



Telebit T3000

Reference Manual

90201-01 Rev. A

Telebit T3000

Reference Manual

90201-01 Rev. A

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FCC Standards

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 ER95WS-17716-MD-E.
 - Ringer equivalence number 0.3B.
 - Modular jack number USOC RJ-11C.
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 telephone does 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 Chapter 8, Warranty and Repair Procedures at the end of 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.

Preface

The T3000 Modem

Telebit's T3000 standalone modem supports full asynchronous and synchronous compatibility with dial up V.32 and V.32bis modems. The modem features error control, data compression, modem security, remote management, and diagnostics. The modem operates over both dial-up and two-wire leased line circuits, and is compatible with CCITT and Bell standard lower-speed modems.

The T3000 modem provides reliable and error-free connectivity at speeds from 300 to 57,600 bits per second (bps). The modem is shipped with prestored configurations that allow operation with a wide variety of industry-standard modems worldwide.

About This Manual

This manual is a comprehensive guide for setting up and using the Telebit T3000 modem. It is designed for both new and experienced modem users.

To help you install and configure the modem, refer to the *T3000 Fast Start Guide*, a separate booklet provided with your modem. If you have special requirements or experience any problems while using the *T3000 Fast Start Guide*, refer to this manual for additional information.

This manual contains eight chapters and six appendices:

Note: Whether you are a first-time or experienced user, install your T3000 modem using the instructions in Chapter Two, Installation.

- Chapter One, Introduction, describes the main features of the T3000 modem.
- Chapter Two, Installation, tells how to install the modem and connect the AC power cord, RS-232D cable, and telephone line cable.
- Chapter Three, The Basics, explains how to use the modem, including manipulating the front panel controls and indicators, and establishing and terminating a connection.
- Chapter Four, Beyond the Basics, describes command mode operations, flow control, RS-232 control signal interpretations, error control, data compression, protocol support, and synchronous support.
- Chapter Five, AT Command Descriptions, describes the commands and explains the possible parameters, the range of parameters, and the default settings.
- Chapter Six, AT Register Descriptions, describes the registers used to operate the T3000 modem and explains the possible parameters, the range of parameters, and the default settings.

- Chapter Seven, 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 Eight, 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, Interface Description, provides information on the RS-232 interface, including signals and pin assignments.
- Appendix C, Result Codes, describes the result messages that describe modem status.
- Appendix D, Prestored Configurations, describes the configurations already stored in the modem to meet most user application needs.
- Appendix E, Leased Line Considerations, describes special settings and connections for leased-line applications.
- Appendix F, Technical Specifications, lists the T3000 product specifications.

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.

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This chapter provides an overview of the features and benefits of the T3000 modem. The major features offered by the modem are discussed in the following sections.

CCITT V.32bis Support

The modem can operate in either asynchronous or synchronous V.32bis mode. When operating in V.32bis mode with Trellis Coded Modulation, the modem operates at a speed of 14,400 bits per second (bps) with selectable fallback speeds of 12,000, 9600, or 7200 bps.

Note: If the modem falls back to 9600 or 4800 bps, it operates in V.32 mode.

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 utilizes a speed of 9600 bps, with a selectable fallback of 4800 bps.

Compatibility with Other Modems

For use with other modems, the T3000 is compatible with 14,400 and 12,000 bps V.32bis; 9600 and 4800 bps V.3; 2400 bps V.22bis; 1200 bps V.22; and Bell 212A; 300 bps Bell 103J; and V.21 standards.

Interface Speeds

The T3000 modem supports RS-232 interface speeds of 300, 1200, 2400, 4800, 7200, 9600, 12,000, 14,400, 19,200, and 38,400 in fixed speed or autobaud operation, and 57,600 bps in fixed speed operation.

CCITT V.42 Error Control

The T3000 modem supports the V.42 error control protocol standard, which provides error-free transmission over a standard full-duplex, V.32bis, V.32, V.22, V.22bis, 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)TM up to class 4. The inclusion of MNP provides backward compatibility between V.42 and existing MNP modems.

CCITT V.42bis Data Compression

The T3000 modem supports the V.42bis standard. V.42bis is a high-performance data compression algorithm that increases the data throughput by a ratio of up to 4:1. V.42bis data compression is possible only for connections established using LAP-M and if both connected modems are configured for data compression.

MNP Support

The modem can be configured to support MNP up to class 4 for error correction, and class 5 for data compression. MNP 5 increases the data throughput up to 2:1. When a connection is established, the modems at each end negotiate the highest MNP class supported by both modems.

