

*Modem Reference Manual
for the
Telebit T3000 and WorldBlazer
Family of Products*

90238-01

 **TELEBIT**[®]
When connectivity counts.

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for the
Telebit T3000 and WorldBlazer
Family of Products

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How to Use This Manual

About This Manual

This manual is a reference guide for using any of the Telebit T3000 and WorldBlazer modems. It is designed for both new and experienced modem users.

To help you install and configure the modem, refer to the *User's Guide* for your particular modem. It is a separate booklet provided with your modem. If you have special requirements or experience any problems while using your *User's Guide*, refer to this manual for additional information.

Note: *Read your User's Guide before reading this reference manual. Whether you are a first-time or experienced user, install your modem using the instructions in your User's Guide.*

This manual contains six chapters and four appendices:

- Chapter 1, Introduction, describes the main features of the modem.
- Chapter 2, Modem Operation and Special Features, describes command mode operations, flow control, RS-232 control signal interpretations, error control, data compression, protocol support, and synchronous support.
- Chapter 3, AT Command Descriptions, describes the commands and explains the possible parameters, the range of parameters, and the default settings.

- Chapter 4, S Register Descriptions, describes the registers used to operate the modem and explains the possible parameters, the range of parameters, and the default settings.
- Chapter 5, Troubleshooting, describes the diagnostic tests performed by the modem after it is powered up. It includes user assurance test procedures with troubleshooting guidelines to assist you if you encounter problems installing and using your modem.
- Chapter 6, Warranty and Repair Procedures, discusses Telebit's policies regarding warranty and repair procedures.
- Appendix A, ASCII Code Chart, defines the ASCII code characters in decimal and hexadecimal equivalents.
- Appendix B, Result Codes, describes the result messages that indicate modem status.
- Appendix C, Prestored Configurations, describes the configurations already stored in the modem to meet most user application needs.
- Appendix D, V.25bis Operation, describes the modem's V.25bis operation.

A glossary and index are included at the end of this manual. The glossary defines terms used throughout the manual, and the index provides a reference to information contained in this manual.

Typographical Conventions

Several conventions are used in formatting the text for Telebit reference manuals. These conventions make the material easy to read and understand. They include the use of different type styles to make material stand out.

Boldface type indicates reader input. In most cases, a string of text in boldface type should be followed with a return character. On your keyboard, the return character may be represented with `ENTER` or `RETURN`, or it may be designated by a return arrow: ().

The `Courier` typeface indicates a screen display. Whether the screen displays a single word or many lines of text, all screen text appears in this manual in the `Courier` typeface.

In command lines, an *n* or *x* written in *italics* represents a variable. Select a variable from the choices presented in the corresponding text.

Warning: *Warning notes indicate potential danger to the user or the equipment. Read all warning notes carefully.*

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FCC Information

This equipment generates and uses radio frequency energy, and if not installed and used in strict accordance with the instructions in this manual, may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class A computing device under Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the modem on and off, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Move the modem away from the receiver or relocate the receiver with respect to the modem.
- Plug the modem into a different outlet so that the modem and receiver are on different branch circuits.

If necessary, you should talk to your dealer or any experienced radio/television technician for additional suggestions. You may find a booklet prepared by the FCC entitled “How to Identify and Resolve Radio-TV Interference Problems” helpful in resolving any problems. This booklet is available from the U.S. Government Printing Office, Washington DC 20402, Stock Number 004-000-00345-4.

FCC Notice to Users

1. Upon request only, you must notify your telephone utility company (telco) of your intentions to install or permanently remove an FCC Part 68 registered device, and provide them with the following information:
 - The telephone number to which the equipment will be connected.
 - FCC registration number ER95W5-17716-MD-E.
 - Ringer equivalence number 0.2.
 - Modular jack number USOC RJ-11.
2. The equipment may not be used on telco coin-operated telephone lines. Party lines and privately owned coin-operated telephone lines are subject to local and state regulatory policies, and possible additional state special features.
3. The telephone company has the right to make changes to their network which may affect the operation of your equipment, provided you are given adequate advance written notice to permit correct operation.
4. In the event of operational problems, disconnect your unit by removing the modular jack from the telco's termination. If your regular phone still works properly, your modem may need to be returned for repairs in or out of warranty. If after disconnecting the equipment, your regular telephones not operate correctly, notify your telephone company that they may have a problem. If a problem is found in premises wiring not telco-installed, you will be subject to an authorized service charge. If a fault is found in telco installed wiring, you may be subject to a charge for the service call.

5. Except as instructed in the Troubleshooting chapter of this manual, you may not under any circumstances (in or out of warranty) attempt any service, adjustments or repairs on this unit. It must be returned to the factory or authorized service agency for all such work. Refer to the chapter entitled Warranty and Repair Procedures in this manual for instructions on returning your modem for repair.
6. If the equipment is to be placed behind a PBX or KTS system, it comes under a special FCC category requiring the written approval of the PBX/KTS owner as well as additional FCC registration.

Canadian Department of Communications (CDOC): Requirements for End Users

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

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). Compliance with the above conditions may not prevent degradation of service in some situations. Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

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

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

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

Repairs

Inquiries regarding Canadian repair centers should be to Telebit Corporation. For Canadian service information, contact the appropriate regional customer support office nearest you.

Canadian Radio/Television Interference

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications (schedule V to VIII).

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

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This chapter provides an overview of the features and benefits of the T3000 and WorldBlazer modems.

T3000 and WorldBlazer Modems

Telebit's T3000 and WorldBlazer modems support full asynchronous and synchronous compatibility with dial-up V.32 and V.32*bis* modems. The modems feature error control, data compression, modem security, remote management, and diagnostics. The modems operate over both dial-up and 2-wire leased-line circuits and are compatible with CCITT and Bell standard modems.

WorldBlazer modems support an enhanced Packetized Ensemble Protocol called TurboPEP, Telebit's new multicarrier modulation, as well as original PEP. The WorldBlazer modem provides reliable and error-free connectivity at speeds from 300 to 23,000 bits per second (bps). The modem is shipped with prestored configurations that allow operation with a wide variety of applications.

TurboPEP

TurboPEP is an important, unique feature of the WorldBlazer modem. With TurboPEP, the modem can transmit or receive data asynchronously at speeds up to 23,000 bps over dial-up telephone lines. When V.42*bis* data compression is enabled, the modem operates at speeds of more than 70,000 bps. Also, TurboPEP provides robust connectivity on impaired channels by using trellis coding.

When using TurboPEP, the WorldBlazer modem sends 512 carrier frequencies onto the line at once. Each carrier uses its small portion of the channel by sending 2 to 7 bits of data. This allows higher throughput with increased efficiency.

DTE Interface Speeds

The WorldBlazer and T3000 modems supports data terminal equipment (DTE) interface speeds up to 115,200 bps. This capability allows data transmission rates of more than 70,000 bps with data compression and TurboPEP.

The modem supports RS-232 asynchronous interface speeds of 300, 1200, 2400, 4800, 7200, 9600, 12,000, 14,400, 19,200, and 38,400 bps in fixed speed or autobaud operation, and 57,600, 76,800, or 115,200 bps in fixed speed operation. The modem also supports synchronous interface speeds of 300, 1200, 2400, 4800, 7200, 9600, 12,000, 14,400, and 19,200 bps.

Facsimile Capability

Your WorldBlazer or T3000 modem allows you to send and receive facsimiles (faxes). To use the modem's facsimile capabilities, you need application software on your computer. The type of computer you use determines the particular software you need.

Robust Connectivity over Impaired Lines

The WorldBlazer's TurboPEP gives you robust connectivity over highly impaired lines by using trellis coding. Trellis coding is a modulation method that improves modem performance on noisy telephone lines.

The WorldBlazer modem can establish international connections when other CCITT standard devices cannot. TurboPEP lets the WorldBlazer modem fall back in increments of 10 bps to find a telephone line's fastest transmission rate.

Universal Compatibility with PEP, CCITT, and Bell Standards

WorldBlazer's TurboPEP is compatible with all other modems that use PEP, including the TrailBlazer, TrailBlazer Plus, and the T1000, T2000, and T2500 modems.

The WorldBlazer and T3000 modems also work with CCITT standards V.32*bis* (14,400, 12,000, 9600, and 7200 bps); V.32 (9600 and 4800 bps); V.23 (1200 and 75 bps); V.22*bis* (2400 bps); V.22 (1200 bps); and V.21 (300 bps), as well as Bell 212A (1200 bps) and Bell 103 (300 bps).

CCITT V.32*bis* Support

The modem can operate in either asynchronous or synchronous V.32*bis* mode. When operating in V.32*bis* mode with trellis coded modulation, the modem operates at a speed of 14,400 bps with selectable fallback speeds of 12,000, 9600, or 7200 bps.

CCITT V.32 Support

The modem can operate in either asynchronous or synchronous V.32 mode. When operating in V.32 mode with trellis coded modulation, the modem uses a speed of 9600 bps, with a selectable fallback of 4800 bps.

Command Sets

AT Command Set

The modem supports the Telebit Extended AT command set, which is compatible with the industry-standard AT command set.

CCITT V.25*bis* Command Set Support

Your modem is compatible with both the bit-synchronous and asynchronous versions of the V.25*bis* command set.

LPDA

The LPDA dialing command set is the communications protocol between IBM host software and transmission devices for exchanging diagnostic and control information. LPDA commands provide a means for an attached DTE to command the modem to dial a telephone number and report back if the call is successful or not.

CCITT V.42 Error Control

The modem supports the V.42 error control protocol standard, which provides virtually error-free transmission over a standard full-duplex, V.32*bis*, V.32, V.22, V.22*bis*, or Bell 212A connection.

The V.42 protocol includes the Link Access Procedure for Modems (LAP-M), the main protocol used between two V.42 modems. In addition, V.42 includes an alternate protocol, the Microcom Networking Protocol (MNP) up to Class 4. The inclusion of MNP provides compatibility between V.42 and existing MNP modems.

MNP Support

The modem supports MNP up to Class 4 for error correction and Class 5 for data compression. When a connection is established, the modems at each end negotiate the highest MNP class supported by both modems.

Data Compression

CCITT V.42*bis*

The WorldBlazer and T3000 modems support the CCITT V.42*bis* standard. It is one of the data compression standards that can be used with TurboPEP.

V.42*bis* is a high-performance data compression algorithm that substantially increases the data throughput for more than 70,000 bps when used with TurboPEP. (The data compression ratio you get depends on the type of data you are sending. V.42*bis* compression typically increases data throughput between two to one and four to one.)

V.42*bis* data compression is possible for connections established using TurboPEP, PEP, LAP-M, or MNP and if both connected modems are configured for data compression.

MNP 5

The modem supports MNP Class 5 for data compression. MNP 5 increases the data throughput up to two to one. MNP 5 cannot be used with TurboPEP or PEP.

Lempel-Ziv

The WorldBlazer modem can also use Telebit Lempel-Ziv (LZ) data compression with TurboPEP or PEP.

Prestored Configurations

Your modem maintains prestored configurations in program memory for various applications. You can select the configurations from the front panel or by entering a command.

Modem Security

The modem supports both callback and password security to protect the connected DTE from unauthorized access.

The telephone number directory holds up to 10 callback numbers and corresponding passwords. In callback security, if the password entered by the user corresponds to the password stored in the number directory, the answering modem hangs up the telephone, waits 15 seconds, and calls back the appropriate number indexed in the directory.

Password security can also be configured to require the caller to enter a password before gaining access to the attached DTE but without calling back the user.

Remote Access and Diagnostics

Remote management is provided through the modem's remote access feature. Remote access allows a central site technician to configure, test, and diagnose T3000 and WorldBlazer modems that are in the field.

To ensure reliable performance, each time you turn on the modem a series of internal logic tests, memory tests, and internal loopback checks occur. In addition, the modem provides data transmission statistics such as line-quality analysis, data-flow analysis, and packet error rates.

Hardware and Software Flow Control

The modem lets you specify the method of data flow control to be used when transmitting information. You can select XON/XOFF software flow control or RTS/CTS hardware flow control.

Stored Telephone Numbers

The number directory stores up to 10 telephone numbers and descriptors in nonvolatile memory for easy dialing.

File Transfer Protocol Support

The modem can use protocol support to optimize file transfers when operating in PEP, TurboPEP, or when using MNP error correction. You can configure the modems to support Kermit, Xmodem, Ymodem, UUCP, or SDLC protocols. The modems at each end negotiate protocol support during the TurboPEP, PEP, or MNP

initialization sequence. Both modems must agree on the protocol supported; otherwise, protocol support is not negotiated during the communications session.

Note: *Protocol support is negotiated only between Telebit modems.*

Modem Operation and Special Features

Telebit modems can interface with a wide variety of computer and data communications equipment, and they can be used in many applications. Because each device has its own specific requirements, your modem is equipped with several commands and registers that you can set to meet the specific requirements of your system.

This chapter describes command mode operations, flow control, RS-232 control signal interpretations, error control, data compression, protocol support, and synchronous support.

AT Command Mode Operation

The modem supports the Telebit Extended AT command set (refer to Chapter 3, AT Command Descriptions).

In data mode, the modem can transfer information to and receive information from a remote location. In command mode, the modem processes data received through the serial interface port as instructions to perform various functions.

Each modem enters command mode when:

- The power is turned on, and the modem has completed the power-up diagnostic tests.
- A data call is disconnected, and the modem goes on hook (offline).
- The modem cannot successfully complete a call, or the remote modem's data carrier is dropped.

- The modem receives a defined escape sequence, RS-232 signal, or break signal while in data mode.
- A semicolon (;) occurs at the end of a dialing string.

To enter AT commands, follow the instructions listed in Chapter 3, AT Command Descriptions. The modem processes commands from left to right. If an error occurs during the execution of a command line, processing stops and everything following the erroneous command is ignored.

To ensure that the modem recognizes the AT prefix, you must use one of the following data formats while issuing commands to the modem:

- 8-bit data with no parity
- 7-bit data with even, odd, mark, or space parity
- 8-bit data with mark parity

The following sections of this chapter refer to many commands and registers. For additional detailed descriptions of the Telebit Extended AT command set, refer to Chapter 3, AT Command Descriptions. Chapter 4, S Register Descriptions, provides complete descriptions of the registers.

How to Use the Number Directory

Set Number Directory

The ~N command allows you to save any character string in the number directory in nonvolatile memory. The string of digits and dialing control characters are stored at the number location defined as any number from 0 through 9.

In addition to the numbers stored in the number directory, you may define alpha character names to be used for later reference in initiating calls or for the passwords used for callback security.

To define a name for a particular telephone number, you must precede and follow the name with a backslash symbol (\). Each directory number may contain up to 70 alphanumeric characters. For example:

```
AT ~N3=1234567\TEST\
```

This command stores the telephone number 123-4567 into location 3 and names the number TEST.

List Number Directory

The ~L command lists all entries stored in the number directory from 0 through 9. If a storage location does not contain a number, the directory entry number appears alone. For example:

```
AT~L  
0: 12345-6789\ACCOUNT\  
1: 1 (415)555-6789  
2:  
3: 1234567\TEST\  
4:  
5:  
6: 1-800-555-4739  
7: 0-S=6,,S=0  
8:  
9: 222-3333 \HOME\
```

Dialing

To dial a number in the number directory, use the S= modifier after the D command. For example, to dial entry number 0 in the number directory, enter the following command:

AT DS=0

To dial a number referenced by name in the number directory, enter a backslash (\) after the D command, enter the name, then enter a second backslash. For example, to dial the entry named ACCOUNT, enter:

AT D\ACCOUNT

Automatic Dialing

The S104 register enables automatic dialing using the data terminal ready (DTR) signal from the local data terminal equipment (DTE). If you are using DTR for automatic dialing, the S104 register operates only if the modem can interpret DTR signals; therefore, to use this feature, you must set the &D command to 1, 2, or 3.

For all settings, the S100 register applies unless you override it with an R dial modifier.

Break Signal Handling

While in data mode, the modem's default action upon receiving a break signal is to enter command mode. You can configure the modem to pass the break signal through the modem to the remote end by changing the setting of the S61 register. The S63 register determines the modem's response when the local DTE transmits a break signal.

For most applications that need to be able to transmit a break signal to the remote modem, set S61 to 0 and S63 to 0. The modem then passes break signals.

Escape Sequence

The escape sequence causes the modem to escape from data mode and enter command mode so it can interpret commands.

During a data connection, the escape sequence provides a way to enter command mode without disconnecting the communications link. An escape sequence contains three consecutive escape characters (defined by the S2 register) followed by a valid AT command. For example, to disconnect a call, enter:

+++ATH

The modem switches to command mode only after you enter an escape sequence. The data connection is maintained while the modem is in command mode.

Note: *When the local modem receives an escape sequence, it discards any data received from the remote modem if no link protocol (PEP, V.42, or MNP) is active.*

To disable the escape sequence, enter:

AT S2=255S48=0

Resetting the Modem

To reset your modem, you can turn the power off and then back on or enter an **ATZ** command.

Serial Port Interface Speed and Flow Control

Most communication problems occurring over the DTE/data communications equipment (DCE) interface result from a mismatch in the interface speed or flow control method used by the DTE and the modem. Both devices must agree on the interface speed and flow control method used; otherwise, information may be lost or garbled.

Serial Port Interface Speed

To allow the DTE to communicate with the modem, the interface speed used by both the DTE and the modem must match. For maximum data throughput, set the interface speed between the DTE and the modem to the highest possible speed supported by both devices. Register S51 governs the serial interface speed of the modem.

When the modems connect without error control, your modem may change its interface speed to match the speed of the connection, depending on the current setting of the S181 register (refer to the section titled V.42 and MNP Error Control Support described later in this chapter).

The interface speed of the modem can be set either manually or automatically. For example, to set the modem's interface speed to 57,600 bps using the S51 register, enter:

AT S51=7

Note: *The modem cannot communicate at 57,600, 76,800, or 115,200 bps until you set the S51 register to 7, 8, or 9, respectively.*

The modem can also automatically sense the DTE's speed by monitoring the AT prefix of every command line. The modem uses the A in the prefix to determine the serial interface speed and the T to determine the parity. This technique is commonly called autobaud.

Note: *The modem cannot respond to an AT command at 57,600, 76,800, or 115,200 bps if you enable autobaud.*

When S51 is set to 252, the modem determines the current interface speed after each command line, and you cannot enter a new command line until the result code from the previous command is displayed. This setting enables you to send an AT command at one speed, then send another command at a different speed; the modem can recognize each command.

If you do not enter command lines after a power-up, the speed at which the default profile was saved (see the &W command in Chapter 3, AT Command Descriptions) is the speed used to send RING and CONNECT messages when an incoming call is received.

When S51 is set to 253, 254, or 255, the modem checks the interface speed on the first AT prefix only after one of the following events occurs:

- The modem is powered up or reset.
- The S51 register is reset to 253, 254, or 255.
- A connection is dropped, and the modem is placed on hook.
- A break is received in command mode.
- A NO CARRIER result code occurs because the carrier is lost, a dial or answer command is aborted, or the time allowed to connect as specified by the S7 register has expired.

The modem cannot recognize commands at other speeds until one of the listed events occurs.

If you do not enter command lines after a power-up, the modem uses 38,400 bps (S51=253), 19,200 bps (S51=254), or 9600 bps (S51= 255) to send RING and CONNECT messages when an incoming call is received.

Modem Flow Control

Modems using error control must be able to selectively stop and start the flow of data from the associated DTE. Flow control allows the modem to stop incoming data from the DTE while it retransmits data that contains errors, preventing buffer overflow. The modem provides two types of flow control: software (XON/XOFF) and hardware (RTS/CTS),

Software flow control uses XON and XOFF characters to stop and start the data from the DTE. The XON character turns the data flow on; the XOFF character turns the data flow off. The XON and XOFF characters must not inadvertently exist in the user data because the modems interpret them as flow control characters. Software flow control, therefore, should be used for text-only applications.

Hardware flow control uses RS-232 control signals (RTS and CTS) to stop and start the flow of data.

When the clear to send (CTS) signal is turned on, the modem is notifying the DTE to start sending data. When the CTS signal is turned off, the modem is telling the terminal to stop sending data.

Request to send (RTS) is an electrical signal from the DTE. When RTS is on, the modem can send data to the DTE. When RTS is off, the modem must stop sending data.

Flow control also allows the modem's DTE rate (the rate at which the modem and DTE exchange data) to be higher than the actual data transmission rate. This speed conversion typically is used so that the modem's DTE rate can remain fixed regardless of the actual transmission rate when operating with error control (S180), buffered (S181), or data compression (S190) modes.

