Touch Tone Recognition.                                                                             |
| AT%V=PWn | Assign the password in account <b>n</b> in your modem's security account as your Autopass password. |



Asterisk Command Set

The following table includes the Asterisk AT Command Set:

| Command | Function                                                                                                                                                                                                                                                                                                                                                                                       |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AT*\$   | Displays the help for the asterisk (*) command set.                                                                                                                                                                                                                                                                                                                                            |
| AT*U1n  | Originate Mode HDLC Protocol Selection. <div><div>n = 0</div><div>None</div><div>n = 1</div><div>V.120</div><div>n = 2</div><div>X.75</div><div>n = 3</div><div>Async-to-Sync PPP</div></div>                                                                                                                                                                                                  |
| AT*U2n  | Originate Mode Non-HDLC Protocol Selection. <div><div>n = 0</div><div>None</div><div>n = 1</div><div>V.110</div></div>                                                                                                                                                                                                                                                                         |
| AT*U3n  | Originate Mode Analog Modem/Fax Selection. <div><div>n = 0</div><div>None</div><div>n = 1</div><div>Analog Modem/Fax</div></div>                                                                                                                                                                                                                                                               |
| AT*V2n  | Originate / Answer Mode Protocol Selection. <div><div>n = 0</div><div>Auto Detect</div><div>n = 1</div><div>V.120 Rate Adaptation only</div><div>n = 2</div><div>V.110 Rate Adaptation only</div><div>n = 3</div><div>Modem / Fax Emulation only</div><div>n = 4</div><div>Clear Channel only</div><div>n = 5</div><div>Async-to-Sync PPP only</div><div>n = 6</div><div>x.75 only</div></div> |
| AT*X0n  | Frame Size in bytes. <div><div>n = 1</div><div>Minimum</div><div>n = 2048</div><div>Maximum</div></div>                                                                                                                                                                                                                                                                                        |
| AT*X1n  | X.75 Window size in frames. <div><div>n = 1</div><div>Minimum</div><div>n = 7</div><div>Maximum</div></div>                                                                                                                                                                                                                                                                                    |

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