Prestored Configurations

The T3000 modem maintains prestored configurations in program memory for various applications. You can select the configurations from the front panel or by using the AT&F command.

Command Set

The T3000 modem supports the Telebit Extended AT command set, which is also compatible with the industry-standard AT command set.

Modem Security

The T3000 standalone modem supports both callback and password security to protect the connected Data Terminal Equipment (DTE) from unauthorized access.

The T3000's 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 listed in the number directory, the answering modem hangs up the telephone, waits 10 seconds, and calls back the appropriate number indexed in the directory.

Password security also requires the caller to enter their password before gaining access, but does not call back the user.

Remote Management and Diagnostics

Remote access allows a central site technician to configure, test, and diagnose T3000 modems in the field.

To ensure reliable network 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 T3000 modem lets you specify the method of data flow control when transmitting information. You can select a software protocol such as XON/XOFF and/or hardware flow control using the RS-232 RTS/CTS control signals.

Stored Telephone Numbers

The T3000 modem number directory stores up to 10 telephone numbers and descriptors in nonvolatile memory for easy dialing.

Synchronous Capabilities

The modem supports transparent or direct synchronous operation at speeds of 1200, 2400, 4800, 7200, 9600, 12,000, and 14,000 bps, using either dial-up or two-wire leased lines.

File Transfer Protocol Support

The modem contains protocol support firmware to optimize file transfers when operating with MNP error correction. You can configure the modem to support Kermit, X/Ymodem, or UUCP protocols. The modems at each end negotiate protocol support during the MNP initialization sequence. Both

modems must agree on the protocol supported; otherwise, no protocol is supported during the communications session.

Note: Protocol support is negotiated only between Telebit modems.

This chapter provides instructions for connecting the T3000 modem between your equipment and the telephone line. The modem is designed to be used with a computer, terminal, or other serial device via an RS-232D serial interface port.

If you have already installed the modem by following the instructions in your *T3000 Fast Start Guide*, you do not need to use this chapter.

Equipment Check List

Before installing the modem, make sure that you have the following equipment:

- An AC power cord and transformer provided with your modem.
- The 7-foot telephone cable supplied with your modem.
- A shielded RS-232D cable with a DB-25 male connector for the modem. Your computer dealer can assist you in obtaining the appropriate cable for your requirements. Pin assignments for the RS-232D connectors are provided in Appendix B, Interface Description.
- A small flat-blade screwdriver.

If you do not have the items listed, obtain them before proceeding.

Installation Checklist

This section summarizes the sequence of steps you should follow to install the modem. For specific instructions on performing the procedures listed, refer to the specified page in this manual.

1. Before installing the modem in its final position, you may need to first connect it to a terminal (or personal computer with a terminal emulation program), and preconfigure it for your system. Refer to Chapter 3, The Basics.
2. Verify that the modem's power switch is turned off, then connect the AC power cord. Refer to page 2-3.
3. Connect a shielded RS-232D cable between the modem and your equipment. Refer to page 2-3.
4. Connect the telephone line from the wall jack to the LINE connector on your modem. Refer to page 2-5.
5. If desired, connect your telephone to the PHONE connector on the modem. Refer to page 2-5.
6. Power up the modem and initialize it, selecting your prestored configurations.

After you have completed the installation, the modem is ready for use. Refer to Chapter 3, The Basics, for information on configuring and using the modem.

Connecting the AC Power Cord

An AC power cord with a transformer assembly is supplied with the modem.

Warning: To avoid damaging the modem, only use the AC power cord and transformer provided with your T3000 modem. For Canadian users: Pour utiliser avec BASLER ELECTRIC Model BE117125BBB010 source d'alimentation.

Refer to Figure 2-1 while connecting the AC power cord to the modem:

1. Verify that the power switch (I/O) on the rear of the modem is turned off (O).
2. Attach the power cord to the connector labeled POWER on the rear panel of the modem. Ensure that the beveled edge of the plug is facing up so that it mates with the retainer clip on the connector.
3. Plug the other end of the power cord into a grounded AC wall outlet.

Connecting the RS-232D Cable

A 25-pin RS-232D connector, located on the back of the unit, is used to connect the modem to your computer or terminal. You must provide a shielded RS-232D cable. Pin assignments for the connectors are listed in Appendix B, Interface Descriptions.