The S58 and S68 registers determine the method of data flow control used by the DTE and the modem when transferring data over the serial interface. The S58 register governs the method of flow control used by the DTE to control the flow of data coming from the modem, and the S68 register controls the flow of data from the DTE to the modem.

Sometimes the flow control used for data entering the modem through the serial interface must differ from the flow control method used for data leaving the modem over the interface.

When you select XON/XOFF flow control, the S56, S57, and S48 registers control recognition of the XON and XOFF characters. The S56 and S57 registers specify the ASCII code used for the XON and XOFF characters, respectively. The S48 register determines how an incoming character should be treated when compared with the contents of S56 and S57.

If S48 is set to 0, the modem examines only the lower 7 data bits to detect an XON or XOFF character. Therefore, if the DTE is using an 8-bit data format, characters with a decimal value greater than 127 could be misinterpreted as an XON or XOFF character. To avoid this condition, the S48 register should be set to 1 when the DTE is using 8-bit characters.

Some of the most commonly used flow control settings are listed as follows:

- S58=3, S68=255. Use XON/XOFF software flow control if you want a dumb terminal to access a mainframe computer or if you use Kermit or Zmodem as one of your file transfer protocols.
- S58=2, S68=255. This setting is preferred for all types of applications, provided that your computer system supports RTS/CTS hardware flow control.
- S58=0, S68=3. Compromise software flow control does not provide complete control over data flow, but it may help if the computer does not support hardware flow control but you use file transfer protocols such as Xmodem, Ymodem, or UUCP.

RS-232 Control Signal Interpretations

To allow the modem to interface with a variety of DTEs, the &C, &D, &R, and &S commands define the various ways that the modem interprets and uses the RS-232 control signals. If your software uses any of the RS-232 control signals defined by these commands, enter the following dial string:

AT &C1&D2&R3&S0&W

The &D command controls how the modem interprets the DTR control signal from the DTE. The S25 register affects how the modem interprets changes in DTR. The S104 register defines the automatic calling options possible using the DTR signal.

The &S command determines how the modem handles the data set ready (DSR) control signal. The S47 register controls how long the modem pulses this signal.

The &C command determines how the modem handles the data carrier detected (DCD) control signal. The S47 register controls how long the modem pulses this signal.

When the modem uses RTS/CTS hardware flow control, the CTS signal goes on and off to control the flow of data from the DTE, as detailed in the S58 and S68 register descriptions.

When the modem is not using RTS/CTS flow control, the &R command determines how the modem uses CTS and RTS control signals.

Modulation Speed Considerations

The modem's modulation speed is determined by the current setting of S50. If S50 is not set to 0, the S94 register controls whether the modem falls back to a slower speed.

V.32*bis* falls back to 12,000, 9600, or 7200 bps; V.32 falls back to 4800 bps; and V.22*bis* uses a fallback speed of 1200 bps. When the modem connects in automatic speed determination mode (S50=0), the answering modem cycles through several different answering tones in sequence to allow the calling modem to synchronize to the appropriate speed. In general, the modem starts with the highest transmission speed and works down toward the lowest speed. Therefore, if a slower speed modem is calling, the local modem may need to extend the time that it waits to detect carrier (refer to the S7 register in Chapter 4, S Register Descriptions).

The B command determines if the modem uses Bell standards (212A and 103) or CCITT standards (V.22 and V.21) for 1200 bps and 300 bps operation.

V.42 and MNP Error Control Support

The modem supports the CCITT V.42 error control protocol. V.42 provides error-free transmission over a V.32*bis*, V.32, V.22*bis*, V.22, or Bell 212A connection.

The V.42 protocol includes LAP-M. In addition, V.42 includes MNP up to Class 4 as an alternate protocol. MNP provides compatibility between V.42 and existing MNP modems.

The V.42 error control mode and fallback is controlled by two registers: S180 and S181.

The S180 register determines which type of error control the modem attempts while connecting with a remote modem.

If the modem cannot connect using error control or if error control mode is disabled, the S181 register determines the fallback alternatives.

Data Compression

While connecting using TurboPEP, PEP, LAP-M, or MNP, data compression is negotiated between the two connecting modems. Telebit T3000 and WorldBlazer modems support V.42*bis* and MNP 5 data compression. The WorldBlazer also supports Telebit Lempel-Ziv compression. Data compression typically increases data throughput by a factor of two to four.

The S190 and S191 registers are used to control data compression negotiation. Both modems must allow data compression for data compression to occur.

Protocol Support

When you set the modem to enable file transfer protocol support, the modem interacts with the protocol to eliminate file transfer delays that normally occur with other high-speed modems. This significantly increases data throughput without altering the protocol functionality.

Using the S111 register, you can set the modem to provide support for any of the following file transfer protocols:

- Kermit
- Xmodem or Ymodem
- UUCP
- SDLC

Both modems typically negotiate protocol support during the connection initialization sequence.

To enable file transfer protocol support, first ensure that at least one of the modems is set to MNP error control (register S180 is set to 3), or TurboPEP or PEP is enabled.

The S111 register's default setting of 255 allows the modem to support the protocol specified by the modem at the other end of the connection. Typically, if the answering modem's S111 register is left at its default setting of 255, the calling modem can then specify the protocol to support via its S111 register setting. If both modems have S111 set to 255, no protocol is supported. If neither modem has its S111 register set to 255, then both modems must agree on the setting of the S111 register to allow protocol support.

Note: *Protocol support is negotiated only between Telebit modems.*

Asynchronous/Synchronous Mode Selection

Use the &Q command to set the serial interface for either synchronous or asynchronous data mode. Register S253 sets the command mode.

Modem Security

Callback security protects the DTE from unauthorized access. Register S46 determines the type of call security used when the modem answers an incoming call.

To change the setting of this register, you must enter a password. The default system password is PEP, which must be entered in uppercase. To change this password, issue a ~U command.

Callback telephone numbers and associated passwords are stored in the ~N number directory.

Remote Access

The modem allows you to send commands to the remote modem. To negotiate and use remote access, the modems must connect using MNP error control, TurboPEP, or PEP.

The S45 register enables or disables access to the control functions of the modem from a remote modem.

To allow remote command access, the following conditions must be met:

- Both modems must have remote access capability and must connect with TurboPEP, PEP, or MNP.
- Register S45 must be set to 255 or 1 before establishing the call.

Remote access is not enabled during the session unless all of the above conditions are met.

The % command modifier allows you to send commands from a local DTE to a remote modem as if the commands had been entered by the remote DTE.

Note: *When the modem is configured for TTY configuration using the front panel switches, S45 is set to 255 (enable remote access), S0 is set to 1 (enable auto-answer), and S180 is set to 3 (enable MNP) in the active configuration (RAM). This allows Technical Support to have remote access to the modem through a TurboPEP, PEP, or MNP connection, if necessary, as long as the modem is not reset (AT Z command) or powered off and then back on.*

Facsimile Capability

Your WorldBlazer or T3000 modem allows you to send and receive facsimiles. The Telecommunications Industry Association is creating a standard for facsimile modems. This emerging standard is called SP-2388, and the August 1990 draft of SP-2388 has become a de facto industry standard. The modem conforms to this de facto standard for Class 2 facsimile functionality.

In order to use the modem's facsimile capabilities, you need application software on your computer. The type of computer you use determines the particular software you need.

- For PC-compatible computers with DOS, use DOSFax software by Delrina Technology, Inc.
- For PC-compatible computers with Windows, use WinFax software by Delrina Technology, Inc.
- For PC-compatible computers with UNIX or XENIX, use Faximum by Faximum Software Inc.
- For Macintosh computers, use Quick Link II Fax by Smith Micro Software, Inc.
- For the UNIX environment, use Faximum by Faximum Software Inc.

Load the software recommended for your computer environment and follow the software's directions for using facsimile.

These software packages may not be the only products that are fully compatible with Telebit facsimile functionality. We advise you to check with individual software vendors for information on whether their products are fully compatible with the SP-2388 standard or Class 2 facsimile functionality.

If you have problems when using the facsimile function, contact your facsimile software vendor.

This chapter describes the Telebit Extended AT commands used when your modem is operating in command mode and you have selected the AT command set. The AT command set is a series of machine instructions used to activate the features of an intelligent modem. AT is a mnemonic code for ATtention, which is the prefix that initiates each command to the modem.

You may enter a command line of up to 80 characters in uppercase or lowercase letters. You must precede the first command in the line with an **AT** or **at** and follow the last command by pressing `[RETURN]`.

If you make an error while entering a command, simply backspace over the mistake and then retype the line. You cannot backspace over the AT prefix because it is interpreted immediately after being typed.

Entering Commands

To enter commands, enter the prefix **AT** before the line of command. For example:

AT E1 Q0

enables command echo and sets the Q command (Quiet Mode Select) to the numeric option 0, which indicates how the modem reports result codes.

Command Syntax

You can issue commands to the modem by entering **AT** followed by the command and any associated parameters and pressing `[RETURN]`.

You can repeat the last command line issued by entering **A/** or **a/**. Because it also repeats the AT prefix and `[RETURN]`, do not enter the AT prefix or press `[RETURN]` when using this command. **A/** or **a/** is useful for redialing a number.

You can add blanks and tabs to enhance readability. However, they are not necessary for the modem to interpret commands.

The notation *x* represents an assigned value. If you enter a command without a value when one is expected, the modem assumes a value of 0.

The notation *n* in the command descriptions represents a decimal numeric option. The option immediately follows the command.

For example, to turn off result codes, enter:

AT Q1

Do not enter:

AT Q=1

Escape Sequence

The escape sequence **+++** followed by a valid AT command causes the modem to escape from data mode so it can interpret commands.

Once a data connection to a remote modem has been established, the modem sends all data it receives from the DTE to the remote modem. The modem begins interpreting that data as commands once it receives an escape sequence from the DTE.

Command Descriptions

The following paragraphs describe the modem commands and the available settings for each command.

A Answer

The A command causes the modem to connect to the telephone line and issue a carrier. If you are using the established telephone connection for voice communications and then want to switch your modem to data mode to communicate with the other party's modem, you must use this command in the following way:

1. Have the other party enter **AT D** to their modem without entering a telephone number.
2. Enter **AT A** to your modem within a few seconds. Both parties can hang up the telephone. The modem sends a `CONNECT` result message when the connection occurs provided that `Q0` is set.

If no carrier signal is detected within the timeout period defined by the `S7` register, the modem hangs up, sends a `NO CARRIER` result message, and returns to command state.

This command can be aborted by pressing any key (when `S64=0`). If the command is aborted, the modem sends a `NO CARRIER` result message.

Bn Bell/CCITT Mode Select

Range: 0 or 1
Default: 1

The B command is used to select either Bell or CCITT standards while operating at 1200 or 300 bps transmission modes.

B Same as B0.

B0 Use CCITT standard (V.21 at 300 bps, V.22 at 1200 bps).

B1 Use Bell standard (103J at 300, 212A at 1200 bps).

D Dial

See also: P, T, S6, S7, S8, S11, S59, S64

Use the D command included in a dialing string to place a call. A valid dialing string consists of a D followed by any digits from 0 through 9, which specify the number to dial, and dialing options. The characters A, B, C, D, #, and * may also be used when you tone dial (T). These characters are ignored when pulse dialing (P).

Parentheses, slashes, hyphens, periods, and spaces may be used in the dialing string to improve readability, but they are not required.

The D command causes the modem to stop interpreting other commands, dial the number indicated, and wait for a connection. If the modems do not connect within the period of time defined by the S7 register or if any character is sent from your DTE before the modems establish a connection (when S64=0), the D command is canceled and the modem returns to command mode.

Because the modem can use either pulse or tone dialing, you must select which you prefer or the modem uses the last mode selected. Also, the modem defaults to pulse

dialing when powered on unless you set the parameter in the nonvolatile memory to tone dialing; i.e., by entering **AT T&W**.

The following dialing options are valid within a dialing string:

- P Use pulse dialing.
- R Switch to answer mode when finished dialing. The R command may occur at any location during the dial string but is valid only for the dial string in which it occurs.
- T Use tone dialing.
- W Wait up to the number of seconds in the S7 register for a valid dial tone. For example, to dial 9, wait for a second dial tone, then dial 555-1212, enter **AT D9W5551212**.
- S=*n* Designates a number directory entry to be used in the current dial string. The modem includes the designated number directory entry in the dial string (in place of S=*n*) and execution progresses as if this string had been entered directly. Before dialing begins, the modem displays the stored number when the S=*n* modifier is executed, provided either X2 or X12 is in effect. Valid values for *n* are 0 through 9.
- ,
- Pause for the amount of time specified by the S8 register before continuing the dial string.
- @ Wait for silence after a remote ring before continuing. If the modem does not detect silence within the amount of time specified by the S7 register, it hangs up and sends a NO ANSWER result code.
- ! The exclamation point (!) dial modifier initiates on hook flash, a function similar to that of rapidly pressing your telephone hook down and up. The modem goes on hook for 0.5 second, then goes off hook and waits 2 seconds before executing the next modifier. The telephone handset must be on hook for this to work.

- ;
Remain in command mode after dialing without waiting for a connection. The semicolon (;) terminates the dial string, causing the modem to remain in command mode. The modem does not attempt to connect with another modem.

- \$
The dollar sign causes the modem to wait for a calling card billing prompt tone. If the prompt tone is not detected within the amount of time specified by the S7 register, the modem sends a NO PROMPTTONE result code. If the modem detects a busy signal while waiting for the prompt tone, it sends the BUSY result code when X2, X4, or X12 is in effect.

- \
The backslash (\) tells the modem to dial a number defined by a name in the number directory. When the modem encounters text containing the backslash, it searches the number directory for an entry that has identical text between the backslash symbols. The number directory element is stripped of the identifier text, inserted into the dial string, and processed. For example, if the following command was previously executed,

AT ~N3=(415)555-1212\HELP

then the following three command lines are equivalent:

AT DT (415)555-1212

AT DT\HELP

AT DTS=3

The following examples show the correct command format to make the modem dial a number using pulse dialing, wait for an outside line, and then switch to tone dialing:

AT D P9W T408-555-6789

or

AT D P9WT4085556789

Either way is acceptable because the modem ignores spaces and hyphens in the dialing string.

En Command Echo

Range: 0 or 1

Default: 1

The E command instructs the modem, while in command mode, to echo characters back to the local DTE.

E Same as E0

E0 Echo off

E1 Echo on

Hn Hook Control

Range: 0 or 1

Default: 0

The H command allows the modem to control the telephone switch hook.

H Same as H0

H0 Go on hook

H1 Go off hook

In Information Request

Range: 0–5

See also: Chapter 6, Appendix B

The I command requests the modem's product identification number, internal diagnostic status, current transmission mode, or current revision level.

- I Same as I0.
- I0 Returns the product identification character string, 965, which defines the model number.
- I1 Returns an error code status generated by summing the numbers associated with failed tests. If it is not 000, call Telebit Technical Support. See Chapter 6, Warranty and Repair Procedures, for further information.
- I2 Reports `CONNECT` status. Refer to Appendix B, Result Codes, for details on result code reporting.
- I3 Responds with the modem's model name and firmware revision level.
- I4 Reserved.
- I5 Last number dialed.

On Return to Data State

Range: 0–2

See also: S111, S190

The O command places the modem in a data state during a connection. When the modem has been forced to enter command mode with the break signal or the escape sequence, the O command resumes data communication. If the modem is off hook but not connected, it attempts to connect in the same mode (originate or answer) as the most recent connection. The modem sends an `ERROR` result code to the DTE if this command is issued while the modem is on hook.

- O Same as O0.

- O0 The modem switches to data state.
- O1 Retrain before returning to data state.
- O2 Renegotiate file transfer protocol support (register S111) and data compression (register S190) before returning to data state (valid only for TurboPEP or PEP connections).

P Pulse Dialing

The P command causes the modem to use pulse dialing for all subsequent dialing operations.

Qn Quiet Mode Select

Range: 0–2
Default: 0

The Q command controls the reporting of result codes to the local modem.

- Q Same as Q0.
- Q0 Modem reports result codes.
- Q1 Modem does not report result codes.
- Q2 Modem reports result codes when originating a call but does not return result codes when answering a call.

T Tone Dialing

The T command causes the modem to use tone dialing for all subsequent dialing operations.

Vn Result Code Format Select

Range: 0 or 1

Default: 1

See also: Appendix B

The V command determines the format of the result codes.

V Same as V0.

V0 Numeric result codes enabled. In *V.25bis* operation, this command causes result codes to be unformatted.

V1 English descriptions of result codes enabled. In *V.25bis* operation, this command causes result codes to be formatted.

Xn Result Code Select

Range: 0–2, 4, 11, 12

Default: 2

See also: Q, V, S59, Appendix B

The X command selects a set of result codes and can enable call progress detection. The parameters are as follows:

X Same as X0.

X0 Supports the following result codes:

Number	Words
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR

X1 Adds modulation speed to the `CONNECT` message:

Number	Words
0	OK
1	CONNECT 300

2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200
47	CONNECT 1275
46	CONNECT 7512
10	CONNECT 2400
11	CONNECT 4800
48	CONNECT 7200
12	CONNECT 9600
49	CONNECT 12000
13	CONNECT 14400
50	CONNECT FAST

X2 Supports the X1 result codes and adds the following:

Number	Words
6	NO DIALTONE
7	BUSY
52	RRING
53	DIALING

X4 Supports the X11 result codes and adds the following:

Number	Words
6	NO DIALTONE
7	BUSY

X11 Similar to X1, except the number after the `CONNECT` message reflects the DTE interface speed rather than the modulation speed.

Number	Words
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	CONNECT 1200

10	CONNECT 2400
11	CONNECT 4800
48	CONNECT 7200
12	CONNECT 9600
49	CONNECT 12000
13	CONNECT 14400
14	CONNECT 19200
15	CONNECT 38400
16	CONNECT 57600
17	CONNECT 76800
18	CONNECT 115200

X12 Supports the X11 result codes and adds the following:

Number	Words
6	NO DIALTONE
7	BUSY
52	RRING
53	DIALING

When you dial using X0, X1, or X11, the modem does not recognize the busy signal because the `BUSY` result code has not been enabled, and the modem performs a blind wait before dialing (see register S6).

When you dial using X2, X4, or X12, call progress detection is enabled. In particular, the modem recognizes the busy signal, and it requires dial tone before dialing even if the `W` modifier is not entered.

Yn Long Space Disconnect

Range: 0 or 1

Default: 0

The `Y` command determines if the modem responds to a long space disconnect signal.

`Y` Same as `Y0`.

- Y0 Modem does not respond to a long space disconnect signal.
- Y1 If the modem receives a continuous break signal from the remote modem for a period greater than or equal to 1.6 seconds, it disconnects. When commanded to hang up, the modem transmits a 4-second break signal, then disconnects (goes on hook).

Zn Reset

Range: 0 or 1
See also: S255

The Z command disconnects the telephone line and resets the active configuration from the user configuration values stored in nonvolatile memory. If the modem is off hook, it drops the connection, goes on hook, and loads a configuration specified by the command line parameter.

After you enter the Z command, you must wait 250 milliseconds after the modem reports the OK response message before entering the next command.

- Z Same as Z0.
- Z0 Modem resets and recalls the default user configuration specified by the S255 register.
- S255=0. Uses configuration A.
- S255=1. Uses configuration B.
- Z1 Modem resets and recalls user configuration B.

Note: *The modem ignores any commands on the command line following the Z command.*

&Cn Data Carrier Detect (DCD) Control

Range: 0–6

Default: 0

See also: S47

The &C command controls the DCD signal interpretation to the local DTE.

&C Same as &C0.

&C0 The DCD signal is always on.

&C1 When the local modem detects a carrier from the remote modem, the DCD signal turns on after the `CONNECT` result code is sent to the DTE. The DCD signal turns off when the carrier is dropped.

&C2 The DCD signal is on except when it turns off for a period of time specified by the S47 register while disconnecting a call.

&C3 DCD is on only when received data is being sent to the DTE.

&C4 For synchronous operation only. When the local modem detects a carrier from the remote modem, the DCD signal turns on. The DCD signal turns off when the carrier is dropped.

When the modem detects a V.13 pattern from the remote modem, it sets received data to mark and turns off DCD. (Received data is the RS-232 data signal received by the DTE from the modem on pin 3.)

&C5 The DCD signal is on only when received data is being sent to the DTE. The &C5 command is intended for use with the SDLC accelerator (S111).

&C6 The DCD signal follows the DTR signal when the modem is on hook. DCD turns on after the `CONNECT` message is sent to the DTE and stays on during the connection.