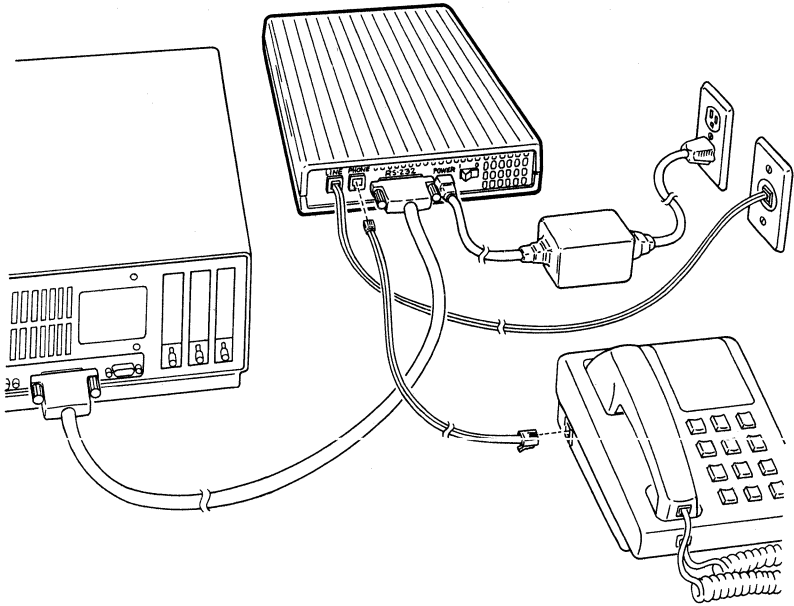


Figure 2-1. Cable Connections

Refer to Figure 2-1 while connecting the RS-232D cables to the modem:

1. Attach the male connector of the RS-232D cable to the female connector labeled RS-232D on the rear panel of the modem, and tighten the connector screws until snug.
2. Attach the other end of the RS-232D cable to the correct RS-232D connector on your DTE. Consult your equipment manual for the location of this connector.

Connecting the Telephone Line

A seven-foot telephone cable is provided with your modem. Use this cable to connect the modem to the telephone line as shown in Figure 2-1.

Attach one end of the provided RJ-11 telephone cable to the connector labeled TO LINE on the rear panel of the modem. Attach the other end to your telephone wall jack.

Note: The modem is equipped with a special phone cable that fits tightly into the rear-panel RJ-11 jack. If you substitute your own cable, be certain that it fits securely into the modem's TO LINE jack before attempting to use the modem. Loose connections may affect the modem's performance.

Connecting a Telephone

Your telephone can be connected to the modem, allowing you to make normal telephone calls while your modem is not in use. Simply connect the cord from your telephone to the connector labeled TO PHONE on the rear panel of the modem.

After Completing the Installation

Before powering up the T3000 modem, refer to Chapter 3, The Basics, to determine how to configure the modem to ensure compatibility with your computer's data communications software.

This chapter presents a general overview of the T3000 modem's operating characteristics, and shows you how to enter commands and set registers that control the modem's operation.

Proceed with this chapter after the modem has been installed by following the instructions in the *T3000 Fast Start Guide* or Chapter 2 of this manual.

Front Panel Controls and Indicators

The modem's front panel contains two switches and ten LED indicators, which determine the current operating status of the modem (refer to Figure 3-1). The status indicators are described in Table 3-1.

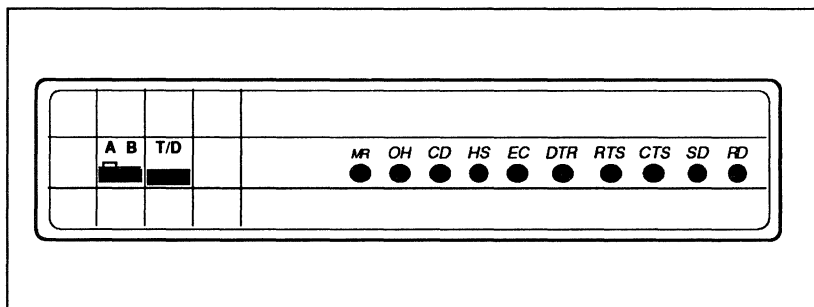


Figure 3-1. Front Panel Display

Table 3-1. Front Panel Status Indicators

| | |
|------------|--|
| MR | Modem Ready —Indicates that the modem is operational. |
| OH | Off-Hook —Indicates the modem is using the telephone line. Flashes ON and OFF during a test. |
| CD | Carrier Detect —Indicates that the modem has established a connection with another modem. Flashes ON and OFF during a retrain. |
| HS | High Speed —Is ON when the T3000 is connected at a modulation rate at or above 9600 bps and OFF when the T3000 is connected at a rate below 9600 bps. |
| EC | Error Control —Indicates when an error controlled (MNP or V.42) connection has been established. |
| DTR | Data Terminal Ready —Indicates whether the terminal or computer connected to the serial port is ready to transmit or receive data. |
| RTS | Request to Send —Indicates whether the terminal is able to receive data from the modem (DCE). |
| CTS | Clear to Send —Indicates whether the modem is ready to accept data from the terminal or computer. When the indicator is lit, the modem can accept data from the DTE for transmission. |
| SD | Send Data —Indicates that the DTE is sending data to the modem. |
| RD | Receive Data —Indicates that the terminal or computer connected to the modem is receiving data from the modem. |

Note: Each of the following LEDs are also used in the factory prestored configuration matrix when the T3000 is powered up with the Talk/Data switch pressed: MR, OH, CD, HS, and EC.

The front panel switches are described in the following paragraphs.

- **A/B Configuration Select**

This switch is used to select one of two possible sets of operating configurations.

When you power up or reset the modem, it loads Configuration A or B operating parameters from the nonvolatile memory, depending on the position of the A/B switch. If the switch is in the A position, the modem loads Configuration A; if the switch is in the B position, the modem loads Configuration B.

Changing the position of the A/B switch resets the modem and loads the corresponding new configuration from nonvolatile memory. Do not press the A/B switch while a communications session is in progress, as this disconnects the call.

- **T/D (Talk/Data) Switch**

This switch controls the modem's connection to the telephone line much like the hook switch on your telephone.

If you press the T/D (Talk/Data) switch while the modem is on-hook (off-line; OH indicator is OFF), the modem goes off-hook (on-line) and attempts to connect. This allows you to manually place a call using the telephone set, then switch to Data Mode when the call is established.

If you lift the telephone handset, then press the T/D switch while the modem is off-hook (OH indicator is ON), the modem goes on-hook, allowing you to either disconnect the call or switch to voice communications.

If you press the T/D switch while switching on the power, the modem enters the configuration selection mode.

Power Switch

The power switch (I/O), mounted on the rear of the modem, is used to turn the modem on or off. Each time you turn on the modem, it runs a series of diagnostic tests. After successfully completing the tests, the modem loads the configuration parameters previously stored in its nonvolatile memory into its registers, and the MR (Modem Ready) LED lights.

Modem Configuration Requirements

If you connected the modem directly to a terminal, input the commands from the keyboard. When the modem is connected to a computer, use its **data communications software or a terminal emulation program** to configure and use the modem.

If you intend to use the modem with a mainframe computer or other serial device that accepts only incoming calls, you can use a terminal (or personal computer with a terminal emulation program) to preconfigure the modem's operating parameters and save them in nonvolatile memory.

Prestored Configurations

The T3000 modem contains fifteen prestored configurations. These configurations address a wide range of applications. Before choosing your application, decide which configuration meets the requirements of your system.

You can select the prestored configurations from the front panel or by using the &F commands described in Table 3-2.

Table 3-2. Prestored Configurations

| Prestored Configuration | Front Panel LED | | | | | AT&F Command |
|---|-----------------|----|----|----|----|--------------|
| | MR | OH | CD | HS | EC | |
| TTY (factory default) | ● | ● | ● | ● | ● | &F or &F0 |
| Unattended Answer Mode | ● | | | | | &F1 |
| Intelligent Answer Mode | | ● | | | | &F2 |
| System V (HDB) (UUCP) | ● | ● | | | | &F3 |
| Ver 2 (BSD) (UUCP) 4.2-4.3 and SCO Xenix | | | ● | | | &F4 |
| Transparent Sync | ● | | ● | | | &F5 |
| IBM PC/MAC with SW flow control (XON/XOFF) | | | | ● | | &F8 |
| IBM PC/MAC with HW flow control (RTS/CTS) | ● | | | ● | | &F9 |
| Leased Line Async Originate Mode | | ● | | ● | | &F10 |
| Leased Line Async Answer Mode | ● | ● | | ● | | &F11 |
| Leased Line Sync Originate Mode | | | ● | ● | | &F12 |
| Leased Line Sync Answer Mode | ● | | ● | ● | | &F13 |

To select a prestored configuration from the front panel, use the T/D and A/B switches. The LEDs provide a visual display of the configuration selected.

Not all of the preset configurations are accessible from the front panel. Refer to Table 3-3.