&Dn Data Terminal Ready (DTR) Interpretation

Range: 0–4

Default: 0

See also: &Q, S25

The &D command defines the DTR signal interpretation from the DTE. The &Q command can override the behavior dictated by this command, which will not change the current value of the &D command.

The modem responds to changes in the DTR signal as follows:

- &D Same as &D0.
- &D0 The modem ignores DTR and assumes that DTR is always on.
- &D1 The modem enters command mode when a filtered on-to-off transition of DTR is detected. (Filter time is defined by the S25 register.) DTR does not affect auto-answer.
- &D2 The modem disconnects a call in progress, enters command mode, and disables auto-answer when the DTR signal goes from on to off. Auto-answer is enabled when the DTR signal turns on.
- &D3 The modem disconnects a call in progress, enters command mode, and disables auto-answer when the DTR signal goes from on to off. Auto-answer is enabled when the DTR signal turns on. The modem restores the configuration profile specified by the S255 register following an on-to-off transition of DTR.
- &D4 When DTR is off, the modem goes on hook if it is off hook and disables auto-answer and command recognition.

&Fn Load Factory Configuration

Range: 0–16, 29, 30, 32–34

See also: S254, S255, Appendix C

The &F command loads the ROM-based factory configurations into the active configuration except for registers S254 and S255.

&F Same as &F0.

&F0 TTY (factory default). Loads configuration according to the S254 register. Used with most asynchronous terminals.

&F1 Unattended answer mode. Used with most asynchronous front end processor (FEP) host ports operating at a fixed interface speed of 19,200 bps.

&F2 Intelligent answer mode. Used with most computers running software that interprets the modem result codes and adjusts its speed accordingly. Modem result codes are enabled and the interface speed follows the connect speed.

&F3 UNIX/UUCP with RTS/CTS flow control. Used with UNIX systems that support RTS/CTS flow control. The modem defaults to UUCP protocol support for TurboPEP, PEP, and MNP connections. V.42 error control is disabled.

For additional information when configuring your computer for UUCP, use your hardware and software configuration guides for your UNIX operating system or refer to the Nutshell handbook entitled *Managing UUCP and Usenet* published by O'Reilly and Associates, Inc.

For specific configuration guides, call Telebit Technical Support at 408-734-5200.

&F4 UNIX/UUCP with XON/XOFF flow control. Used with UNIX systems that cannot support RTS/CTS flow control. The modem uses a compromise XON/XOFF flow control setting that does not interfere with UUCP file transfers.

The modem defaults to UUCP protocol support for TurboPEP, PEP, and MNP connections. V.42 error control is disabled.

For additional information when configuring your computer for UUCP, use your hardware and software configuration guides for your UNIX operating system or refer to the Nutshell handbook entitled *Managing UUCP and Usenet* published by O'Reilly and Associates, Inc.

For specific configuration guides, call Telebit Technical Support at 408-734-5200.

- &F5 Transparent synchronous mode. Use with most 14,400 bps synchronous terminals or devices. Operates in V.32*bis* full-duplex transparent synchronous mode at 14,400 bps using the DCE clock.
- &F6 Half-duplex 14,400 bps transparent synchronous LPDA dialing.
- &F7 IBM AS 400 half-duplex 14,400 bps bit-synchronous V.25*bis* dialing.
- &F8 IBM PC or Mac with XON/XOFF flow control. Used with most personal computer software packages that support XON/XOFF flow control.
- &F9 IBM PC or Mac with RTS/CTS flow control.

Note: *To use RTS/CTS control on a Macintosh, the communications software must support the feature, and a special cable must be used as recommended in the software documentation. You must set the modem to ignore DTR (&D0).*

- &F10 Leased line-asynchronous originate mode. Used in asynchronous point-to-point, 2-wire leased-line applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem that is configured with the AT&F11 command (or

another properly configured V.32*bis* modem) in asynchronous V.32*bis* mode at 14,400 bps. If the modem cannot negotiate V.42 or MNP error control, it does not connect.

- &F11 Leased line—asynchronous answer mode. Used in asynchronous point-to-point, 2-wire leased-line applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem that is configured with the AT&F10 command (or another properly configured V.32*bis* modem) in asynchronous V.32*bis* mode at 14,400 bps. If the modem cannot negotiate V.42 or MNP error control, it does not connect.
- &F12 Leased line—synchronous originate mode. Used in any synchronous point-to-point, 2-wire leased-line application. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem that is configured with the &F13 command (or another properly configured V.32*bis* modem), in synchronous V.32*bis* mode at 14,400 bps.
- &F13 Leased line—synchronous answer mode. Used in synchronous point-to-point, 2-wire leased-line applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem that is configured with the &F12 command (or another properly configured V.32*bis* modem), in synchronous V.32*bis* mode at 14,400 bps.
- &F14 Half-duplex PEP SDLC with command set disabled.
- &F15 Half-duplex PEP SDLC with LPDA dialing.
- &F16 Half-duplex 14,400 bps transparent bit-synchronous V.25*bis* operation.
- &F29 Manual V.21 originate operation.
- &F30 Manual V.21 answer operation.

&F32 Asynchronous/synchronous &Q1. When the modem is not online, the primary data and clock lines operate in asynchronous mode. The modem switches to synchronous mode when a connection to another modem is established.

&F33 HP 3000 (host). Used with an HP 3000 host system using ENQ/ACK flow control.

&F34 HP 3000 (terminal). Used with an HP terminal using ENQ/ACK flow control, which calls an HP 3000 host system using the same flow control.

&Gn Guard Tone Select

Range: 0–2

Default: 0

The &G command selects the type of guard tones the answering modem should send in V.22 or V.22*bis* mode.

&G Same as &G0.

&G0 No guard tones.

&G1 550 Hz guard tone.

&G2 1800 Hz guard tone.

&Jn Jack Type Select

Range: 0–2

Default: 0

The &J command designates how the modem uses available telco leads.

&J Same as &J0.

&J0 Auxiliary telco leads disabled.

&J1 A/A1 control selected.

&J2 MI/MIC control selected.

Note: *The hardware jumpers on the modem board are set for MI/MIC operation. If your configuration requires an A/AI setting, contact the Telebit Support Department at 408-734-5200.*

&Ln Leased Line

Range: 0 or 1

Default: 0

See also: A, D, &D, S100, S104

The &L command configures the modem for leased-line or dial-up line operation.

&L Same as &L0.

&L0 The modem functions as a dial-up modem.

&L1 The modem functions as a leased-line modem.

A leased-line connection may be initiated through an A or D command, by using automatic dialing (see the &D command and S104 register descriptions), or by pressing the T/D switch in the standalone modem.

The modem automatically initiates a leased-line connection on power up if the leased-line configuration has been saved to nonvolatile memory. In this case, if S0=0, the modem attempts to connect in originate mode; otherwise, it attempts to connect in answer mode.

If the modem is originating, it ignores the setting of the S7 register. If the modem is answering and does not establish a connection within the time set by the S7 register, it goes on hook, delays for 20 seconds, and again attempts to establish a connection.

Once a connection is established and a loss of carrier is detected, the modem continuously attempts to reestablish the connection.

If the user disconnects the call (by entering the H or Z command, pressing the T/D switch in the standalone modem, or dropping DTR) or aborts the call before the connection is complete, the modem does not attempt to reestablish the connection.

&Mn Asynchronous/Synchronous Mode Select

Range: 0–3

Default: 0

See also: &Q

The &M command determines the operating mode of the modem, either asynchronous or synchronous interface. &M commands are equivalent to &Q commands.

&M Same as &M0.

&M0 Asynchronous mode; equivalent to &Q0.

&M1 Synchronous mode 1; equivalent to &Q1.

&M2 Synchronous mode 2; equivalent to &Q2.

&M3 Synchronous mode 3; equivalent to &Q3.

Note: *The &M command is a subset of the &Q command. Because the functions are identical for each of the parameters of &M, only &Q appears in the &V register display.*

&Qn Asynchronous/Synchronous Mode Select

Range: 0–3, 6

Default: 0

See also: S1, S25, S104, S253

The modem can be configured for asynchronous or synchronous mode.

&Q Same as &Q0.

&Q0 Asynchronous data operation. Use S253 to set the command mode. Asynchronous interface used for data mode.

- &Q1 Synchronous data operation. Use S253 to set the command mode. When DCD goes on, the modem checks DTR after the S25 delay. If DTR is on, the modem completes the data connection. If DTR is off, the modem disconnects. DTR must be on within the time specified by the S25 register.
- &Q2 Synchronous data operation. Use S253 to set the command mode. An off-to-on DTR change causes the modem to dial a stored telephone number and try to connect.
- &Q3 Synchronous data operation. Use S253 to set the command mode. The &Q3 command uses the automatic dialing setting in S104. The S104 setting enables automatic dialing using the DTR signal from the local DTE.
- &Q6 Synchronous data operation. Use S253 to set the command mode. The modem interprets RS-232 signals according to the parameters stored in the modem.

&Rn Request to Send (RTS) and Clear to Send (CTS) Interpretation

- Range: 0–8
Default: 3
See also: S26, S68

The &R command determines how the modem uses the CTS control signal.

&R Same as R0.

&R0 CTS is on when the modem is not connected to another modem.

CTS goes off at the end of dialing when call progress monitoring begins or when the modem goes off hook to answer a call.

During a connection, the CTS signal follows the RTS signal after the delay specified by the S26 register.

- &R1 The CTS signal turns on after the modem sends the `CONNECT` result code and stays on during the connection.
- &R2 CTS is held off until a valid carrier is detected. When a carrier is detected, CTS is turned on 200 milliseconds after RTS goes active. If RTS/CTS flow control is used, CTS is used to control the flow of data from the DTE.
- &R3 CTS is always on if hardware flow control is disabled. If RTS/CTS flow control is used, CTS is used to control the flow of data from the DTE.
- &R4 CTS follows DTR when the modem is not connected to another modem.

CTS goes off at the end of dialing when call progress monitoring begins or when the modem goes off hook to answer a call.

During a connection, the CTS signal follows the RTS signal after the delay specified by the S26 register.

Note: *For &R0, &R1, and &R4, hardware flow control (S68) is overridden.*

- &R5 Operates the same as &R0; also, the modem sends a V.13 pattern when RTS is off. Valid for synchronous operation only.
- &R6 Operates the same as &R4; also, the modem sends a V.13 pattern when RTS is off. Valid for synchronous operation only.
- &R7 The CTS signal follows the RTS signal after the delay specified by the S26 register.
- &R8 CTS control for the SDLC accelerator (S111). When the modem is in data mode and the SDLC accelerator is running, the modem sends the current SDLC packet to the DTE when RTS goes from off to on, before the modem turns on CTS. When RTS goes from on to off, the modem restarts the SDLC accelerator.

&Sn Data Set Ready (DSR) Control

Range: 0–4

Default: 0

See also: S47

The &S command controls the data set ready (DSR) signal.

&S Same as &S0.

&S0 DSR is always on.

&S1 DSR is on after the modem detects an answer tone, and it stays on throughout the connection.

&S2 DSR is on except when it pulses off for the time defined by S47 when disconnecting a call.

&S3 DSR is on if DTR goes on, or if carrier is detected and DTR is present. DSR goes off if DTR is dropped or the carrier is lost.

&S4 When the local modem detects a carrier from the remote modem, the DSR signal turns on after the `CONNECT` result code is sent to the DTE. The DSR signal turns off when the carrier is dropped.

&Tn Test Modes

Range: 0, 1, 3–9

Default: 4

See also: H, Z, S18

Use the &T command to determine if a communications problem is caused by the local modem or DTE, the remote modem or DTE, or the connections between the two sites. When the modem is performing a test, its modem ready (MR) indicator blinks approximately once per second.

Turn off error control before using the &T command.

&T Same as &T0.

- &T0 Ends the test in progress. To end a test, you can also use the H (hang-up) or Z (reset) command, or you can set the S18 register to end a test automatically after a specific amount of time.
- &T1 Checks the path between the local modem and DTE. Enter &T1, wait for the `CONNECT` message, then type a few sentences. If the DTE screen displays your keyboard input as you type, the local DTE and modem are operating correctly. End the test by entering an escape sequence and &T0 command.
- &T3 Checks the communication link and the remote modem. During this test, the local modem sends incoming data directly back to the remote modem. Establish a connection with a remote modem, then enter an escape sequence and &T3 command. Ask the person at the remote modem to type a few sentences. If the data is sent back to the remote modem without errors, the remote modem and communications link are functioning correctly.
- &T4 Enables acceptance of a test request from the remote modem.
- &T5 Denies a test request from the remote modem.
- &T6 Checks the operation of both modems, the local DTE, and the telephone connection by commanding the remote modem to loop back data received from the local modem. The remote modem must be set to grant a test request (&T4). Establish a connection with the remote modem, then enter an escape sequence and &T6 command.

After the command has been accepted, the modem goes back online. Type a few sentences. The data goes to the remote location, then directly back to your terminal without appearing on the remote DTE screen. If the modem echoes your keyboard input as you type it, the modem is operating correctly.

&T7 The local modem sends a self-test pattern to the remote modem, which returns the test pattern to the local modem. The local modem examines the received test pattern and increments a counter each time it detects an error.

The remote modem must be set to grant a test request (&T4). Establish a connection with the remote modem, then enter an escape sequence and &T7 command. When the test ends, a 3-digit number is sent to the local DTE indicating the number of errors. If the error count is 000, the modems and telephone network passed the test. An error count of 255 indicates that 255 or more errors were detected.

&T8 The modem performs a local self test. Perform this test connecting to another modem. When the test ends, a 3-digit number is sent to the local DTE indicating the number of errors. If the error count is 000, the modem passed the test. An error count of 255 indicates that 255 or more errors were detected.

&T9 Disconnects the telephone line and initiates the same internal diagnostic routines that are executed when the modem is turned on. The results of the tests appear at the end of the tests, or you can display them by entering the I1 command.

At the end of the tests, the modem restores all parameters to the values saved in the default user configuration of nonvolatile memory.

If the nonvolatile memory checksum is incorrect, the factory default settings are used.

&Vn View Active Configuration

See also: ~V, S254, S255

The &V command displays the modem's active operational parameters. The S registers that have a colon instead of an equal (=) sign have been changed from the TTY default settings.

&V Same as &V0.

&V0 Displays active RAM configuration.

&Wn Write Current Configuration

Range: 0 or 1

See also: S254, S255

The &W command writes the active configuration in RAM to nonvolatile memory. It does not change the value of registers S254 and S255. The nonvolatile memory configuration that is written depends on the parameter used.

&W Same as &W0.

&W0 Writes current settings to configuration specified by the value of the S255 register.

If S255=0, save configuration in A.

If S255=1, save configuration in B.

&W1 Writes current settings to Configuration B.

&Xn Select Clock Source

Range: 0–2

Default: 0

The &X command selects which clock the modem transmitter uses in synchronous mode.

&X Same as &X0.

&X0 The modem generates the transmit clock signal and applies it to pin 15 of the RS-232 connector.

&X1 The DTE generates the clock signal and applies it to pin 24 of the RS-232 connector.

&X2 The modem derives the transmit clock signal from incoming data signals and applies the clock signal to pin 15 of the RS-232 connector (slave operation).

~Hn Help

Range: 0–9

This command displays brief descriptions of all commands and registers used in the modem. The descriptions are divided into pages for display purposes. Parameters 1 through 9 display the selected page. A parameter of 0 displays the first page and then places the modem into the interactive help mode.

In interactive help mode, enter **P** to go the previous page. Enter **Q** to quit interactive mode. Any other character advances the screen to the next page.

~H Same as ~H0.

~H0 Puts you in interactive help mode. This mode is not available from remote access.

~Hn Display page *n* of help text.

Note: *The modem ignores any commands on the command line following the ~H command.*

~L List Number Directory

The ~L command lists all entries from 0 through 9 that are stored in the number directory. Each entry appears on its own line. If a number is not currently set in a particular directory, the directory entry number appears alone (see Chapter 2, Modem Operation and Special Features, for examples).

If password security is enabled, the modem outputs ERROR. The screen does not display passwords.

~Mn Modify Stored Configuration

Range: 0 or 1

This command modifies parameters in the specified configuration without affecting the current operating parameters. Commands that follow the ~M command (on

the same line) are addressed directly to the stored configuration. In this mode, the modem ignores commands that do not normally change any configuration elements.

~M Same as ~M0

~M0 Modify configuration A

~M1 Modify configuration B

~Nn=x Set Number Directory

Range: 0–9

See also: ~U

The ~N command allows you to save any character string in the number directory. The modem stores the string of digits and dialing control characters, *x*, at the number location defined by *n*, where *n* may be any number from 0 through 9.

In addition to the numbers stored in the number directory, you may define alpha character names to use for later reference in initiating calls or as passwords for modem security.

To define a name or a password for a particular telephone number, you must precede and follow the name or password by a backslash symbol (\). Each directory number can contain up to 70 characters. For example:

```
AT ~N3=1234567\TEST\
```

Any string can be saved in the number directory.

Note: *When using modem security, the passwords are sensitive to uppercase and lowercase entry. Enter each password exactly as originally defined.*

When password security is enabled (S46 is not 0), you must enter the ~U password before the modem accepts changes to the ~N number directory.

~U Update System Password

See also: S46

The ~U command allows you to change the system callback security password, which you must give in order to change the value of the S46 register. This password is also required in order to change an entry in the telephone number directory if callback security is enabled (S46 is not equal to 0).

When you enter the ~U command, the modem asks for the old password (PEP is the factory default, entered in uppercase), the new password (entered in any combination of uppercase and lowercase), and a confirmation of the new password.

After changing the password, the modem asks you to enter a new prompt string (up to 20 characters) to display at the caller's terminal. The default value of this prompt string is Enter Password:.. Press **[RETURN]** to retain this prompt string.

Note: *The modem ignores any commands on the command line following the ~U command.*

~Vn View Nonvolatile Memory Configurations

Range: 0 or 1

See also: &V

The ~V command displays the nonvolatile memory (EEPROM) modem configurations. The display header shows which configuration is displayed (A or B).

~V Same as ~V0.

~V0 Display nonvolatile memory configuration A.

~V1 Display nonvolatile memory configuration B.

% Remote Modem Access

See also: S45

The % command modifier allows you to send commands to a remote modem as if the commands had been entered by the remote DTE.

All commands following a % character to the end of the command line are directed to the remote modem. For example, the command string:

AT %&V

reads the remote modem's active configuration.

A % character precedes the remote modem's responses, which are controlled by the remote modem's V and X command settings.

You can enter local and remote commands on the same line. For example, to get the protocol statistics and the line quality of the local modem followed by the same information for the remote modem, enter:

AT S74? S78? %S74? S78?

Note: *All commands following the % remote command prefix to the end of the command line are directed to the remote modem.*

The local modem first processes the local commands and displays the local data. It then sends the remote commands to the remote modem and displays an OK, indicating that the command line has been processed. The remote modem processes the command and sends back the requested data. The remote modem sends a %OK response to indicate completion of the remote command.

Once a remote command is issued, you cannot send another remote command until the remote modem has finished processing the previous command.

The %~N command causes the modem to accept a remote request to change a number directory entry only after it receives a successful ~X command and S45=1. If S45=255, the modem sends an **ERROR** message for remote ~N commands.

The %~X command causes the modem to send the ~X command to the remote modem. This command has the following syntax:

%~X<remote system password>

If S45=1 and TurboPEP, PEP or MNP error control is being used on the remote modem, it checks the <remote system password> against its local system password. Use the ~U command to set your system password.

If they are equal, the modem sends an **OK** message to the remote modem and accepts its commands for the duration of the data connection. If the parameter and the local system password are not the same, the modem sends an **ERROR** message to the remote modem and does not accept its commands.

Because the password is an arbitrary string, %~X must be the last command on a command line.

%S46 Remotely Change Modem Security

See also: S45

This command causes the modem to accept a remote request to change the system password only after it receives a successful ~X command and S45=1. If S45=255, the modem sends an **ERROR** message for remote ~N commands.

This chapter describes the S registers used in the Telebit Extended AT command set. S (for status) registers are special memory locations in an intelligent modem. These registers are used to store and configure various options in the T3000 and WorldBlazer modems.

Command Syntax

You may enter a command line of up to 80 characters in uppercase or lowercase. You must precede the first command in the line with an **AT** or **at** and follow the last command by pressing `RETURN`.

If you make an error while entering a command, simply backspace over the mistake and then retype the line. You cannot backspace over the AT prefix because it is interpreted immediately after being typed.