Table 3-3. Configurations Set Only With an AT&F Command

| Prestored Configuration | AT&F Command |
|-------------------------|--------------|
| Async/Sync Hayes &M1 | &F32 |
| HP3000 (host) | &F33 |
| HP3000 (terminal) | &F34 |

To load a prestored configuration into the T3000 modem, follow the steps below. Table 3-2 shows the various LED displays encountered while selecting a default set.

1. Determine which configuration you wish to set as a default. To store the configuration as Configuration A, set the A/B switch to position A. To store the configuration as Configuration B, set the A/B, switch to position B.
2. Enter the configuration select mode by holding down the T/D switch while turning on the power. Release the T/D switch when the MR, OH, CD, HS, and EC LEDs flash.
3. View the configuration choices by pressing the T/D switch for less than two seconds. The LEDs change to the next choice each time you press the switch (refer to Table 3-2).

4. When the LEDs indicate the desired configuration, make your selection by pressing the T/D switch for more than two seconds. When the modem accepts your choice, the LEDs corresponding to the selected configuration flash. Release the T/D switch when the LEDs flash.
5. The LEDs turn off and the modem tags the configuration as Configuration A or B, as you selected. When the modem is set to the new configuration, the MR LED turns on.

Use Table 3-2 and Table 3-3 as a guide to select the configuration that meets your system requirements.

Note: For additional information on the configurations, refer to the &F command description in Chapter 5, AT Command Descriptions, and Appendix D, Prestored Configurations.

If you are a personal computer user, your communication software package may not provide the initialization sequence required to operate the T3000 modem in your PC system environment. If the available options in the software package do not meet your system's needs, choose either of the prestored configurations with hardware or software flow control.

Configuration Memory Organization

The active configuration stored in RAM defines the current operating characteristics of the modem. The factory default configurations, permanently stored in ROM, contain the operating parameters most commonly used for data communications. To restore

the default parameters to the active configuration, enter an &F command from the terminal or initialize the modem through the front panel switches.

You can modify and save the current operating parameters in nonvolatile memory as Configuration A or Configuration B via the &W command. When a new configuration is retrieved, its settings replace the current operating parameters. Refer to Chapter 5, AT Command Descriptions, for additional information on these commands.

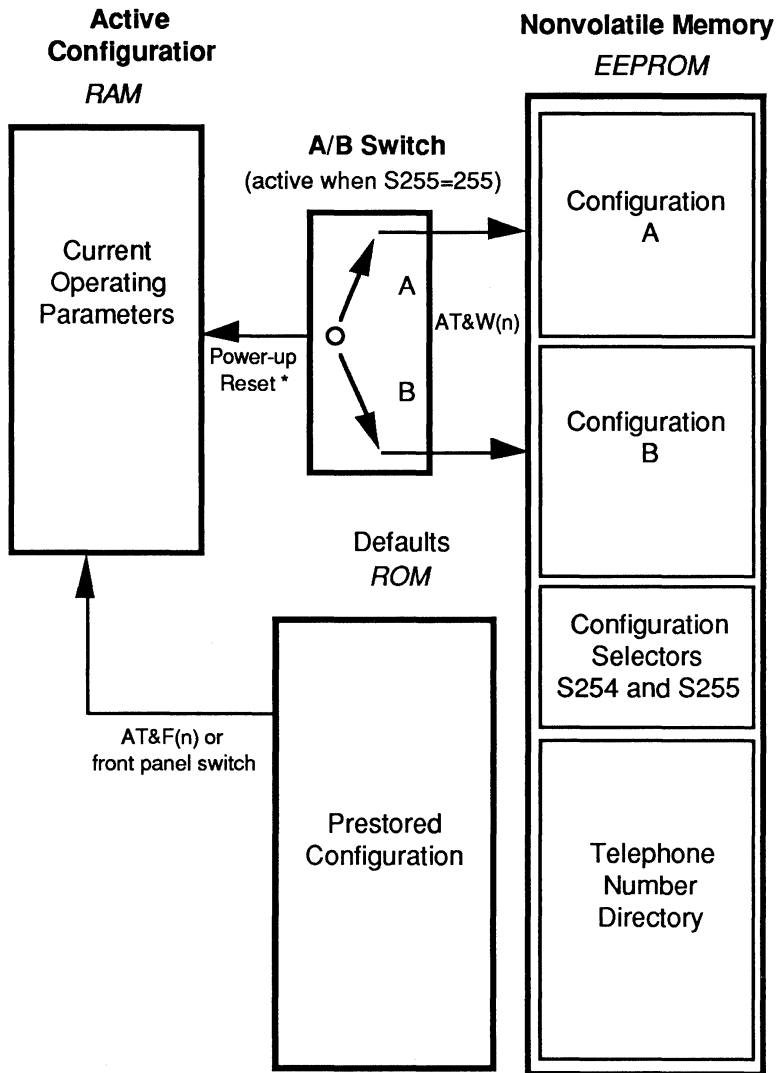
The S255 register determines which configuration is used when you power up or reset the modem. When S255 is set to 255 (by typing `ATS255=255`), press the A/B switch to reset the modem and load the new configuration indicated by the switch into the active configuration (refer to Figure 3-2).

Commands and Registers

The T3000 modem is equipped with commands and registers that you can set to meet the specific requirements of your data communications system. The T3000 modem currently supports the Telebit Extended AT command set.

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 the return key.

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



* Source of configuration loaded is determined by the setting of the S255 register.

Figure 3-2. T3000 Memory Organization

The notation (n) in the descriptions used in this manual represents a decimal numeric option. The option should immediately follow the command.

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

Do not type parentheses.

The = command enables the setting of S registers to desired values.

The ? command allows you to inspect the contents of a given S register. An example follows using the S51 register:

```
ATS51?
```

The &V command allows you to view the current configuration.

Entering a Command

To enter a command, type the prefix **AT** before the command. For example:

```
ATQ0
```

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

Refer to Chapter 5, AT Command Descriptions, for additional information on the Telebit Extended AT command set.

Setting a Register

The following is an example of how to set a specific register:

```
ATS0=5
```

sets the S0 register to a value of 5.

Refer to Chapter 6, AT Register Descriptions, for complete descriptions of the registers.

Establishing a Connection

This section describes the procedures used to establish a connection.

Using the Dial Command

Use the Dial (D) command to place a call through the modem. When you type the D command, the modem stops processing commands, dials the number indicated, and waits for a connection.

If no connection occurs within the specific period of time defined by the S7 command, the command is canceled, and the modem returns to command mode (waits for the next command).

The following example shows you how to call another modem using tone dialing:

```
AT DT 555-6789
```

The next example shows you how to have the modem dial through a PBX using pulse dialing (DP9), wait for an outside line (W), dial a long distance telephone

number, wait for 8 seconds (,,,) then switch to tone dialing (T) to charge the call to a telephone credit card:

```
AT DP9 W 0-408-555-6789,,,,T123-456-7890-1234
```

Using the T/D Switch

If you set the S104 register to 3, pressing the T/D switch automatically dials the first or second number in the number directory, depending on the current setting of the A/B switch. When the A/B switch is set to A, the modem dials the first number (~N0); if the switch is set to B, the modem dials the second number (~N1).

Using the Auto Answer Feature

The modem automatically answers an incoming call after a specified number of rings, and usually sends a carrier signal to the remote modem. If the modem does not detect an originate signal within a specified period of time, or if you send any character from your equipment before the modems establish a communication link, the modem sends a NO CARRIER result code.

If the modem detects a carrier, it sends a CONNECT result code indicating the successful connection and, depending on the X command setting, the speed of the connection or serial interface.

Connecting During a Phone Conversation

If you are talking on the telephone and then want to use your computer to communicate with the remote location's computer, use the Dial (D) and Answer (A) commands.

1. Have the other party enter **AT D** on their system without entering a phone number.
2. Enter **AT A** on your system within a few seconds.

Both parties can then hang up the telephone. The modem sends a **CONNECT** result code when the connection is established.

Ending a Connection

To terminate a connection, disconnect through your communications software. If you are not using communications software, you can disconnect a call by pressing the T/D switch on the front panel of the modem.

The T3000 modem is designed to interface with a wide variety of computer and data communications equipment, and it can be used in many applications. Because each device has its own specific requirements, the modem is equipped with a wealth of commands and registers that you can set to meet the specific requirements of your system.

Command Mode Operation

The T3000 modem supports the Telebit Extended AT command set (refer to Chapter 5, AT Command Descriptions, and Chapter 6, AT Register Descriptions).

The modem supports two basic modes of operation: command mode and data transfer mode.

In command mode, the modem processes data received through the serial interface port as instructions to perform various functions.

The 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 (off-line).
- The modem cannot successfully complete a call, or the remote modem's data carrier is dropped.

- The modem receives a defined escape sequence 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 the section titled **Commands and Registers** in Chapter 3. 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 parity
- 7-bit data with mark/space parity
- 8-bit data with even, odd, mark, or space 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 5, **AT Command Descriptions**. Chapter 6, **AT 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 by n where n may equal 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.