A comma (,) used between commands causes the modem to pause for the time specified by the S8 register.

You can repeat the last command line issued by entering **A/** or **a/**. Because it also repeats the AT prefix and `RETURN`, do not enter the AT prefix or press `RETURN` when using this command.

You can add blanks and tabs to enhance readability.

The notation *n* in the command descriptions represents a decimal numeric option. The option immediately follows the command.

For example, to turn off the result codes, enter:

AT Q1

Do not enter:

AT Q=1

The notation *x* represents an assigned value. If you enter a command without a value when one is expected, the modem assumes a 0 value.

How to Set and Modify a Register

The modem supports a number of definable registers. The modem remembers the last register queried or modified. For example, to set register S11 to 70, enter:

AT S11=70

This sets S11 to a value of 70. You can then enter:

AT=95

This sets S11 to a value of 95, because the modem remembered that S11 was the last register modified.

If you use an S command with no number, the register number defaults to 0 and the modem changes the value of S0. For example, the following are equivalent:

AT S0=3

AT S=3

Register Inquiry

Entering the *ATS*n*?* command allows you to read the contents of a given S register.

As in modifying a register, the modem also remembers the location of the last inquiry. For example, the following sequence of commands displays the contents of the S11 register twice:

AT S11? This displays the value of S11.

AT? This displays the value of S11.

When you use S with no number, the register number defaults to 0 and the modem responds with the value of S0. For example, to display the value of S0, enter:

AT S?

Register Concatenation

Register modifications and inquiries can be linked together on the same command line. For example, to display the value of S11 and then set it to a value of 60, enter:

AT S11?=60

The following example sets S11 to the value of 60 and then displays its contents.

AT S11=60?

Register Initialization

If you turn the power off and then on, reset the modem with a Z command, or, for the standalone modem, press the A/B switch, the modem resets the register values stored in the nonvolatile memory.

Caution: *All unused register numbers and parameters outside of the defined range are reserved for future expansion and may cause undesirable results if used.*

To view the screen displays for all S registers, enter an &V command:

AT &V

Registers

The following paragraphs describe the S registers and their available settings.

S0 Automatic Answer

Range: 0–255

Default: 0

The S0 register determines the number of rings after which the modem answers a call. The modem counts the number of rings and answers the call when the count is greater than or equal to the value contained in this register. S0=0 disables auto-answer.

S1 Ring Count

Range: 0–255

The S1 register contains the number of incoming rings. If the modem does not answer, and if more than 8 seconds have elapsed since the last ring, the count is reset to 0. This is a read-only register.

S2 Escape Character

Range: ASCII Code 0–255

Default: ASCII Code 43 (+)

See also: S12, S48

The S2 register contains the code used as the escape character. To disable the modem's ability to recognize the escape character, set S2 to a value greater than 127 and S48 to 0.

S3 Command Line Termination Character

Range: ASCII Code 0–127

Default: ASCII Code 13 (RETURN)

The S3 register defines the character used as the RETURN character when in command mode. Attempting to set S3 to a value greater than 127 generates an `ERROR` response.

S4 Line Feed Character

Range: ASCII Code 0–127

Default: ASCII Code 10 (line feed)

The S4 register defines the character used as the line-feed character when in command mode. Attempting to set S4 to a value greater than 127 generates an `ERROR` response.

S5 Backspace Character

Range: ASCII Code 0–255

Default: ASCII Code 8 (backspace)

The S5 register sets the backspace character. When the modem receives this character in command mode, it removes the last character in the command line. The last character is also removed from the command buffer. This character does not back up over the `AT` prefix.

S6 Pause Before Dialing

Range: 2–255

Default: 2 (seconds)

The S6 register contains the length of time in seconds that the modem waits after going off hook before it starts the dialing sequence. This allows the telephone central office time to detect the off hook condition and apply a dial tone.

S7 Wait for Connection/Dial Tone Time

Range: 1–255
Default: 60 (seconds)

The S7 register controls the time in seconds that the modem waits for the remote modem to send a valid carrier tone. This register defines the duration of the W modifier in the Dial command.

S8 Comma Pause Time

Range: 0–255
Default: 2 (seconds)

The S8 register contains the time in seconds that the modem waits when it encounters a comma in the command line, inside or outside of a dial string.

S9 Carrier Redetect Time

Range: 1–255
Default: 6 (600 milliseconds)

The S9 register contains the length of time that the modem waits before reestablishing a connection to the telephone line when a carrier has been detected after it was lost. Each count represents 100 milliseconds.

S10 Carrier Loss Disconnect Time

Range: 0–255
Default: 14 (1.4 seconds)

The S10 register contains the amount of time the modem waits after the carrier has been lost before disconnecting the line. Each count represents 100 milliseconds. When S10=255, the modem does not disconnect until explicitly told to do so.

S11 Touch Tone Timing

Range: 50–255

Default: 70 (milliseconds)

The S11 register defines the time in milliseconds of the duration and spacing of the tones in tone dialing. The S11 register does not affect pulse dialing, which is fixed at 100 milliseconds per pulse.

S12 Delay for Prompt Message

Range: 0–255

Default: 50 (1 second)

The delay for prompt message is the time delay immediately after entering three consecutive escape characters in data mode before the modem issues an OK prompt. This delay time also applies to the time between the escape characters. The delay time is in units of 20 milliseconds (1/50 second).

S18 Test Duration Timer

Range: 0–255

Default: 0

See also: &T

This register determines the length of time in seconds a diagnostic test runs before automatically ending. If the register is left at its factory default setting of 0, the timer does not expire.

S25 DTR Delay Timer

Range: 5–255

Default: 5 (50 milliseconds)

The S25 register causes the modem to ignore DTR level changes with a duration of less than the value specified. Each unit represents 10 milliseconds.

When the modem is in asynchronous/synchronous mode (&Q1), S25 determines the number of seconds after a data connection has been synchronized before the modem looks at the DTR signal. If DTR is on at that time, the modem does not disconnect.

S26 RTS-to-CTS Delay Interval

Range: 0–255
Default: 1 (100 milliseconds)
See also: &R

When &R0 or &R4 are in effect and the modem detects an on-to-off or off-to-on RTS transition, the modem delays the period of time specified by this register before turning the CTS signal on. Each unit represents 100 milliseconds.

S38 Delay Before Disconnect

Range: 0–255
Default: 0

When the modem receives a command to hang up, it waits up to the number of seconds specified by this register before disconnecting. This delay is used in any mode to ensure that data in the modem's buffers is sent before the connection ends.

If the timeout occurs before the modem transmits the buffered data, the modem sends a NO CARRIER result code to the DTE indicating that data has been lost. If all data is transmitted before the timeout, the modem sends an OK response. Possible settings for this register are as follows:

- 0 Discard buffered data and disconnect.
- 1–254 Attempt to transmit buffered data until completed. If the remote modem hangs up or the S38 timer expires, the untransmitted data is discarded and the modem disconnects.

255 Attempt to transmit buffered data until completed. If the remote modem hangs up, untransmitted data is discarded.

Note: *If S38=255, the modem never times out. It disconnects only when all of the buffered data has been sent or the carrier from the other modem is lost.*

S41 Inactivity Timeout

Range: 0–255

Default: 0

The S41 register specifies the amount of time in tenths of hours (6 minutes per count) that the modem allows the connection to be idle. If the modem does not receive data from the local DTE or the remote modem within the time specified by this register, it disconnects the call. This timeout prevents frozen asynchronous connections from running up an expensive connection cost. The register default setting of 0 disables the inactivity timer.

S45 Remote Access Enable

Range: 0, 1, or 255

Default: 0

See also: %, S180

The S45 register enables or disables access to the modem control functions from a remote modem.

To allow remote command access, the modems must connect with TurboPEP, PEP, or MNP, and this register on both modems must be set to 1 or 255 before connecting. Remote access is not enabled for a session unless these conditions are met.

Possible settings for this register are as follows:

- 0 Disables remote access.
- 1 Enables remote access with password security.
- 255 Enables/negotiates remote access.

S46 Modem Security

Range: 0–3

Default: 0

See also: ~L, ~N, ~U

Register S46 determines the type of call security used when the modem answers an incoming call.

To change the setting of this register, you must enter a password. The default system password is PEP, which must be entered in uppercase. You can change the password by entering the ~U command.

Possible settings for the register are as follows:

- 0 Callback security disabled.
- 1 Callback security enabled.
- 2 Callback security enabled with password reverification.
- 3 Pass through security enabled; no callback occurs.

When the S46 register is set to 1, the modem prompts the caller for a password. If the password entered by the caller corresponds to a password listed in the number directory, the answering modem hangs up the phone, waits 15 seconds, and calls back the appropriate number indexed in the number directory, eventually connecting the caller to the local DTE.

When S46 is set to 2, the modem prompts the caller for a password. If the password is correct, the modem hangs up, calls the appropriate number, and again prompts the original caller for the password. If the password is verified, the modem connects the caller to the local DTE.

If S46 is set to 3, the modem prompts the caller for a password. If a valid password is entered, the modem immediately connects the caller to the local DTE. No callback occurs.

Note: *The user passwords are not the system password. The user password entered by the caller is the password stored in the number directory with the ~N command. The caller does not use the system password set with the ~U command.*

S47 DSR/DCD Delay Time

Range: 0–255
Default: 4 (200 milliseconds)
See also: &S, &C

The S47 register specifies the amount of time that DSR or DCD is pulsed when carrier is lost and &S2 or &C2 is in effect. Each count represents 50 milliseconds.

S48 Control Character Mask

Range: 0 or 1
Default: 0

The S48 register controls how the modem determines if a character sent by the local DTE is an XON, XOFF, or escape character. Possible settings for this register are as follows:

- 0 The most significant bit of the 8-bit character received is set to 0 before comparing it with the value in the S2, S56, and S57 registers to determine if the character is an escape, XON, or XOFF character, respectively. As a result, if S2, S56, or S57 is set to a decimal value greater than 127, the modem disables recognition of the character specified by the register.
- 1 All 8 bits are compared with the value in the S2, S56, or S57 registers to determine if the character is an escape, XON, or XOFF character. Use this register setting only when the local DTE is using 8 data bits with or without parity.

Note: *If the local DTE uses a data format of 7 data bits plus parity, set the S48 register to 0 to mask the eighth bit when testing for escape, XON, or XOFF. This permits end-to-end parity checking between data and allows the modem to recognize escape, XON, and XOFF.*

S50 Modulation Speed

Range: 0–3, 5–7, 254, 255

Default: 0

See also: S92, S94

The S50 register determines the modulation speed between modems. Possible settings for this register are as follows:

- 0 Automatic speed determination
- 1 300 bps (Bell 103 or V.21)
- 2 1200 bps (Bell 212A or V.22)
- 3 2400 bps (V.22*bis*)
- 5 1200/75 bps (V.23)
- 6 9600 bps (V.32)
- 7 14,400 bps (V.32*bis*)
- 254 Attempt to connect at the closest current DTE speed (non-PEP)
- 255 Fast operation (TurboPEP or PEP mode)

If S94 is set to 0, the modem connects only at the speed specified by the S50 register. If the S94 register is set to 1, it attempts to connect at any speed up to the maximum specified by the S50 register. If the S50 register is set to 0, the modem automatically determines the appropriate data transmission method.

If you set S50 to 1 or 2, use the B command to select between Bell and CCITT standards.

If you set S50 to 3, the modem operates in V.22*bis* mode and starts any search sequence at 2400 bps.

If you set S50 to either 2 or 3, the modem checks the &G command to determine what type of guard tone (if any) to transmit with the data in answer mode.

If you set S50 to 5, the modem operates using the V.23 standard. If the modem originates a call, it modulates data at 75 bps and demodulates data at 1200 bps. If the modem answers a call, it modulates data at 1200 bps and demodulates data at 75 bps. V.23 operation works only in buffered data mode.

If you set S50 to 6, the modem operates in V.32 mode and starts any search sequence at 9600 bps.

If you set S50 to 7, the modem operates in V.32*bis* mode and starts any search sequence at 14,400 bps.

If you set S50 to 254, the modem automatically searches for the correct transmission speed starting with the closest current non-PEP DTE speed. Its default is the highest single-carrier speed supported by the modem. For example, if the last AT command was entered at 2400 bps, the modem attempts to connect at 2400 bps, followed by 1200 bps and finally 300 bps. The modem attempts a V.32 connection only if the last AT command was issued at 9600 bps or and it attempts a V.32*bis* 14,400 bps connection if the last AT command was issued at 19,200 bps or greater.

If you set S50 to 255, only TurboPEP or PEP connections are allowed.

S51 DTE Interface Speed

Range: 0–9, 35, 43, 46, 252–255

Default: 252

The S51 register determines the data rate between the modem and the local DTE when operating asynchronously.

When the modems connect and nonbuffered mode is enabled, the local DTE must be set to match the modem's transmission speed indicated by the `CONNECT XXXX` result code. Failure to do so results in erroneous data. When the connection ends, the speed reverts to that specified by S51 unless S51 is set to 252, 253, 254, or 255 (autobaud).

Possible settings for this register are as follows:

- | | |
|-----|---|
| 0 | 300 bps. |
| 1 | 1200 bps. |
| 2 | 2400 bps. |
| 3 | 4800 bps. |
| 35 | 7200 bps. |
| 4 | 9600 bps. |
| 43 | 12,000 bps. |
| 46 | 14,400 bps. |
| 5 | 19,200 bps. |
| 6 | 38,400 bps. |
| 7 | 57,600 bps. |
| 8 | 76,800 bps. |
| 9 | 115,200 bps. |
| 252 | Autobaud on every AT command. |
| 253 | Autobaud on the first AT command only. Default to 38,400 bps on incoming calls. |
| 254 | Autobaud on the first AT command only. Default to 19,200 bps. |
| 255 | Autobaud on the first AT command only. Default to 9600 bps. |

Note: *Autobaud does not support 57,600, 76,800, or 115,200 bps. You must use autobaud with one of the following data formats:*

- 8-bit data with no parity
- 7-bit data with even, odd, mark, or space parity
- 8-bit data with mark parity

When S51 is set to 252, the modem examines each AT prefix to derive the current interface speed, and you cannot enter a new command line until the result code from the previous command is displayed. If no command lines have been entered after powering on, the speed at which the default configuration was saved is the speed the modem uses to send RING and CONNECT messages when it receives an incoming call.

When S51 is set to 253, 254, or 255, the modem checks the interface speed on the first AT prefix only after one of the following events occurs:

- The modem is powered on or reset.
- S51 is set to 253, 254, or 255 while in command mode.
- A data call disconnects and the modem goes on hook.
- A break is received from the local DTE.
- A NO CARRIER condition is generated because connect time has expired (S7 register), dial command is aborted, or the carrier is lost.

If no command lines have been entered after powering on, the modem uses 38,400 bps (S51=253), 19,200 bps (S51=254), or 9,600 bps (S51=255) to send RING and CONNECT messages when the modem receives a call.

S56 XON Character

Range: ASCII Code 0–255
Default: ASCII Code 17 (**CTRL**-Q)
See also: S48

The S56 register defines the character to be used for resuming data flow when S58 or S68 is set to 3 or 4.

S57 XOFF Character

Range: ASCII Code 0–255
Default: ASCII Code 19 (**CTRL**-S)
See also: S48

The S57 register defines the character to be used for suspending data flow when S58 or S68 is set to 3 or 4.

S58 DTE Flow Control

Range: 0–4
Default: 3
See also: S48, S56, S57, S68, S180, S181

The S58 register determines the local DTE's method for controlling the flow of data coming from the modem when a buffered or error-control connection occurs. Possible settings for this register are the following:

- 0 No flow control.
- 1 Use RTS/CTS flow control in half-duplex mode. When the local DTE turns on RTS, the modem responds by turning on CTS. The modem receives data from the local DTE. When the local DTE turns off RTS, the modem turns off CTS and sends buffered data to the local DTE.
- 2 Use full-duplex RTS/CTS flow control. When RTS is off, the modem does not send data to the local DTE. When RTS is on, the modem sends data to the local DTE.

- 3 Use XON/XOFF flow control. If the modem receives an XOFF character, it stops sending data to the local DTE until it receives an XON. The XON and XOFF characters used for flow control are defined by the S56 and S57 registers, respectively. The S48 register defines how the modem determines if an XON or XOFF is received when an 8-bit data format is used.
- 4 Use both XON/XOFF flow control and full-duplex RTS/CTS flow control. If the modem receives an XOFF or if RTS is off, the modem stops sending data to the local DTE. Sending resumes when RTS goes on or if XON is received.

S59 CONNECT Suffixes

Range: 0–15

Default: 0

See also: V, X, Appendix B

S59 is a bit-mapped register. In word response mode (V1), each of the `CONNECT` messages can have suffixes, which are separated by the slash (/) character and controlled by this register.

If a particular bit is a 0, that suffix is disabled. If a particular bit is a 1, that suffix is enabled.

With X0, the modem reports `CONNECT`, without the speed, in the main body of the connection result code. Suffixes are appended according the value of this register.

With X1 or X2, the modem reports the connection speed in the main body of the result code, and the “Other” Speed reports the RS-232 interface speed.

With X4, X11, or X12, the modem reports the RS-232 interface speed in the main body of the result code and a second speed, which is the connection (or RS-232 interface) speed.

S60 Data Format

Range: 0–4

Default: 0

The S60 register defines the format of the data sent over the serial interface between the local modem and the local DTE.

Possible settings for this register are the following:

- 0 8 data bits, no parity (10-bit word size).
- 1 8 data bits, odd parity (11-bit word size).
- 2 8 data bits, even parity (11-bit word size).
- 3 8 data bits, mark parity (11-bit word size).
- 4 8 data bits, space parity (11-bit word size).

Note: *For links that use 7 data bits and parity, leave S60 at the default of 0 to allow end-to-end parity checking.*

S61 Local Action on Break

Range: 0 or 1

Default: 1

The S61 register determines how the modem reacts when it detects a break signal from the DTE. Possible contents for this register are as follows:

- 0 Break is processed as defined in the S63 register.
- 1 Go into command mode.

S62 Break Length

Range: 0–255

Default: 15 (150 milliseconds)

The content of the S62 register determines the length of time a break signal is placed on the receive data (RD) line when the modem receives a break from the remote modem during an error-controlled connection. Each count represents 10 milliseconds.

S63 Link Layer Action on Break

Range: 0–3

Default: 0

The S63 register determines the modem's response when the local DTE transmits a break signal. Possible settings for this register are as follows:

- 0 Break is in sequence with the data.
- 1 Send break to remote DTE immediately.
- 2 Reserved.
- 3 Discard break signal.

S64 Dial/Answer Sequence Abort

Range: 0 or 1

Default: 0

The S64 register controls whether the modem aborts a dialing or answering sequence if the local DTE transmits characters before a connection occurs. Possible settings for this register are as follows:

- 0 Abort the dialing or answering sequence if the local DTE transmits characters before a connection is established.
- 1 Ignore any characters sent by the local DTE while dialing or answering a call.

S68 DCE Flow Control

Range: 0, 2–4, 255

Default: 255

See also: S48, S56, S57, S58, S180, S181

The S68 register determines the method of flow control used by the modem. This register, in conjunction with the S58 register, controls the flow of data from the local DTE to the modem when a buffered or error-controlled connection occurs.

If S58 is set to 1, the modem ignores the contents of the S68 register and operates in half-duplex mode. Refer to the S58 register description for information on half-duplex operation.

Possible settings for the S68 register are as follows:

- 0 No flow control.
- 2 Use full-duplex RTS/CTS flow control. The modem turns CTS off when it wants to stop the flow of data from the DTE. The modem turns CTS on when it is ready to accept data.
- 3 Use XON/XOFF flow control. The modem issues an XOFF when it wants to stop the flow of data and an XON to resume the flow of data. The XON and XOFF characters used for flow control are defined by the S56 and S57 registers, respectively.
- 4 Use both XON/XOFF and RTS/CTS flow control.
- 255 Use the flow control specified by the S58 register.

S69 XON/XOFF Signal Handling

Range: 0–2

Default: 0

The S69 register determines how the XON/XOFF character is handled when the local DTE uses XON/XOFF flow control. Possible settings for this register are as follows:

- 0 The modem processes and discards the XON/XOFF character and does not pass it to the remote modem.
- 1 Reserved.
- 2 If it has previously received an XOFF character, the modem processes the XON character and does not pass it on to the remote modem. If the modem has not received an XOFF character, the modem does not process the XON character but passes it on to the remote modem.

S70 Transmit Modulation Rate

The *S70* register indicates the modulation rate at which the local modem transmits data to the remote modem in bits per second. *S70* contains either the current data rate if communication is currently active or the last sample made if the connection is broken.