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

```
AT~N3=1234567\TEST\<CR>
```

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<CR>
0: 12345-6789\ACCOUNT\
1: 1 (415)555-6789
2:
3: 1-800-555-1212
4:
5:
6: (415)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 4 in the number directory, enter the following command:

```
AT D S=4
```

Automatic Dialing

The S104 register enables automatic dialing using the DTR signal from the local DTE or from the front panel T/D switch. Available S104 settings are:

- 0 Disable automatic dialing.
- 1 Enable automatic dialing via 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 (the actual number is determined by the position of the A/B switch).
- 2 Reserved. The modem sends an ERROR response code if you use this register setting.
- 3 Enable automatic dialing from the front panel T/D switch. If the modem is idle (OH indicator is off) and you press the T/D switch, the modem goes off-hook and automatically dials the first or second number in the Number Directory (the actual number is determined by the position of the A/B switch).
- 4 When the DTR signal is ON, the modem assumes the originate mode if the setting of register S1 is less than that of register S0. If the setting of register S1 is greater than or equal to that of register S0, the modem assumes the answer mode.

For values 0–4, the S100 register applies unless you override it with an R dial modifier.

Break Signal Handling

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.

The S61 register determines how the modem handles a break signal as follows:

- 0 Break is processed as defined in register S63.
- 1 The modem switches to command mode when it receives a break signal.

The S63 register determines the modem's action if the break signal is to be transmitted, as follows:

- 0 Send break signal within data sequence.
- 1 Send break to remote DTE immediately.
- 2 Reserved.
- 3 Discard the break signal.

For most applications, set S61 to 0 and S63 to 0 (the default setting). The modem then passes break signals.

Escape Sequence (return from data mode to command mode)

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) separated from other characters by a guard time (specified by the S12 register).

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

Note: The local modem discards any data received from the remote modem if no link protocol is active.

Serial Port Interface Speed and Flow Control

Most communication problems occurring over the DTE–DCE interface result from a mismatch in the interface speed and/or flow control method used by the DTE and 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 in nonreliable (no error control) mode, the T3000 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 300 bps using the S51 register, type:

```
ATS51=0<CR>
```

To manually set the modem's interface speed, set the S51 register to one of the values listed below:

| | |
|----|-----------|
| 0 | 300 bps |
| 1 | 1200 bps |
| 2 | 2400 bps |
| 3 | 4800 bps |
| 35 | 7200 bps |
| 4 | 9600 bps |
| 43 | 12000 bps |
| 46 | 14400 bps |
| 5 | 19200 bps |
| 6 | 38400 bps |
| 7 | 57600 bps |

Note: The modem cannot communicate at 57,600 bps until you set the S51 register to 7.

The T3000 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.

To select autobaud, set S51 to one of the following values:

- 252 Autobaud with type ahead not permitted.
- 253 Autobaud with type ahead permitted and a default output speed of 38,400 bps.
- 254 Autobaud with type ahead permitted and a default output speed of 19,200 bps.
- 255 Autobaud with type ahead permitted and a default output speed of 9600 bps.

Note: The modem cannot respond to an AT command at 57,600 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 sent 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 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 set 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.

Because the interface speed is not determined after every command line, you can enter multiple command lines without waiting for the results of previous command lines. Some communications programs may not wait for result codes when setting up the modem and therefore require this type-ahead capability.

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 DTEs (data terminal equipment). The T3000 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 the 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 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) or buffered mode (S181).

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.

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.

The S58 register governs the method of flow control used by the DTE to control the flow of data coming from the modem.

- 0 The modem does not use flow control.
- 1 Use RTS/CTS flow control in half-duplex mode.
- 2 Use RTS/CTS flow control in full-duplex mode.
- 3 Use XON/XOFF flow control.
- 4 Use both RTS/CTS and XON/XOFF flow control.

The S68 register controls the flow of data from the DTE to the modem.

- 0 The modem does not use flow control.
- 2 Use RTS/CTS flow control in full-duplex mode.
- 3 Use XON/XOFF flow control.
- 4 Use both RTS/CTS and XON/XOFF flow control.
- 255 Use the same flow control specified by S58.

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 seven 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 below:

- S58=3, S68=255. Use software flow control if you want a dumb terminal to access a mainframe computer, or if you use a Kermit or Zmodem file transfer protocol.
- S58=2, S68=255. If your computer system supports hardware flow control, this flow control setting is preferred for all types of applications.
- 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 requires 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.

DTR Signal Interpretation

The &D command controls how the modem interprets the Data Terminal Ready (DTR) control signal from the DTE as follows.