The register includes PEP and TurboPEP modulation rates. Any new connection attempt resets this register. This is a read-only register. It provides statistical information and cannot be set by the user.

S71 Transmit Bits Per Channel

S71 is used for TurboPEP or PEP connections only. It shows the number of transmit bits assigned to each channel at 512 frequency points in the current telephone connection.

If the modem is not connected in TurboPEP or PEP mode, the register returns `ERROR`. Any new connection attempt resets this register. This is a read-only register. It provides statistical information and cannot be set by the user.

S72 Receive Modulation Rate

The S72 register indicates the modulation rate at which data is being received from the remote modem in bits per second. It includes TurboPEP or PEP modulation rates. S72 contains either the current data rate if communication is active or the last sample made if the connection is broken. Any new connection attempt resets this register.

This is a read-only register. It provides statistical information and cannot be set by the user.

S73 Receive Bits Per Channel

S73 is used for TurboPEP or PEP connections. It shows the number of receive bits assigned to each channel at 512 frequency points in the current telephone connection.

If the modem is not connected in TurboPEP or PEP mode, the register returns `ERROR`. Any new connection attempt resets this register. This is a read-only register. It provides statistical information and cannot be set by the user.

S74 Link Protocol Packets Statistics

S74 shows the statistics of the connection in the following format:

```
nnnn  PACKETS  TRANSMITTED
nnnn  PACKETS  RECEIVED
nnnn  PACKETS  RETRANSMITTED
nnnn  PACKETS  NACKED
OK
```

If the data transmission is not error corrected, S74 shows `OK` only. This is a read-only register. It provides statistical information and cannot be set by the user.

S78 Line Quality

The S78 register reports the modem's estimate of the quality of the current connection. This register is valid for all modulations except V.21 or Bell 103. The quality registers on a scale from 0 to 100. The higher the number, the better the line quality. Errors are less likely to occur on a higher quality line.

A line quality greater than 50 can be considered acceptable for good communications. You may want to redial to establish another connection if the line quality is less than 30, because the line error rate may increase transmission cost and reduce reliability. This is a read-only register. It provides statistical information and cannot be set by the user.

S90 Data Signal Rate Select (DSRS) Behavior

Range: 0 or 1

Default: 0

The S90 register enables or disables the DSRS pin on the RS-232 interface. Possible settings for this register are as follows:

- 0 Disables DTE/DSRS input.
- 1 Enables DTE/DSRS input on the RS-232 interface. If a conflict exists between the S94 register and the DTE/DSRS line, the DTE/DSRS line takes precedence if it specifies a fallback speed.

S92 Answer Sequence Selection

Range: 0 or 1

Default: 0

See also: S50

The S92 register is used to change the sequence of answering tones issued by the modem when it answers a call with automatic speed determination (S50=0). When

S92=1, the modem accommodates slower-speed modems that may be adversely affected by TurboPEP or PEP answer tones.

The following values for the S92 register are valid only when the modem answers a call with automatic speed determination:

- 0 Issue the TurboPEP answer tones at the beginning of the search sequence.
- 1 Issue the TurboPEP answer tones at the end of the search sequence rather than at the beginning to accommodate slower-speed (non-PEP) modems. To connect TurboPEP when the answering modem's S92 register is set to 1, the calling (originating) modem must have its S50 register set to 255. Also, the calling modem's S7 register must be set to 60 seconds or more to allow enough time to detect a valid TurboPEP answer sequence.

S93 V.32bis/V.32 AC Transmit Time

Range: 3–255

Default: 8 (800 milliseconds)

See also: S50

When the modem is in answer mode and register S50 is set to 0, 6, or 7, this register sets the amount of time the modem waits for a V.32bis or V.32 originate sequence before abandoning this mode. The default of 800 milliseconds works well with most V.32bis and V.32 modems. If you have trouble connecting with some V.22bis modems, try a shorter duration.

For manual or late-answer V.32bis or V.32 modems, a longer duration may be necessary. The units for this register are 100 milliseconds.

S94 Modulation Speed Negotiation

Range: 0–3

Default: 1

See also: S50, S90

The S94 register determines whether the modem connects at any speed up to the maximum set by the S50 and S90 registers. The modem ignores this register when the S50 register is set to 0. The possible settings for the S94 register are the following:

- 0 Negotiation disabled. The speed of the connection must be as specified by the S50 register. If S50 is set to 254, the connection speed must match the speed of the last AT command.
- 1 Allows a connection at any transmission speed supported by both modems up to the maximum specified by the S50 register. The modems select the highest speed that is supported by both modems. Fallback can occur within a given modulation scheme or, if necessary, can go to another scheme.
- 2 Fallback within a specified modulation scheme only. The modem cannot use another scheme if the connection fails. Connect only at the speed set by the S50 register or the associated fallback speed.
- 3 Use appropriate fallback exclusively. Connect only in the modulation scheme set by the S50 register.

Note: *If S94 is set to 3 and the specified modulation has no fallback, the modem uses the primary speed.*

S100 Reverse Answer/Originate Mode

Range: 0 or 1
Default: 0

The S100 register controls whether the modem reverses the answer/originate protocol used to establish a connection. Possible settings for this register are as follows:

- 0 Normal mode. After dialing, the modem uses the originate protocol. If the R dial modifier is present or after answering a ring signal, the modem uses the answer protocol. In the standalone modem, the T/D switch allows the user to originate manually.
- 1 Reverse mode. After dialing, the modem uses the answer protocol. After answering a ring signal, the modem uses the originate protocol. The R dial modifier still causes the modem to use the answer protocol after dialing. In the standalone version, the T/D switch allows the modem to answer manually.

S104 Automatic Dialing

Range: 0, 1, 3, 4
Default: 0
See also: &D, ~N, S100, S105

The S104 register enables automatic dialing using the DTR signal from the local DTE or, in standalone modems, the front panel T/D switch. To ensure that the modem can interpret DTR signals, set the &D command to 1, 2, 3, or 4.

Possible settings for this register are as follows:

- 0 Disable automatic dialing.
- 1 Enable automatic dialing using an off-to-on transition on the DTR control signal line. When DTR is on, the modem goes off hook and dials the first or second number in the number directory.

- 3 In the standalone modem, pressing the T/D switch dials a prestored number. The A/B switch determines the number dialed. When the A/B switch is set to A, the modem dials the number stored in ~N0. When the A/B switch is set to B, the modem dials the number stored in ~N1.
- 4 When the DTR signal goes from off to on, the modem assumes the originate mode if S1=0. If the S1 register setting is greater than 0, the modem assumes answer mode.

The S100 register applies unless it is overridden by an R dial modifier.

S111 File Transfer Protocol Support

Range: 0, 10–14, 20, 30, 40–43, 50, 255

Default: 255

The S111 register determines which file transfer protocol, if any, should be supported during a communications session. To negotiate protocol support, the modem must have a TurboPEP, PEP, or MNP connection.

When protocol support is enabled, the modem interacts with the protocol to eliminate delays in the file transfer that normally occur with other high-speed modems. This significantly increases the data throughput rate without altering the protocol functionality.

Possible settings for this register are as follows:

- 0 No protocol is supported.
- 10 Kermit protocol with no parity supported.
- 11 Kermit protocol with odd parity supported.
- 12 Kermit protocol with even parity supported.
- 13 Kermit protocol with mark parity supported.
- 14 Kermit protocol with space parity supported.
- 20 Xmodem/Ymodem protocol supported.

- 30 UUCP-g protocol supported.
- 40 ENQ/ACK protocol—Host (negotiated).
- 41 ENQ/ACK protocol—Terminal (negotiated).
- 42 ENQ/ACK protocol—Host (not negotiated).
- 43 ENQ/ACK protocol—Terminal (not negotiated).
- 50 Selects the SDLC accelerator (set &Q6 when S111=50).
- 255 Use protocol specified by remote modem.

Both modems must agree on the protocol supported; otherwise, no protocol is supported. If one modem has its S111 register set to 255, it supports the protocol specified by the other modem. If both modems have the S111 register set to 255, no protocol is supported.

When S111 is set to 42 or 43, you do not need to set the modem for error correction because the modem always assumes the flow control of ENQ/ACK. For all other settings, protocol support is negotiated only when the modems use TurboPEP, PEP, or MNP error correction.

Note: *To UUCP Users—For additional information when configuring the modem for UUCP protocol support, use your hardware and software configuration guides for your UNIX operating system or refer to the Nutshell handbook entitled Managing UUCP and Usenet, published by O'Reilly and Associates, Inc. For specific configuration guides, call your Technical Support representative.*

Note: *To Kermit Users—The modem modifies the S packet exchange to force the use of Kermit without sliding windows. The [CTRL]-X and [CTRL]-Z options for interrupting file transfer operations are not supported when used to interrupt the reception of a file. However, these two options can be used to interrupt the transmission of a file.*

S112 Kermit Mark Character

Range: ASCII Code 0–255
Default: ASCII Code 1 (CTRL-A)

The S112 register specifies the character used by Kermit as a mark character to begin a packet. The default of 1 (ASCII CTRL-A) is the standard mark character used by Kermit. This register applies only while operating in Kermit protocol support mode.

S113 Tilde (~) Character Alternative

Range: ASCII Code 0–127
Default: ASCII Code 126 (~)
See also: Chapter 3

The tilde (~) is used with certain AT commands. However, this character does not appear on all keyboards. You can either use the S113 register to select a character that is more convenient to use or continue to use the tilde.

S114 Calling Tone Enable

Range: 0 or 1
Default: 0

The S114 register controls the calling tone function. When enabled, the modem issues the calling tone. Possible settings for this register are as follows:

- 0 Calling tone is disabled.
- 1 Calling tone is enabled.

S115 Answer Tone Detection Required

Range: 0 or 1
Default: 0

The S115 register controls answer tone detection.

- 0 Answer tone detection is not required. The modem does not need to detect an answer tone to proceed with the modulation handshake.

- 1 Answer tone detection is required. The modem must receive an answer tone before proceeding with the modulation handshake.

S151 Synchronous Clock Speed

Range: 0–5, 35, 43, 46

Default: 4

See also: &Q, &X, S111

The S151 register sets the synchronous clock speed. This register is in effect in synchronous command modes and when you use the SDLC accelerator (S111). Possible settings for this register are as follows:

0	300 bps
1	1200 bps
2	2400 bps
3	4800 bps
35	7200 bps
4	9600 bps
43	12,000 bps
46	14,400 bps
5	19,200 bps

S155 NRZ/NRZI Data Encoding

Range: 0 or 1

Default: 0

See also: S111

The S155 register specifies which data-encoding method is used with the SDLC accelerator. The values for this register are as follows:

- 0 NRZ encoding is used. A 1 (one) is represented by a high level and a 0 (zero) by a low level.

- 1 NRZI encoding is used. A 1 (one) is represented by no change in the level and a 0 (zero) by a change in the level.

S180 Error Control Request

Range: 0–3

Default: 2

See also: S181

The S180 register determines whether or not an error control connection should be attempted and also determines the type. Table 4-1 shows how S180 values are set for error control mode. This register does not affect TurboPEP or PEP. Possible settings for this register are as follows:

- 0 Error control disabled.
- 1 V.42 (LAP-M) without detection phase; MNP fallback not allowed.
- 2 V.42 with detection phase; MNP fallback allowed.
- 3 MNP error control.

Table 4-1. Error Control Mode and Fallback

Error Control Mode and Fallback			S180	S181
		Direct*	0	0
LAP-M →		Direct*	1	0
LAP-M →	MNP →	Direct*	2	0
	MNP →	Direct*	3	0
		Buffered	0	1
LAP-M →		Buffered	1	1
LAP-M →	MNP →	Buffered	2	1
	MNP →	Buffered	3	1
LAP-M →	MNP →	Disconnects	2	2
LAP-M only →		Disconnects	1	2
	MNP only →	Disconnects	3	2
No connection			0	2

* In direct (nonbuffered; no error control) connections, the DTE speed matches the modulation speed.

S181 Error Control Fallback

Range: 0–2

Default: 1

The S181 register determines the alternatives for the modem if an error-controlled connection could not be negotiated or is turned off. Table 4-1 shows how S181 values are set for error control fallback. Possible settings for this register are the following:

- 0 If no error control, nonbuffered mode. DTE speed matches modulation speed. Flow control is disabled.

- 1 If no error control, buffered mode. Flow control is enabled.
- 2 If no error control is negotiated, the connection is dropped.

S183 Error Control Detection Timer

Range: 8–255
Default: 25 (2.5 seconds)

This register determines the amount of time the modem waits for the LAP-M or MNP mode start pattern. The units for this register are 100 milliseconds.

S190 Data Compression Enable

Range: 0 or 1
Default: 1
See Also: S180, S191

The S190 register controls data compression negotiation. It allows the modem to use *V.42bis*, MNP 5, or Telebit LZ compression, depending on the setting of the S191 register. When S190 is set to 1 (enable compression), the modem automatically negotiates the most beneficial compression method.

Possible settings for the register are as follows:

- 0 Disabled in both directions.
- 1 Enabled in both directions.

S191 Data Compression Negotiation

Range: 6 or 7
Default: 7

If S191=7, Telebit Lempel-Ziv (LZ) is negotiated along with *V.42bis* data compression. *V.42bis* is selected if the remote modem supports both compressions.

If S191=6, Telebit LZ is not negotiated.

The values for the S191 register are as follows:

- 6 Disables Telebit LZ compression.
- 7 Enables negotiation of Telebit LZ compression if data compression is enabled.

S253 Command Set Selection

Range: 0, 10, 20, 22, 32

Default: 10

See also: Z, &W

The register specifies the modem's command set. After the register is set and saved to nonvolatile memory, the appropriate command set becomes active (along with that command set's operational properties) the next time you reset the modem. Possible settings for this register are as follows:

- 0 No command set (modem does not respond to any commands).
- 10 AT asynchronous command set.
- 20 V.25*bis* asynchronous command set.
- 22 V.25*bis* bit-synchronous command set.
- 32 LPDA bit-synchronous dialing.

Note: *Changing this register does not change any of the other registers or the functions that they control.*

S254 &F0 Configuration Select

Range: 0, 1, 255

Default: 255

See also: &F

When you use the &F0 command, the S254 register defines the configuration that is recalled. Possible settings for this register are as follows:

0 Load configuration A.

1 Load configuration B.

255 Load factory defaults.

Note: *An &F command does not change the setting of this register.*

S255 Configuration Select

Range: 0, 1, 255

Default: 255

The S255 register designates which user configuration to recall when you turn on or reset the modem. The possible settings for this register are as follows:

0 Recall user configuration A after power up or reset. When the modem uses automatic dialing, it dials location 0 in the number directory.

1 Recall user configuration B after power up or reset. When the modem uses automatic dialing, it dials location 1 in the number directory.

255 For standalone modems, check the A/B switch. If the switch is set to A, load configuration A on power-up; if switch is set to B, load configuration B on power-up.

This chapter describes the diagnostic tests and provides user assurance test procedures and troubleshooting guidelines to use if you encounter a problem while setting up or using the modem.

Diagnostic Tests

When you turn the power on, the modem automatically runs a series of self-diagnostic tests. You can view the results of these tests by using the `II` command. This command returns a decimal number that represents the sum of the failure codes triggered during testing. If no errors are detected during the diagnostic tests, the DTE screen displays 000 (zero).

You can run the diagnostic tests at any time by using the `&T9` command. However, do not run the diagnostic tests during a current communications session; this disconnects the line and resets the modem. The `&T9` command displays the results of the tests as a short message on the screen. If no errors are detected, the `&T9` command returns a `Diagnostics Complete` message.

When you turn the modem on or enter the `&T9` command, the modem performs the following diagnostic tests:

- ROM Test
- RAM Addressing Test
- RAM Read/Write Test
- EEPROM Test

- Loopback Test
- Signal Processor Test

Successful completion of the first three tests means that the modem's firmware is intact and that the memory is operating correctly.

During the EEPROM test, the modem reads a checksum, which tests the integrity of the nonvolatile memory. If the checksum is correct, Profile A or B register settings stored in nonvolatile memory are loaded into memory. If the checksum is incorrect, the factory default settings are loaded. Which configuration the modem loads depends on the current setting of the S255 register.

The final two tests check the loopback capability of the digital/analog interface chip and verify that the signal processor chip is operating correctly.

User Assurance Tests

The following tests check those components not tested at power-up. To perform these tests, you should be familiar with the contents of this manual, understand how to operate the modem, and be able to communicate with the modem through the RS-232 serial interface port using a terminal or personal computer.

Nonvolatile Memory Test

To verify that the modem's nonvolatile memory is working correctly, perform the following:

1. Enter one or two telephone numbers in the number directory (~Nn=x command).
2. Turn the modem off, then back on, and verify that the new numbers are still present (~L command).

Ring Detect Test

The easiest way to check the modem's ring detection circuit is to disable the auto-answer feature by setting the S0 register to 0, then call the telephone number to which the modem is connected. When the modem detects a ring signal, the DTE screen displays the word RING. The word should appear every four to six seconds to indicate the end of each ring signal.

If a telephone is connected to the TO PHONE connector on the rear of the modem, the telephone should also ring.

Remember to reset the S0 register to any number from 1 to 255 if you plan to use the auto-answer feature.

Common Problems

If you encounter problems while setting up and using your modem, you can simplify the troubleshooting process by progressing in stages. This approach makes it easier to isolate and resolve any problems that you might encounter as you progress through the various stages.

This section covers the following three stages of establishing a communications link:

- **Pre-Call Initialization**—Focuses on ensuring that the modem and your equipment are properly configured for communications over the DTE–DCE interface. Use this section to confirm that the modem can, in fact, communicate with your equipment.
- **Call Establishment**—Deals with problems that may occur while attempting to place or answer a call up to the point at which the modems can exchange data across the communications link. This section helps if you have problems placing or answering a call.

- **Call In Progress**—Addresses problems that may occur while actually transmitting information between two locations.

Problems that can occur while a call is in progress include the following:

- Data is lost or garbled.
- The modems unexpectedly stop communicating.
- The connection is prematurely dropped.

Note: *Before you begin troubleshooting, ensure that the DTE displays all result messages by setting the X command to either setting 2 or 12.*

Modem Preconfiguration

Is the modem configured to operate in asynchronous mode and connected to an asynchronous DTE?

The modem and DTE must be operating in asynchronous mode while preconfiguring the modem.

Is the modem ready (MR) indicator on the front panel on?

The MR light indicates that the modem is operational. If the indicator is off, try issuing an ATI1 command to obtain the results of the diagnostic tests. If you get no response or the test result code returned is not 000, try running the self diagnostics test again by using the &T9 command to restart your rackmount modem or turning your standalone modem's power off and then back on. If the MR indicator still does not turn on, contact your technical support representative for further assistance.

What are the modem's current register settings?

Issue an AT&V command to display the modem's current register settings.

Do double characters appear on the screen?

Both the DTE and the modem are echoing characters to the screen. Disable local echo on your DTE. If this is not possible, disable echo from the modem by issuing an ATE0 command to the modem.

Are you getting garbled data or no response from the modem?

Verify that the modem is connected to a functioning RS-232 port on your DTE and that the RS-232 cable is configured correctly. Refer to the appendix discussing interface descriptions in your *User's Guide*.

Make sure that the modem and DTE are both operating in asynchronous mode and are using the same interface speed and data format. Configure the modem to meet the specific requirements of your system and save the configuration parameters in nonvolatile memory.

Refer to the chapter titled The Basics in your *User's Guide* for configuration guidelines.

Is your modem's facsimile function working incorrectly or not at all?

If you are having problems when using facsimile, contact your facsimile software vendor.

Placing a Call

Are the modem and DTE installed correctly?

Be sure that the DTE is installed correctly and the modem is seated properly in the chassis. Check all cables to ensure that they are in good condition and fully connected.

Is the modem ready to accept commands or data from the DTE? The MR, data terminal ready (DTR), and clear to send (CTS) indicators should be on.

The modem must be operational and able to communicate with the DTE before placing a call.

Send a dialing command sequence to the modem from your terminal or computer.

Be sure to include any required access codes and wait for dial tone characters (W) in the dialing sequence. In the standalone modem, if your call requires operator assistance, you can place a call manually using your telephone set, then press the T/D switch to cause the modem to go off hook and listen for the called modem's answer tones.

Did the modem go off hook and begin the dialing sequence? You should hear a brief dial tone followed by dialing sounds as the modem places the call. The off hook/ring (OH/RI) indicator should be on.

The OH/RI indicator turns on when the modem is off hook, and it flashes during dialing. If the OH/RI indicator did not turn on, the modem probably did not recognize the dial command. Try entering the command again. Be sure to precede the command with an AT prefix and follow the command by pressing `[RETURN]`. Verify that the modem is properly configured to communicate with your equipment.

If the OH/RI indicator still did not turn on, check the telephone line for a dial tone to make sure the telephone line is not dead. If the line does not work, contact your telephone company service representative for assistance.

Did the remote site receive the call?

Make certain that you entered the correct dialing sequence. If you are going through a private branch exchange (PBX), you may need to enter 9W to access an outside line and wait for a second dial tone. The S7 register determines how long the modem waits for a dial tone when a W is entered in a dialing sequence.

If your call is routed through key systems, security devices, or similar equipment, additional access digits might be required, and it may take longer to set up the call. You can use one or more commas in the dialing sequence to cause the modem to pause when necessary. The length of the pause is determined by the S8 register.

You may need to extend the time that the modem waits for a carrier by increasing the value of the S7 register.

It is possible that the touch tone speed is too fast for the telephone switching equipment, which occasionally happens with older telephone equipment. Try lengthening the touch tone timing specified by the S11 register.

If the remote modem does not answer the call, ask the remote site operator to check the equipment and connections at that location.

Did the remote modem answer the call?

If the telephone continues to ring with no answer, verify that you are dialing the correct number. Ask the operator at the remote site to confirm that the remote equipment can answer the telephone.

If the ringing signal stops but the remote modem does not respond, ask the remote site operator to check the equipment and connections at that location.

Did the modems at both ends synchronize?

Verify that the modems at both ends agree on the transmission mode used. The S50 register determines the transmission mode used by the modem. If this register is not set for automatic speed determination (S50=0), it must match the transmission speed of the remote modem.

If the modem goes on hook (the OH indicator turns off) during synchronization, you may need to extend the time that it waits for a carrier by increasing the value of the S7 register.

If you are calling a V.22 or V.22*bis*-type modem, you should also check the setting of the B command and the &G command. The B command sets either 212A (B1) or V.22 (B0) emulation when operating at 1200 bps. Some V.22 or V.22*bis* modems use guard tones during synchronization. Try changing the setting of the &G register to use either a 1800 Hz guard tone (&G2) or a 550 Hz guard tone (&G1) if you have problems synchronizing in V.22 or V.22*bis*.

If expected, did you receive a valid (ungarbled) sign-on message from the remote site?

Sign-on procedures vary from one system to another. You may need to press the space bar or take some other action to get the sign-on message. Refer to the system's operating instructions for the appropriate procedure.

If, after taking the appropriate action, you still do not receive a sign-on message or the message is garbled, there may be some problem with the interface speed between the DTE and modem at either end or a mismatch in the data format (usually parity) used between the DTEs at each site.

Answering a Call

Is the MR indicator on the modem's front panel on?

The MR light indicates that the modem is operational. If the indicator is off, the modem failed the power-up diagnostic test. Contact your technical support representative for further assistance.

Did the modem answer an incoming call by going off hook when a ringing signal was received? The OH/RI indicator should be on.

If register S0 is set to 0, the modem does not automatically answer an incoming call. To enable auto-answer mode, set this register to the ring number on which the modem should answer a call.

For certain &D values, the modem does not answer an incoming call while DTR is off. Your equipment should provide this signal when it is ready to transmit or receive data or in response to a ringing signal on the RI signal line of the RS-232D interface.

If the DTR indicator on the front panel is not on, verify that the RS-232 cable is configured correctly. If your equipment asserts DTR in response to a ringing signal, verify that it is receiving a signal on the RI line and turning DTR on at the appropriate time.

Try placing the same call with a telephone set on each end of the connection. If the call cannot be placed with telephone sets, it will not work with modems.

Did the modem answer the call and then hang up before a connection was established? This can occur very rapidly so that the OH/RI indicator is barely noticeable. The caller may hear a pair of clicks after the last ring.

Make certain that your equipment is not sending a sign-on message before data carrier detected (DCD) is turned on. This could cause the modem to hang up. Note that setting S64 to 1 causes the modem to ignore any characters sent by the local DTE while dialing or answering a call.

If the modem is configured to show result messages, your equipment may be echoing the result message back to the modem causing it to hang up. To solve this problem, turn off echo and place the modem in quiet mode by issuing the E0 and Q1 commands.

For certain &D values, the modem disconnects a call if DTR is dropped. Make certain that your equipment is not turning DTR off during a call. Your equipment may be periodically switching DTR on and off while searching for an active device (looking for an active DSR or DCD signal from a modem). Try setting &C and &S to 0 to enable both of these signals. If you cannot configure your equipment to provide DTR, set &D to 0 so that the modem does not hang up when DTR is not present.

Did the modems at both ends synchronize?

Verify that the modems at both ends agree on the transmission mode used. The S50 register determines the transmission mode used by the modem. If this register is not set for automatic speed determination (S50=0), it must match the transmission speed of the calling modem.

When the modem answers a call in automatic speed determination mode, it steps through several different answer tones to allow the calling modem to synchronize on the appropriate tone. The calling modem may need to extend the time that it waits for a carrier before disconnecting to allow time for the modem to arrive at the correct answer tone.

If the calling modem is a V.22 or V.22*bis*-type modem, you should also check the setting of the B command and the &G command. The B command register sets either 212A (B1) or V.22 (B0) emulation when operating at 1200 bps. Some V.22 or V.22*bis* modems use guard tones during synchronization. Try changing the setting of the &G command to use either an 1800 Hz guard tone (&G2) or a 550 Hz guard tone (&G1) if you have problems synchronizing in V.22 or V.22*bis*.

If expected, did the calling modem receive a valid (ungarbled) sign-on message from the remote site?

Sign-on procedures vary from one system to another. The caller may need to press the space bar or take some other action to get the sign-on message. Ask the operator at the calling site to confirm that they are following the correct sign-on procedure.

If, after taking the appropriate action, the caller still does not receive a sign-on message or the message is garbled, there may be some problem with the interface speed between the DTE and modem at either end or a mismatch in the data format (usually parity) used between the DTEs at each site.

At this point, the modem should be capable of communicating with the calling modem.

Call in Progress

Is data (or the sign-on message) being garbled during transmission?

If the modems connect (CD indicator is on), the line quality of the connection may be inadequate for error-free transmission. Hang up and try placing the call again. The probability of getting the same connection is unlikely.

A problem may exist with the interface speed between the DTE and modem at either end or a mismatch in the data format (usually parity) used between the DTEs at each site. Ask the operator at the remote site to confirm that they do not have an interface speed mismatch at their end.

Check the setting of the S60 register. Except for a few rare cases, this register should be set to 0, which permits end-to-end parity checking between DTEs as well as providing a transparent data path for binary file transmissions.

Verify that the data format (data length, parity, and stop bits) used by your DTE matches the data format used by the DTE at the remote site. Refer to your equipment's manual for instructions on setting the data format.

Is data being lost during transmission?

Most problems with loss of data during transmission result from a mismatch in the flow control method used between the modem and the DTE at either end. Data in the DTE or modem's buffer is being overwritten.

The modem uses two registers to control the flow of data between the DTE and the modem. The S58 register controls data flow over the received data (RD) line to the DTE. A similar register, S68, controls data flow over the transmitted data (TD) line to the modem. The two most common flow control methods supported by the modem are XON/XOFF or RTS/CTS.

Check your equipment's manual to determine which type of flow control method it supports and set the S58 and S68 registers to match that flow control method.

The DTE may not be responding to the flow control signal soon enough to avoid a buffer overflow condition.

Did either modem unexpectedly stop transmitting or receiving data?

The calling modem, answering modem, or both modems may have been inadvertently placed in command mode by a break signal or escape sequence. Registers S61 and S63 determine how the modem responds to a break signal. The escape sequence during a data connection provides you with a way to enter command mode. An escape sequence contains three consecutive escape characters defined by the S2 register and

bordered by the proper guard time specified by the S12 register. You may need to change the setting of these registers to prevent the modem from entering command mode at an inappropriate time.

Note: *If the modem is installed in an unattended answer environment, these registers should usually be set to prevent entering command mode under any condition.*

If the answering site's modem is configured to ignore the DTR signal (&D0), it maintains the connection even if its DTE drops DTR because of inactivity or some other condition. If this happens, the calling site must terminate the connection and, if desired, reinitiate the call.

Was the connection dropped prematurely?

If the modems connect (CD indicator is on), the carrier signal may have been dropped because of a degradation in the line quality of the connection. Try placing the call again. The probability of getting the same connection is unlikely.

If the modem's &D command is set to 2 or 3 and its associated DTE drops DTR because of inactivity or some other condition, the modem disconnects the call.

Telebit Corporation has made every effort to ensure that the product you have purchased is of excellent quality in all respects. Telebit products are rigorously tested and subjected to strict quality control procedures. However, if you experience difficulty in the use of this product, or it does not appear to operate correctly, we suggest doing the following:

- Read this manual. It has been provided to help you configure and use your modem.
- Contact your dealer. Telebit authorized dealers are familiar with Telebit's products and should be able to help you resolve any problems that you may encounter while setting up and using the modem.
- Finally, call Telebit's Technical Support Department at 408-734-5200. Before calling, please have all the following information about your unit available:

Product Name

Serial Number

Date of Purchase

Place of Purchase

Install the modem on a system close to your telephone before calling Telebit Technical support. The Technical Support representative will want to test the modem with you.

If your product requires service, we will repair or replace it under the terms of our Two-Year Limited Warranty. Please read the warranty statement included in this chapter and return the Warranty Registration Card at the back of this manual.

When the Two-Year Limited Warranty period expires, Telebit will continue to service your product for the current applicable service fee. If you wish, you may extend your warranty protection for an additional two years by purchasing the Two-Year Limited Warranty Extension any time before the first two-year warranty expires. The limited warranty will then be for a total of four years from the purchase date.

However, there is a cost savings if you purchase this option within 10 days of the original equipment purchase date.

Return for Repair Procedure

The following procedure describes how to return the unit to Telebit for repair. This procedure is applicable to both in and out of warranty repairs.

1. Call Telebit's Technical Support Department at 408-734-5200 and describe the problem. Be prepared to test the unit with the service representative. Tell the technical support representative if your unit is or is not covered by warranty. He or she will issue you an RMA number.

If the unit is covered by a warranty but not registered, you must submit proof of purchase.

If you do not have proof of purchase or your unit is not covered by the warranty, you must send the current repair fee with your unit.

The technical support representative will provide you with that information and any further instructions if necessary.

2. Pack the unit in its original container or in a sturdy corrugated box using nonstatic material, such as newspaper, as a cushion. Do not use highly static-prone material such as plastic wrap or Styrofoam packing material (beads or peanuts), as they may further damage the unit in transit.
3. Ship the unit only. Do not ship manuals, power supply, or telephone cord unless your technical support representative instructs you to do so.
4. Include the following information with your unit:

Name

Address

City, State, Zip Code

Telephone Number

RMA Number

Description of the Problem

Current Repair Fee (if applicable)

5. Ship the unit (for repair) freight prepaid to:

Telebit Corporation

Attention: Technical Support RMA #

1315 Chesapeake Terrace

Sunnyvale, CA 94089

We recommend that you insure the unit when shipped. Telebit will not accept units shipped C.O.D.

6. Telebit ships the repaired or replacement product at no cost to you to any destination in the United States. Telebit will choose the carrier and method of shipment. If you desire some other specific form of conveyance or you are located outside the United States, you must bear the cost of return shipment and other incidental costs.

Two-Year Limited Warranty

Telebit Corporation (Telebit) warrants the hardware products and all components thereof against defects in materials and/or workmanship for two years from the date of your original retail purchase.

If you discover a malfunction or defect in materials or workmanship, Telebit, at its option, will repair or replace the product or component at no charge to you, provided you return it, as set forth above, during the warranty period.

Telebit will furnish repair parts and replacement products on an exchange basis; all returned parts and products become Telebit's property. Repairs and replacements may be either reconditioned or new. Telebit will make the final determination as to the existence and cause of any alleged defect. If a returned product shows (no trouble found), Telebit may assess a repair charge.

Telebit does not warrant that any product will operate uninterrupted or without error. The warranty is contingent upon proper use of the product in the application for which it is intended.

The warranty will be void on products that have been subjected to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation; modified without Telebit's approval; subjected to unusual physical or electrical stress; or used with a power supply other than the one provided with the product. Expendable items

(such as lamps and fuses) are not warranted. This limited warranty is extended only to the original purchaser and is not assignable.

THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHERS, ORAL OR WRITTEN, EXPRESSED OR IMPLIED. TELEBIT MAKES NO EXPRESSED OR IMPLIED WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT AS EXPRESSLY SET FORTH IN THIS LIMITED WARRANTY.

SOFTWARE AND DOCUMENTATION IS PROVIDED ON AN AS IS BASIS. IN NO EVENT SHALL TELEBIT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, COSTS OR EXPENSES ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF ANY PRODUCT DELIVERED HEREUNDER.

Note: *Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages for consumer products, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.*

Two-Year Limited Warranty Extension

You can extend your two-year limited warranty for an additional two years by paying a reasonable one-time fee. This fee guarantees repair or replacement of a faulty unit as often as required while it is under warranty subject to the same terms and conditions as the Telebit Two-Year Limited Warranty.

The warranty period will then be for a total of four years from the date of purchase. You may purchase this warranty extension at any time before the Two-Year Limited Warranty expires.

If you purchase this warranty extension within 10 days of the date you purchase the modem, the price of the extended warranty is reduced. Contact your sales representative or Telebit's Technical Support Department for the current pricing options for your product. Be prepared to provide them with the product name, serial number, and date and place of purchase.

You may also purchase this warranty extension by completing Part 2 of the Warranty Registration Card and returning it to Telebit Corporation.

ASCII Code Chart

A

Table A-1. ASCII Codes

Code	Mnem	Dec	Hex	Code	Dec	Hex	Code	Dec	Hex	Code	Dec	Hex
	NUL	00	00	SP	32	20	@	64	40	`	96	60
CTRL A	SOH	01	01	!	33	21	A	65	41	a	97	61
CTRL B	STX	02	02	"	34	22	B	66	42	b	98	62
CTRL C	ETX	03	03	#	35	23	C	67	43	c	99	63
CTRL D	EOT	04	04	\$	36	24	D	68	44	d	100	64
CTRL E	ENQ	05	05	%	37	25	E	69	45	e	101	65
CTRL F	ACK	06	06	&	38	26	F	70	46	f	102	66
CTRL G	BEL	07	07	'	39	27	G	71	47	g	103	67
CTRL H	BS	08	08	(	40	28	H	72	48	h	104	68
CTRL I	HT	09	09	)	41	29	I	73	49	i	105	69
CTRL J	LF	10	0A	*	42	2A	J	74	4A	j	106	6A
CTRL K	VT	11	0B	+	43	2B	K	75	4B	k	107	6B
CTRL L	FF	12	0C	,	44	2C	L	76	4C	l	108	6C
CTRL M	CR	13	0D	-	45	2D	M	77	4D	m	109	6D
CTRL N	S0	14	0E	.	46	2E	N	78	4E	n	110	6E
CTRL O	S1	15	0F	/	47	2F	O	79	4F	o	111	6F
CTRL P	DLE	16	10	0	48	30	P	80	50	p	112	70
CTRL Q	DC1	17	11	1	49	31	Q	81	51	q	113	71
CTRL R	DC2	18	12	2	50	32	R	82	52	r	114	72
CTRL S	DC3	19	13	3	51	33	S	83	53	s	115	73
CTRL T	DC4	20	14	4	52	34	T	84	54	t	116	74
CTRL U	NAK	21	15	5	53	35	U	85	55	u	117	75
CTRL V	SYN	22	16	6	54	36	V	86	56	v	118	76
CTRL W	ETB	23	17	7	55	37	W	87	57	w	119	77
CTRL X	CAN	24	18	8	56	38	X	88	58	x	120	78
CTRL Y	EM	25	19	9	57	39	Y	89	59	y	121	79
CTRL Z	SUB	26	1A	:	58	3A	Z	90	5A	z	122	7A
	ESC	27	1B	;	59	3B	[	91	5B	{	123	7B
	FS	28	1C	<	60	3C	\	92	5C	|	124	7C
	GS	29	1D	=	61	3D	]	93	5D	}	125	7D
	RS	30	1E	>	62	3E	^	94	5E	~	126	7E
	US	31	1F	?	63	3F	_	95	5F	DEL	127	7F

The modem provides you with the current status of a call by issuing result codes. Depending on the current setting of the V command, the modem's responses appear in either numeric (V0) or word response (V1) mode.

The current setting of the X command determines which set of result codes are used as described:

- X0 Use only the first five basic result codes (0–4) listed in Table B-1. No speed is reported in the `CONNECT` message. `BUSY`, `NO ANSWER`, and `NO DIALTONE` are mapped to `NO CARRIER`. The `RRING` message is not reported.
- X1 Includes the modulation speed in the `CONNECT` message. Adds result codes 5 and 10–13, 46, and 47 to the first five basic result codes (0–4) listed in Table B-1.
- X2 Supports all of the X1 result codes and adds result codes 6, 7, 52, and 53 to the result codes of X1.
- X4 Supports all of the X11 result codes and adds results codes 6 and 7 to the result codes of X11.
- X11 Includes the DTE interface speed in the `CONNECT` message. Adds result codes 5, 10–18, and 46–49 to the first five basic result codes (0–4) listed in Table B-1.
- X12 Supports all of the X11 result codes and adds results codes 6, 7, 52, and 53 to the result codes of X11.

Table B-1. Result Codes

Number	Message and Description
0	OK—The command was successfully completed.
1	CONNECT
2	RING—An incoming ring has been detected.
3	NO CARRIER—Time to connect has expired, dial command aborted, or carrier lost.
4	ERROR—A command error has been encountered.
5	CONNECT 1200—Connected at 1200 bps (Bell 212A or V.22 compatible).
6	NO DIAL TONE—No dial tone was detected.
7	BUSY—Remote telephone is busy.
8	NO ANSWER—Five seconds of silence was not detected within 30 seconds when a @ modifier was encountered in the dial string.
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 14400
14	CONNECT 19200
15	CONNECT 38400
16	CONNECT 57600
17	CONNECT 76800
18	CONNECT 115200

Table B-1. Result Codes

Number	Message and Description
46	CONNECT 7512
47	CONNECT 1275
48	CONNECT 7200
49	CONNECT 12000
52	RRING— Remote telephone is ringing.
53	DIALING
54	NO PROMPTTONE
50	CONNECT FAST

Certain modifiers of the D command generate result codes that override the X0, X1, and X11 settings. The dial modifiers are the following:

- **W**—Always returns a NO DIALTONE result code if a dial tone is not present when the W is executed.
- **@**—Always returns a NO ANSWER result code if silence is not detected within the amount of time specified by the S7 register after a remote ring.
- **\$**—Always returns a NO PROMPTTONE result code if the calling card prompt tone is not detected within the amount of time specified by the S7 register after the \$ starts execution.

When dialing using X0, X1, or X11, the modem does not recognize the busy signal because the BUSY result code has not been enabled, and the modem performs a blind wait before dialing.

When you dial using X2, X4, or X12, call progress detection is enabled. In particular, the modem recognizes the busy signal, and it requires dial tone before dialing even if the W modifier is not entered.

Each of the `CONNECT` messages can have suffixes, separated by the slash (/) character, which are controlled by the S59 register listed in Table B-2.

Table B-2. S59 Suffixes

S59	SUFFIXES			
Value	Link Protocol	Compression	DTE Protocol	Other Speed*
0				
1	X			
2		X		
3	X	X		
4			X	
5	X		X	
6		X	X	
7	X	X	X	
8				X
9	X			X
10		X		X
11	X	X		X
12			X	X
13	X		X	X
14		X	X	X
15	X	X	X	X

* If ATX is set to 1 or 2, Other Speed is the DTE speed. If ATX is set to 4, 11, or 12, Other Speed is the DCE speed.

The value of the S59 register does not affect the numeric result code associated with the root `CONNECT` message. For example:

```
CONNECT 9600/REL/COMP/19200
```

has the same numeric result code as:

```
CONNECT 9600
```

which is 12.

The format of the extended `CONNECT` message is:

```
CONNECT (X command speed) / (link)
/ (compression) / (DTE protocol) / (other speed)
```

When a suffix is not generated, the slash (/) delimiter for that suffix is also suppressed; that is, double slashes do not appear.

Table B-3 and the following paragraphs present the possible `CONNECT` message suffixes for the X command, link protocol, compression, and DTE protocol.

Table B-3. Possible X Command Speeds

X0, X1, X2	X4, X11, X12
nothing	nothing
300	300
1200	1200
2400	2400
4800	4800
7200	7200
9600	9600
12000	12000
14400	14400
1275	19200
7512	38400
FAST	57600
	76800
	115200

Possible link protocol suffixes are:

nothing

REL

LAPM

Possible compression suffixes are:

nothing

COMP

Possible DTE protocol suffixes are:

nothing

KERM

XMDM

UUCP

ENQ

ACK

Possible other speeds are shown in Table B-3.

Table B-4. Possible Other Speeds

X0, X1, X2	X4, X11, X12
nothing	nothing
300	300
1200	1200
2400	2400
4800	4800
7200	7200
9600	9600
12000	12000
14400	14400
19200	1275
38400	7512
57600	FAST
76800	
115200	

The WorldBlazer modem provides you with several prestored configurations. You can select configurations by using the AT &F*n* command, where *n* is the number of the stored configuration you have selected. After you select a configuration, you can use AT&V to display the configuration on the screen.

The following sections give suggested uses for each configuration, the appropriate &F command, and a screen display for that configuration. The commands and S registers that have been changed from &F0 settings are shown in boldface type for easy reference. S registers that have been changed from the &F0 factory default have a colon instead of an equal sign.

Configuration: TTY Command: &F0

The &F0 configuration is used with most asynchronous terminals or PCs emulating asynchronous terminal operation. The TTY settings are the factory defaults. The screen display is as follows:

```
WorldBlazer SA - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C0 &D0 &G0 &J0 &L0 &Q0 &R3 &S0 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

When selected from the front panel, the following register differs from those stored in nonvolatile memory:

```
S000=1 S045=255
```

Configuration: Unattended Answer Mode Command: &F1

The &F1 configuration is used with most asynchronous front end processor (FEP) host ports operating at a fixed interface speed of 19,200 bps. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E0 L2 M1 P Q2 V1 X1 Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R2 &S4 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051:254
S056=17 S057=19 S058=3 S059=0 S060=0 S061:0 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Configuration: Intelligent Answer Mode Command: &F2

The &F2 configuration is used with most computers running intelligent communications software that interprets the modem result codes and adjusts its speed accordingly. The modem's interface speed is fixed at 19,200 bps for error-controlled connections, and it matches the connect speed for non-error-controlled connections. Modem result codes are enabled. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X4 Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R2 &S4 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045:255 S046=0 S047=4 S048=0 S050=0 S051:254
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181:0 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Note: *The following two prestored configurations are intended for use in a UNIX/UUCP environment.*

For additional information when configuring the modem for UUCP protocol support, refer to your hardware and software configuration guides for your UNIX operating system or refer to the Nutshell handbook entitled Managing UUCP and Usenet, published by O'Reilly and Associates, Inc.

For specific configuration guides, call your Technical Support representatives at 408-734-5200.

**Configuration: UNIX/UUCP with RTS/CTS
Flow Control
Command: &F3**

The &F3 configuration is used with UNIX systems that support hardware (RTS/CTS) flow control. When a user dials in, the modem locks its interface speed to 19,200 bps. When a user dials out, the modem uses autobaud to match the computer's speed from 300 to 38,400 bps. The modem defaults to UUCP protocol support for TurboPEP, PEP, and MNP connections. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q2 V1 X0 Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R3 &S1 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051:254
S056=17 S057=19 S058:2 S059=0 S060=0 S061:0 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:30 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191:6 S253=10 S254=255
S255=255
```

Configuration: UNIX/UUCP with XON/XOFF Flow Control Command: &F4

The &F4 configuration is used with UNIX systems that cannot support RTS/CTS flow control. The modem uses a compromise software (XON/XOFF) flow control setting that does not interfere with UUCP file transfers. When a user dials in, the modem locks its interface speed at 19,200 bps. When a user dials out, the modem uses autobaud to match the computer's speed from 300 to 38,400 bps. The modem defaults to UUCP protocol support for TurboPEP, PEP, and MNP connections. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q2 V1 X0 Y0
&C1 &D3 &G0 &J0 &L0 &Q0 &R3 &S1 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051:254
S056=17 S057=19 S058:0 S059=0 S060=0 S061:0 S062=15 S063=0
S064:1 S068:3 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:30 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191:6 S253=10 S254=255
S255=255
```

Configuration: Transparent Synchronous Mode Command: &F5

The &F5 configuration is used with most 14,400 bps synchronous terminals or devices. In this configuration, the modem operates in V.32bis transparent, synchronous, full-duplex mode at 14,400 bps. Fallback to slower modulations is allowed. The modem uses the DCE clock. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q1 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q6 &R3 &S3 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:0 S254=255
S255=255
```

Configuration: Half-Duplex Transparent Synchronous LPDA Dialing

Command: &F6

The &F6 configuration enables the modem to operate in V.32bis transparent, synchronous, half-duplex mode at 14,400 bps using LPDA dialing. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C6 &D2 &G0 &J0 &L0 &Q6 &R4 &S4 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026:0
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:32 S254=255
S255=255
```

Configuration: IBM AS 400 V.25bis Bit-Synchronous Operation

Command: &F7

The &F7 configuration enables the modem to operate in V.32bis transparent, synchronous, half-duplex IBM AS 400 mode with V.25bis synchronous dialing. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V0 X0 Y0
&C6 &D2 &G0 &J0 &L0 &Q6 &R4 &S4 &T4 &X0
S000:2 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026:0
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061:0 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:22 S254=255
S255=255
```

Configuration: IBM PC or Mac with XON/XOFF Flow Control

Command: &F8

The &F8 configuration is used with most software packages that support software (XON/XOFF) flow control. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q0 &R3 &S0 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051=252
S056=17 S057=19 S058:0 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068:3 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191:6 S253=10 S254=255
S255=255
```

Configuration: IBM PC or Mac with RTS/CTS Flow Control

Command: &F9

The &F9 configuration is used with most software packages that support hardware (RTS/CTS) flow control.

Note: *To use RTS/CTS flow control on a Macintosh, the communications software must support the feature, and you need a special cable as recommended in the software documentation. You must set the modem to ignore DTR (&D0).*

The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q0 &R3 &S0 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051=252
S056=17 S057=19 S058:2 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181=1 S183=25 S190=1 S191:6 S253=10 S254=255
S255=255
```

Configuration: Leased-Line Asynchronous Originate Mode

Command: **&F10**

The &F10 configuration is used in asynchronous point-to-point, 2-wire leased-line, V.32bis applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem configured with the AT&F11 command (or any properly configured V.32bis modem) at 14,400 bps. If the modems do not negotiate error control, the connection is dropped. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 EO L2 M1 P Q2 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q0 &R3 &S1 &T4 &X0
S000=0 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007:255
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051:5
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094:2 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181:2 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Configuration: Leased-Line Asynchronous Answer Mode

Command: **&F11**

The &F11 configuration is used in asynchronous point-to-point, 2-wire leased-line, V.32bis applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem configured with the AT&F10 command (or any properly configured V.32bis modem) at 14,400 bps. If the modems do not negotiate error control, the connection is dropped. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 EO L2 M1 P Q1 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q0 &R3 &S1 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007:255
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051:5
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094:2 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180=2 S181:2 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Configuration: Leased-Line Synchronous Originate Mode

Command: **&F12**

The &F12 configuration is used in synchronous point-to-point, 2-wire leased-line, V.32bis applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem configured with the AT&F13 command (or any properly configured V.32bis modem) at 14,400 bps. The modem configuration is as follows:

WorldBlazer - Active Configuration

```

B1 E0 L2 M1 P Q1 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q6 &R3 &S3 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007:255
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094:2 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:0 S254=255
S255=255

```

Configuration: Leased-Line Synchronous Answer Mode

Command: **&F13**

The &F13 configuration is used in synchronous point-to-point, 2-wire leased-line, V.32bis applications. The modem connects automatically on a leased line to another T3000 or WorldBlazer modem configured with the AT&F12 command (or any properly configured V.32bis modem) at 14,400 bps. The modem configuration is as follows:

WorldBlazer - Active Configuration

```

B1 E0 L2 M1 P Q1 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q6 &R3 &S3 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007:255
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094:2 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:0 S254=255
S255=255

```

Configuration: Half-Duplex PEP SDLC with Command Set Disabled Command: &F14

The &F14 configuration enables half-duplex TurboPEP or PEP SDLC with NRZI data encoding at a 19,200 bps synchronous clock speed with the command set disabled. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C3 &D2 &G0 &J0 &L0 &Q6 &R7 &S3 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026:0
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:255 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:50 S112=1 S113=126 S114=0 S115=0 S151:5
S155:1 S180:0 S181:0 S183=25 S190=1 S191=7 S253:0 S254=255
S255=255
```

Configuration: Half-Duplex PEP SDLC LPDA Dialing Command: &F15

The &F15 configuration enables half-duplex TurboPEP or PEP SDLC with NRZ data encoding at a 19,200 bps synchronous clock speed with LPDA dialing. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C6 &D2 &G0 &J0 &L0 &Q6 &R4 &S4 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026:0
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:255 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:50 S112=1 S113=126 S114=0 S115=0 S151:5
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:32 S254=255
S255=255
```

Configuration: V.25bis Bit-Synchronous Operation Command: &F16

The &F16 configuration enables the modem to operate in V.32bis transparent, synchronous, half-duplex mode at 14,400 bps using V.25bis bit-synchronous dialing. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V0 X0 Y0
&C1 &D4 &G0 &J0 &L0 &Q6 &R4 &S4 &T4 &X0
S000:2 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026:0
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061:0 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253:22 S254=255
S255=255
```

Configuration: Manual V.21 Originate Operation Command: &F29

The &F29 configuration enables V.21 originate operation. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B0 E1 L2 M1 P Q1 V1 X1 Y0
&C1 &D4 &G0 &J0 &L0 &Q0 &R1 &S4 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010:0 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:1 S051:1
S056=17 S057=19 S058:0 S059=0 S060=0 S061:0 S062=15 S063=0
S064=0 S068:0 S069=0 S090=0 S092=0 S093=8 S094:0 S100=0
S104=0 S105=1 S111:0 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190:0 S191:6 S253=10 S254=255
S255=255
```

Configuration: Manual V.21 Answer Operation Command: &F30

The &F30 configuration enables V.21 answer operation.
The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B0 E1 L2 M1 P Q1 V1 X1 Y0
&C1 &D4 &G0 &J0 &L0 &Q0 &R1 &S4 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010:0 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:1 S051:0
S056=17 S057=19 S058:0 S059=0 S060=0 S061:0 S062=15 S063=0
S064=0 S068:0 S069=0 S090=0 S092=0 S093=8 S094:0 S100:1
S104=0 S105=1 S111:0 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190:0 S191:6 S253=10 S254=255
S255=255
```

Configuration: Asynchronous/Synchronous &Q1 Command: &F32

The &F32 configuration enables asynchronous/
synchronous &Q1 operation. When the modem is not
online, the primary data and clock lines operate in
asynchronous mode. The modem switches to
synchronous mode when a connection to another modem
is established. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q2 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q1 &R3 &S3 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050:7 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111=255 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:0 S181:0 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Configuration: HP 3000 Host Command: &F33

The &F33 configuration is used with an HP 3000 host system using ENQ/ACK flow control. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q0 &R2 &S1 &T4 &X0
S000:1 S001=0 S002:255 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064:1 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:40 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:3 S181=1 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

Configuration: HP 3000 Terminal Command: &F34

The &F34 configuration is used with an HP terminal using ENQ/ACK flow control when calling an HP 3000 host system using the same flow control. The modem configuration is as follows:

```
WorldBlazer - Active Configuration
B1 E1 L2 M1 P Q0 V1 X1 Y0
&C0 &D0 &G0 &J0 &L0 &Q0 &R3 &S0 &T4 &X0
S000=0 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=60
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S046=0 S047=4 S048=0 S050=0 S051=252
S056=17 S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0
S064=0 S068=255 S069=0 S090=0 S092=0 S093=8 S094=1 S100=0
S104=0 S105=1 S111:41 S112=1 S113=126 S114=0 S115=0 S151=4
S155=0 S180:3 S181=1 S183=25 S190=1 S191=7 S253=10 S254=255
S255=255
```

The WorldBlazer and T3000 modems can be set to operate using the V.25bis command set. When in V.25bis operation, the modem complies with CCITT recommendation V.25bis, an internationally recognized standard for serial automatic call originating and answering.

V.25bis allows you to store and dial telephone numbers from the DTE in both synchronous and asynchronous applications. You can dial numbers directly or you can instruct the modem to dial a previously stored number automatically. (The modem does not support double dial-up, identification numbers, delayed calls, or forbidden calls.)

The modem supports asynchronous and bit-synchronous V.25bis dial protocols. The asynchronous protocol operates with standard asynchronous terminals and DTEs. Bit-oriented synchronous protocol (Sync_B) operates with DTEs that use either the HDLC or SDLC protocol.

Enabling the V.25bis Command Set

You can enable the V.25bis command set by selecting one of the Dial V.25bis options. To use V.25bis in asynchronous mode, set 253 to 20; to use V.25bis in bit-synchronous mode, set S253 to 22.

V.25bis Dialing Commands

In asynchronous applications, V.25bis commands come directly from the DTE keyboard or through communications software. In synchronous applications, you can use V.25bis commands to enable computer-controlled communications.

Command Guidelines

V.25bis commands begin with the command characters and end when you press **RETURN** or period (.). Commands may include dial strings, punctuation, and dial modifiers.

You can use punctuation and spaces with V.25bis commands and modifiers for clarity. The modem ignores all punctuation except for the colon (:), which instructs the autodialer to wait for a dial tone.

V.25bis Command Descriptions

Table D-1 shows V.25bis commands that are accepted by the modem.

Table D-1. V.25bis Commands

Command	Description
CIC	Connect Incoming Call
CRN <i>n</i>	Call Request, Number Provided
CRIn; <i>x</i>	Call Request with Number and Identification
CRS <i>n</i>	Call Request, Location Provided
DIC	Disregard Incoming Call
PRN <i>n</i> , <i>x</i>	Program Normal
RLN <i>n</i>	Request Stored Number

V.25bis Response Messages

Table D-2 describes the response messages that may appear on the DTE screen during V.25bis operation. These messages are the V.25bis responses to your commands.

Table D-2. Response Message Descriptions

Message	Description
CFI AB	Call failed because of absence of carrier.
CFI ET	Call failed because of busy signal.
CFI NS	Call failed because the call request specified a memory location that does not contain a stored number.
CFI NT	Call failed because it did not detect an answer tone.
CNX	Call connected.
INC	Incoming call.
INV	Invalid command.
LSN	List of stored numbers. This message appears before a list of memory locations and dial strings.
VAL	The command was accepted. The modem is waiting for the next command.

V.25bis Framing

All V.25bis commands and responses must use the proper syntax and framing to be interpreted correctly by the modem as valid commands.

Asynchronous Data Frame

In asynchronous operation, all commands to the modem must be in 7-bit, with parity (depending on the parity of the last AT command) ASCII format, and they must be followed by an ASCII carriage return. Responses from the modem are followed by a carriage return.

Bit-Oriented Synchronous Data Frame

In bit-oriented synchronous operation, all commands to the modem must be in 7-bit, space-parity ASCII. They must be preceded by an HDLC/SDLC FLAG character (7E hex), an ADDRESS character (FF hex), and a CONTROL character (13 hex), and they must be followed by a 16-bit (2-byte) frame check sequence. The modem then submits the data to standard bit-oriented-protocol framing (zero bit insertion). Responses from the modem follow the same framing.

Automatic Dialing in V.25bis Mode

An alternative to using the CRS command to dial a stored number is to use the automatic dialing option. With automatic dialing enabled, the autodialer dials the number stored in memory location 0 when DTR goes high for at least 50 ms.

Glossary

A

ACK—Control character transmitted by a receiving device as an affirmation to a sending device.

alphanumeric—Letters (alphabetic) and numbers (numeric).

ANSI—American National Standards Institute. Primary standards development body in the United States.

ASCII—American Standard Code for Information Interchange. A 7-bit code established by ANSI for representing alphanumeric and control characters.

asynchronous transmission—Digital transmission technique characterized by start and stop bits at the beginning and end of each character and not synchronized by a clock signal.

autobaud—Determines the speed and parity of any properly entered command line with prefix AT. The modem uses the A in the prefix to determine the serial interface speed and the T to determine the parity.

B

baud rate—Number of discrete signaling events per second; not necessarily the same as bits per second.

bit—A contraction of binary digit. A bit is the smallest unit of digital information represented by the choice of one of two possible states—one (mark) or zero (space).

block—Group of characters treated as a unit for the purpose of data transmission.

bps (bits per second)—The most common unit of measure for specifying the data transfer rate in a communication network.

break—Signal used by computer equipment to interrupt some process, usually represented by 23 or more consecutive bits.

buffer—Temporary storage area used to compensate for a difference in the rate of data flow into and out of a device.

byte—A grouping of bits to specify a single character, usually consisting of eight consecutive bits.

C

carrier—An analog signal that is modulated by another signal containing information to be transmitted.

carrier detected (DCD)—RS-232 control signal used by the DCE to inform the DTE that it has detected a valid carrier signal.

CCITT—Consultive Committee for International Telephone and Telegraph. A standards organization that sets standards for worldwide voice and data communications.

CCITT V.XX—International standards in communications concerned with modem interfaces, speeds, and transmission modes.

channel—An electronic communications path. A voice-grade channel generally ranges from 300 to 3400 Hz.

character—A letter, number, or other symbol contained in a message or used in a control function.

character set—The characters that can be coded or used by a particular machine.

clear to send (CTS)—An RS-232 control signal sent by the DCE to indicate that the DTE may begin a transmission.

clock—Source of timing signals used in synchronous transmission.

code—A predefined set of rules that specifies the way data is to be represented by the transmitting and receiving device.

common carrier—Telephone company that furnishes communications services to the general public.

conditioning—The addition of equipment to a leased voice-grade line to improve the transmission characteristics of the line.

console—Part of a computer system, usually a video display terminal, used by the operator to communicate with the computer.

contention—Condition arising when two or more devices try to transmit at the same time using the same channel.

control character—Character that initiates some control function on the receiving device.

CPU—Central processing unit. The computer hardware that processes software instructions to control the computer system and its peripherals.

CRT—Cathode ray tube. This term is commonly used to represent the video display terminal.

cyclic redundancy check (CRC)—An error-detection technique in which a data validation value is mathematically derived from a block of data and transmitted at the end of the block. The receiving end recomputes the value and, if it matches the value sent, the

data is assumed to be valid (error-free). If not, the receiver notifies the transmitter that an error has occurred and the block is retransmitted.

D

data carrier detected (DCD)—RS-232 control signal used by the DCE to inform the DTE that it has detected a valid carrier signal.

data communications equipment (DCE)—The equipment that provides all the functions required to establish, maintain, and terminate a connection, and provides the signal conversion required for communications between the data terminal equipment and the telephone network.

data compression—An encoding technique that provides for the transmission of fewer data bits without the loss of information. The receiving end expands the data received to its original form.

data set—See modem.

data set ready (DSR)—An RS-232 control signal used to indicate the readiness of the DCE to accept data from the DTE.

data terminal equipment (DTE)—The equipment that provides the data source and/or receiving end of a data transmission link. The DTE may be a CRT or teletype terminal, a personal computer, a printer, a front-end processor to a large mainframe computer, or any other device that can transmit or receive data.

data terminal ready (DTR)—An RS-232D control signal used to indicate the readiness of the DTE for data transmission.

decibel (dB)—Unit of measure indicating the logarithmic ratio of output signal power to input signal power.

dedicated line—A communications line that is not dialed. Also known as leased line or private line.

demodulation—The process of recovering digital information from a modulated analog carrier waveform.

dial-up line—A communication circuit that is established by a switched circuit connection using the telephone dial network.

digital signal—A signal composed of discrete signal levels as opposed to the continuous signal levels of an analog signal.

distortion—Undesired change in a signal's original waveform resulting from the characteristics of the transmission circuits or other external influences.

dumb terminal—Terminals that do not contain an intelligent microprocessor and usually send data one character at a time.

E

EBCDIC—Extended Binary Coded Decimal Interchange Code. An 8-bit code used primarily by IBM equipment.

echoplex—Method of verification of transmitted data by echoing the characters transmitted back to the source device for verification.

EEPROM—Electrically erasable programmable read-only memory.

EIA—Electronic Industries Association. Standards organization in the U.S. that sets standards for the functional characteristics of electronic interfaces.

ENQ—Control character used to enquire as to the identification or status of a remote device.

ETX—End of text. Control character that indicates the end of text in a transmitted message.

F

FCC—Federal Communications Commission.

firmware—Computer program stored permanently in read-only memory.

frame—see block.

front-end processor—Computer equipment designed primarily for communications control associated with a large mainframe.

full duplex—Method of transmission in which transmissions can occur in both directions at the same time.

G

guard band—Narrow frequency band left unused between adjacent channels to minimize interference.

guard tone—A tone used to signal the presence of a carrier.

H

half duplex—Method of transmission in which communications can occur in both directions but not at the same time.

hardware—The electronic or electromechanical devices in a computer system as opposed to the programs or software.

hardware flow control—Hardware flow control uses RS-232 control signals (RTS and CTS) to selectively start and stop the flow of data from the associated DTE.

HDLC—High level data link control. Communications protocol developed by the International Standards Organization.

header—In communications protocols, this is the control information that precedes the message or text portion of a block of data.

hertz (Hz)—Unit of frequency; one cycle per second.

host computer—The main computer system in a data communications system.

I

interface—A shared boundary defined by common physical interconnection characteristics, signal characteristics, and meaning of interchanged signals.

interference—Undesirable disturbances or distortions in a data transmission signal.

ISO—International Standards Organization.

K

Kermit—A data communications protocol. Also see protocol.

L

leased line—Telephone line reserved for the exclusive use of a single customer.

link—A circuit or transmission path, including all equipment, between a sender and a receiver.

loopback—Directing signals sent back toward the source at some point in the communications path.

M

mainframe—Large-scale computer system composed of large number of peripherals and comprehensive software.

mark—One of the two possible states of a binary data element. The closed circuit and idle condition in a teleprinter circuit. Also see space.

MNP—Microcom Networking Protocol. Also see protocol.

modem—MODulator/DEModulator. A type of DCE that converts digital data to an analog signal for transmission on telephone circuits. A modem at the receiving end converts the analog signal to digital form.

modulation—The process of varying some characteristic of the carrier wave in accordance with the data to be transmitted.

N

NAK—Negative acknowledgment. This control character indicates that the last block transmitted was in error and that the receiver is expecting a retransmission.

node—A point of interconnection on a circuit.

noise—Random electrical signals introduced by components of the circuit or natural disturbances that can produce errors in transmission.

nonvolatile memory—Memory that retains its contents even when no power is applied.

P

parity—A bit that is derived from a character's data bits and transmitted along with the character. The receiving end recalculates the parity and if it matches the

transmitted parity that character is assumed to have been transmitted correctly. If the parity does not match, the character is deemed invalid.

PBX—Private branch exchange. Telephone switching equipment dedicated to one customer and connected to the public switched network.

private line—See leased line.

PROM—Programmable read-only memory.

propagation delay—The time required for a signal to travel from one end of a circuit to another.

protocol—The rules governing the orderly exchange of information between devices on a data link.

protocol convertor—Device that converts from one protocol to another.

public switched network—Telephone system providing circuit switching to many customers.

R

RAM—Random access memory.

received line signal detector—See *carrier detected*.

redundancy check—Technique of error detection involving the transmission of additional data related to the message so that the receiving device can determine if the data transmitted is valid (error-free).

request to send (RTS)—RS-232 control signal used by the DTE to inform the DCE that it is ready to transmit data. When used for flow control between the DTE and modem, this signal indicates to the modem that the DTE is ready to accept data.

ring indicator (RI)—RS-232 control signal used by the DCE to inform the DTE that it is receiving a ringing signal.

ROM—Read-only memory.

RS-232D—Recommended standard of the Electronics Industries Association for the interface between data terminal equipment and data communications equipment.

S

serial transmission—Method of transmission in which each data bit is transmitted sequentially.

software—Computer program or set of computer programs held in storage and loaded into RAM for execution.

software flow control—Software flow control uses XON and XOFF characters to stop and start the data from the DTE. Software flow control should be used for text-only applications.

SOH—Start of header. Control character used in synchronous transmissions indicating the start of a header block.

space—One of the two possible states of a binary data element. The open circuit condition in a teleprinter circuit. Also see mark.

start bit—The first bit or element transmitted in asynchronous transmission of a character to synchronize the receiver.

stop bit—The last bit or element transmitted in asynchronous transmission of a character to return the circuit to an idle state.

STX—Start of text. Control character used in synchronous transmission that precedes the text portion of the data block.

SYN—Synchronous idle. Control character transmitted when the line is idle in synchronous transmissions.

synchronous transmission—Transmission method in which the transmitter and receiver are continuously operating at a fixed rate with a clock signal, either derived from the data stream or provided by the transmitter or receiver.

T

terminal—Any device capable of sending and/or receiving data over a communications channel.

text—The message portion of a data block in synchronous data transmissions.

TurboPEP—Enhanced Packetized Ensemble Protocol.

trellis coded modulation—A method of modulating a carrier to reduce errors.

turnaround time—The time required to reverse the direction of transmission when operating in half-duplex mode.

U

UART—Universal asynchronous receiver transmitter. An integrated circuit that performs the functions required for asynchronous communications.

USART—Universal synchronous/asynchronous receiver transmitter. An integrated circuit that performs the functions required for both synchronous and asynchronous communications.

V

voice grade line—Channel with a frequency range of 300 to 3400 Hz suitable for the transmission of speech or data in analog form.

X

XModem—A file transfer protocol. Also see protocol.

XOFF/ XON—The control characters used to stop or resume transmissions.

Y

Ymodem—A file transfer protocol. Also see protocol.

Z

Zmodem—A file transfer protocol. Also see protocol.

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WorldBlazer Quick Reference Card

You may enter a command line of up to 80 characters in uppercase or lowercase, with the first command in the line preceded by **AT** or **at** and pressing **RETURN** after the last command.

The notation *n* in the descriptions represents a decimal numeric option and *x* represents an assigned value. If a command is entered without a value when one is expected, the modem assumes a value of 0. The option should immediately follow the command. For example, to turn off the result codes, enter **Q1**, not **Q=1**.

You can repeat the last command issued by entering **A/** or **a/**. Do not enter an **AT** prefix before entering **A/** and do not press **RETURN** after entering **A/**. This command is useful for redialing a telephone number.

Result Codes

The following are the basic result codes returned when the **Q** command setting is **Q0** or **Q2** and you have originated a call.

Number	Message and Description
0	OK--The command was successfully completed.
1	CONNECT
2	RING--An incoming ring has been detected.
3	NO CARRIER--Time to connect has expired, dial command aborted, or carrier lost.
4	ERROR--A command error has been encountered.
5	CONNECT 1200--Connected at 1200 bps (Bell 212A or V.22 compatible).
6	NO DIAL TONE--No dial tone was detected.
7	BUSY--Remote telephone is busy.
8	NO ANSWER--Five seconds of silence was not detected within 30 seconds when a @ modifier was encountered in the dial string.
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 14400
14	CONNECT 19200
15	CONNECT 38400
16	CONNECT 57600
17	CONNECT 76800
18	CONNECT 115200
46	CONNECT 7512
47	CONNECT 1275
48	CONNECT 7200
49	CONNECT 12000
52	RRING--Remote telephone is ringing.
53	DIALING
54	NO PROMPTTONE
50	CONNECT FAST

AT Commands

The following briefly describes the AT commands and shows each command's range and default.

Command	Range	Description	Default
A		Answer	
Bn	0 or 1	Bell/CCITT Mode Select 0 Use CCITT standard 1 Use Bell standard	0
Dn	0-9, A-D, #, Modifiers	Dial P =Pulse dialing R =Switch to answer mode when finished dialing T =Tone dialing W =Wait for dial tone S =Designates a number in number directory , =Timed wait set by S8 @ =Wait for 5 seconds of silence after a remote ring ! =On hook flash ; =Remain in command mode after dialing \$ =Credit card prompt \ =Reference a number by name in number directory	Pulse dialing
En	0 or 1	Command Echo 0 Off 1 On	1
Hn	0 or 1	Hook Control 0 Go on hook 1 Go off hook	0
In	0-5	Information Request 0 Return product ID code 1 Return error code status 2 Reports CONNECT status 3 Model and firmware revision 4 Reserved 5 Last number dialed	
Ln	0-3	Speaker Volume 0 Low volume 1 Low volume 2 Medium volume 3 High volume	2
Mn	0-3	Speaker Mode 0 Speaker disabled 1 Speaker on when connecting 2 Speaker always on 3 Speaker on after dialing until carrier detected	1
On	0-2	Return to Data State 0 Modem switches to data state 1 Retrain equalizer 2 Renegotiate DTE protocol	
P		Pulse Dialing	

Command	Range	Description	Default
<i>Qn</i>	0-2	Quiet Mode Select 0 Modem sends result codes 1 Modem does not report result codes 2 Sends result codes when originating. Does not send result codes when answering	0
T		Tone Dialing	
<i>Vn</i>	0 or 1	Result Code Format Select 0 Return numeric responses. In V.25bis mode, result codes are unformatted 1 Return word responses. In V.25bis mode, result codes are formatted	1
<i>Xn</i>	0-2, 4, 11, 12	Result Code Select 0 0-4 result codes 1 Adds modulation speed to 0-5, 10-13, 46-50 2 Same as X1, with 6, 7, 52, 53 4 Same as X11, with 6, 7 11 DTE speed, 0-5, 10-13, 48, 49 12 Same as X11, with 6, 7, 52, 53	2
<i>Yn</i>	0 or 1	Long Space Disconnect 0 Modem ignores long space 1 Modem disconnects on long space	0
<i>Zn</i>	0 or 1	Reset 0 Reset specified by S255 1 Reset and recall profile B	
<i>&Cn</i>	0-6	DCD Control 0 DCD signal is always on 1 DCD on after connect 2 DCD on/off specified by S47 3 DCD on when data is transmitted to DTE 4 Synchronous use only. DCD on when modem detects carrier. Modem sets received data to mark and drops DCD when V.13 pattern detected. 5 DCD on when data transmitted to DTE 6 DCD follows DTR when on hook	0
<i>&Dn</i>	0-4	DTR Interpretation 0 Modem ignores DTR 1 DTR on/off to command mode 2 DTR on/off disconnects 3 Modem loads prestored configuration when DTR signal is off. DTR on/off disconnects 4 If DTR off, modem is disabled	0
<i>&Fn</i>	0-16, 29, 30, 32-34	Load Factory Defaults (see Appendix A)	

Command	Range	Description	Default
&Gn	0-2	Guard Tone Select 0 No guard tone 1 550 Hz guard tone 2 1800 Hz guard tone	0
&Jn	0-2	Jack Type Select 0 Auxiliary telco leads disabled 1 A/A1 control selected 2 MI/MIC control selected	0
&Ln	0 or 1	Leased Line 0 Dial-up line 1 Leased line	0
&Mn	0-3	Asynchronous/Synchronous Mode Select 0 Equivalent to &Q0 1 Equivalent to &Q1 2 Equivalent to &Q2 3 Equivalent to &Q3	0
&Qn	0-3, 6	Asynchronous/Synchronous Mode Select 0 Asynchronous mode 1 Synchronous mode 1 2 Synchronous mode 2 3 Synchronous mode 3 6 Transparent synchronous mode	0
&Rn	0-8	RTS and CTS Interpretation 0 CTS on when modem is not connected. CTS follows RTS per S26 1 CTS is on after CONNECT 2 CTS follows RTS, fixed delay 3 CTS is on if hardware flow control disabled 4 CTS follows DTR when modem is not connected 5 Same as &R0; sends V.13 pattern when RTS off 6 Same as &R4; sends V.13 pattern when RTS off 7 CTS follows RTS per S26 8 CTS control for SDLC accelerator	3
&Sn	0-4	DSR Control 0 DSR always on 1 DSR on after answer tone 2 DSR on/off specified by S47 3 DSR on/off as per DTR 4 DSR on after connect	0

Command	Range	Description	Default
&Tn	0, 1, 3-9	Test Modes 0 Ends test in progress 1 Checks path between modem and DTE 3 Checks communication link and remote modem 4 Enables acceptance of a test request from remote modem 5 Denies test request from remote modem 6 Checks modem operation, DTE, and telephone connection 7 Local modem sends self-test pattern to remote modem 8 Modem performs a local self test 9 Runs diagnostic tests	4
&V		View Active Configuration 0 Displays active RAM configuration	
&Wn	0 or 1	Write Current Configuration 0 Writes current settings per S255 1 Writes current settings to Configuration B	
&Xn	0-2	Select Clock Source 0 Modem generates clock signal 1 DTE generates clock signal 2 Modem derives clock signal	0
~Hn	0-9	Help Provides a brief description of all registers and commands	
~L		List Number Directory	
~Mn	0 or 1	Modify Stored Configuration 0 Modify configuration A 1 Modify configuration B	
~N		Set Number Directory	
~U		Update System Password	
~V	0 or 1	View Nonvolatile Configurations 0 Display nonvolatile profile A 1 Display nonvolatile profile B	
%		Remote Modem Access	
%~N		Set Remote Number Directory Entry	
%~X		Send Remote Access Password	
%S46		Change Remote Modem's System Password	

S Registers

The following briefly describes the S registers and shows each register's range and default.

Register	Range	Description	Default
S0	0–255	Automatic Answer	0
S1	0–255	Ring Count (read only)	
S2	0–255	Escape Character (ASCII)	43
S3	0–127	Command Line Termination Character (ASCII)	13
S4	0–127	Line Feed Character (ASCII)	10
S5	0–255	Backspace Character	8
S6	2–255	Pause Before Dialing	2
S7	1–255	Wait for Connection/Dial Tone Time	60
S8	0–255	Comma Pause Time	2
S9	1–255	Carrier Redetect Time	6
S10	0–255	Carrier Loss Disconnect Time	14
S11	50–255	Touch Tone Timing	70
S12	0–255	Delay for Prompt Message	50
S18	0–255	Test Duration Timer	0
S25	5–255	DTR Delay Timer	5
S26	0–255	RTS-to-CTS Delay Interval	1
S38	0–255	Delay Before Disconnect	0
S41	0–255	Inactivity Timeout	0
S45	0, 1, 255	Remote Access Enable 0 Disables remote access 1 Enables remote access with password security 255 Enables/negotiates remote access	0
S46	0–3	Modem Security 0 Callback security disabled 1 Callback security enabled 2 Callback security enabled with password reverification 3 Passthrough security enabled, no callback	0
S47	0–255	DSR/DCD Delay Time	4
S48	0 or 1	Control Character Mask	0
S50	0–3, 5–7, 254, 255	Modulation Speed 0 Automatic speed determination 1 300 bps (Bell 103 or V.21) 2 1200 bps (Bell 212A or V.22) 3 2400 bps (V.22bis) 5 1200/75 bps (V.23) 6 9600 bps (V.32) 7 14,400 bps (V.32bis) 254 Attempts to connect at closest current non-PEP DTE speed 255 Fast operation (TurboPEP or PEP mode)	0

Register	Range	Description	Default
S51	0-9, 35, 43, 46, 252-255	DTE Interface Speed 0 300 bps 1 1200 bps 2 2400 bps 3 4800 bps 35 7200 bps 4 9600 bps 43 12,000 bps 46 14,400 bps 5 19,200 bps 6 38,400 bps 7 57,600 bps 8 76,800 bps 9 115,200 bps 252 Autobaud 253 One-time autobaud (38,400 bps default) 254 One-time autobaud (19,200 bps default) 255 One-time autobaud (9600 bps default)	252
S56	0-255	XON Character (ASCII)	17
S57	0-255	XOFF Character (ASCII)	19
S58	0-4	DTE Flow Control 0 No flow control 1 Half-duplex RTS/CTS flow control 2 Full-duplex RTS/CTS flow control 3 XON/XOFF flow control 4 Both XON/XOFF and full duplex RTS/CTS flow control	3
S59	0-15	CONNECT Suffixes (ASCII)	0
S60	0-4	Data Format 0 8 data bits, no parity 1 8 data bits, odd parity 2 8 data bits, even parity 3 8 data bits, mark parity 4 8 data bits, space parity	0
S61	0 or 1	Local Action on Break	1
S62	0-255	Break Length	15
S63	0-3	Link Layer Action on Break 0 Break is in sequence with data 1 Send break to remote DTE immediately 2 Reserved 3 Discard break signal	0
S64	0 or 1	Dial/Answer Sequence Abort 0 If characters are sent to modem, abort dialing or answering sequence 1 Ignore characters sent by local DTE while dialing or answering a call	0

Register	Range	Description	Default
S68	0, 2-4, 255	DCE Flow Control 0 No flow control 2 Full-duplex RTS/CTS flow control 3 XON/XOFF flow control 4 Both XON/XOFF and RTS/CTS flow control 255 Flow control specified by S58	255
S69	0-2	XON/XOFF Signal Handling 0 XON/XOFF character processed 1 Reserved 2 Processed if necessary	0
S70		Transmit Modulation Rate (read only)	
S71		Transmit Bits Per Channel (read only)	
S72		Receive Modulation Rate (read only)	
S73		Receive Bits Per Channel (read only)	
S74		Link Protocol Packets Statistics (read only)	
S78		Line Quality (read only)	
S90	0 or 1	DSRS Behavior 0 Disables DTE/DSRS input 1 Enables DTE/DSRS input	0
S92	0 or 1	Answer Sequence Selection 0 Issue PEP answer tones at start of search sequence 1 Issue PEP answer tones at end of search sequence	0
S93	3-255	V.32bis/V.32 AC Transmit Time	8
S94	0-3	Modulation Speed Negotiation 0 Negotiation disabled 1 Allows a connection 2 Fallback within a specified modulation scheme 3 Use only appropriate fallback	1
S100	0 or 1	Reverse Answer/Originate Mode 0 Normal mode 1 Reverse mode	0
S104	0, 1, 3, 4	Automatic Dialing 0 Disable automatic dialing 1 DTR dialing 3 Press T/D switch to dial a prestored number 4 DTR dialing/answering	0
S105	0-2	T/D Switch Enable 0 Disable T/D switch 1 Enable T/D switch 2 Enable T/D switch when modem is on hook	2

Register	Range	Description	Default
S111	0, 10–14, 20, 30, 40–43, 50, 255	File Transfer Protocol 0 No protocol supported 10 Kermit protocol, no parity 11 Kermit protocol, odd parity 12 Kermit protocol, even parity 13 Kermit protocol, mark parity 14 Kermit protocol, space parity 20 Xmodem/Ymodem protocol 30 UUCP-g protocol 40 ENQ/ACK protocol–host 41 ENQ/ACK protocol–terminal 42 ENQ/ACK host, not negotiated 43 ENQ/ACK terminal, not negotiated 50 SDLC accelerator 255 Remote modem protocol	255
S112	0–255	Kermit Mark Character (ASCII)	1
S113	0–127	Tilde (~) Character Alternative	126
S114	0 or 1	Calling Tone Enable 0 Calling tone disabled 1 Calling tone enabled	0
S115	0 or 1	Answer Tone Detection Required 0 Answer tone detection not required 1 Answer tone detection required	0
S151	0–5, 35, 43, 46	Synchronous Clock Speed 0 300 bps 1 1200 bps 2 2400 bps 3 4800 bps 35 7200 bps 4 9600 bps 43 12,000 bps 46 14,400 bps 5 19,200 bps	
S155	0 or 1	NRZ/NRZI Data Encoding 0 NRZ encoding used 1 NRZI encoding used	0
S180	0–3	Error Control Request 0 Error control disabled 1 V.42 without detection phase 2 V.42 with detection 3 MNP error control	2
S181	0–2	Error Control Fallback 0 If no error control, direct 1 If no error control, buffered 2 Error control required	1
S183	8–255	Error Control Detection Timer	25
S190	0 or 1	Data Compression Enable 0 Disabled in both directions 1 Enabled in both directions	1

Register	Range	Description	Default
S191	6 or 7	Data Compression Negotiation 6 Disables Telebit LZ 7 Enables Telebit LZ	7
S253	0, 10, 20, 22, 32	Command Set Selection 0 No command set 10 AT synchronous 20 V.25 <i>bis</i> asynchronous 22 V.25 <i>bis</i> bit synchronous 32 LPDA bit synchronous	10
S254	0, 1, 255	&F0 Configuration Select 0 Load profile A 1 Load profile B 255 Load factory defaults	255
S255	0, 1, 255	Configuration Select 0 Recall user profile A 1 Recall user profile B 255 Recall profile A/B switch	255



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