- &D0 The modem assumes that DTR is always ON.
- &D1 The modem enters command mode when the DTR signal changes from ON to OFF.
- &D2 The modem disconnects a call in progress, enters command mode, and disables auto-answer when the DTR signal changes from ON to OFF. Auto-answer is enabled when the DTR signal changes to ON.
- &D3 The modem resets and enters command mode when the DTR signal changes from ON to OFF. The modem recalls the current user profile parameters from nonvolatile memory.

When &D is set to 0, 1, or 2, the modem does not recognize DTR signal level changes with a duration less than the time specified by S25 register. The S104 register defines the automatic calling options possible via the DTR signal.

- 1 OFF-to-ON DTR transition dials a prestored number. The modem uses the first location in the number directory if the A/B switch is set to A; it uses the second location if the switch is set to B.
- 4 OFF-to-ON DTR transition initiates a call attempt. No dialing is performed. Register S1 is referenced to determine whether the modem will attempt to connect in answer or originate mode.

DSR Signal Handling

The **&S** command determines how the modem handles the Data Set Ready control (DSR) signal.

- &S0** The DSR signal is always ON.
- &S1** The DSR signal goes ON when the modem detects an answer tone, and it stays on throughout the connection.
- &S2** The DSR signal is always ON except when it goes OFF for a period of time set by the S47 register while disconnecting a call.
- &S3** The DSR signal goes ON when DTR is turned ON or when the modem detects a carrier and DTR is present. DSR goes OFF when DTR is dropped or the carrier is lost.
- &S4** DSR follows DCD. DCD is ON when a carrier is detected.

DCD Signal Handling

The **&C** command determines how the modem handles the Data Carrier Detected (DCD) control signal.

- &C0** The DCD signal is always ON.
- &C1** When a carrier is detected from the remote modem, the DCD signal is turned ON after the CONNECT result code is sent to the DTE. DCD is turned OFF when the carrier is dropped.
- &C2** The DCD signal is always ON except when it goes OFF for a period of time specified by the S47 register while disconnecting a call.
- &C3** The DCD signal is the inverse of the CTS signal.

&C4 Operates the same as **&C1**, except that when the modem detects a V.13 signal from the remote modem, it clamps RXD to mark and turns DCD OFF. This setting operates only in synchronous connections.

CTS Signal Handling

When the modem uses RTS/CTS flow control, the CTS signal goes ON and OFF to control the flow of data from the DTE, as described 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 the CTS control signal.

&R0 During a connection, the CTS signal follows the RTS signal after the delay set in the S26 register. When the modem is off-line, the CTS signal stays ON. Hardware flow control is disabled.

&R1 The CTS signal goes ON after the modem sends the CONNECT result code, and it stays ON for the duration of the connection. Hardware flow control is disabled.

&R2 During a connection, the CTS signal follows the RTS signal with a fixed 200 ms delay. When the modem is off-line, the CTS signal goes OFF.

&R3 CTS is always ON if hardware flow control is disabled.

&R4 During a connection, the CTS signal follows the RTS signal after the delay specified by the S26 register. When the modem is off-line, the CTS signal follows DTR. Hardware flow control is disabled.

&R5 Operates the same as **&R0**, except that the modem sends a V.13 signal to the remote modem when RTS is OFF.

&R6 Operates the same as **&R4**, except that the modem sends a V.13 signal to the remote modem when RTS is OFF.

Modulation Speed Considerations

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

You can set the S50 register to any of the following values:

- 0 Automatic speed determination.
- 1 300 bps operation (Bell 103 or V.21).
- 2 1200 bps operation (Bell 212A or V.22).
- 3 2400 bps operation (V.22bis).
- 5 1200/75 bps (V.23).
- 6 9600 bps (V.32).
- 7 14,400 bps (V.32bis).
- 254 Match speed of last AT command.

You can set the S94 register to any of the following values:

- 0 Negotiation disabled. The connection speed must match the speed specified by S50.
- 1 Full negotiation enabled. Connect at any speed specified by the remote modem up to the maximum speed set by S50.
- 2 Partial negotiation enabled. Connect only at the speed specified in S50 or at the corresponding modulation mode's fallback speed.

- 3 Only fallback enabled. Connect only at the fallback speed of the modulation mode specified by the S50 register. If the selected modulation mode does not have an associated fallback speed, connect at the primary speed.

V.22bis uses a fallback speed of 1200 bps; V.32 falls back to 4800 bps; V.32bis falls back to 12,000 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 on the appropriate one. 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.

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

- B0 Use CCITT V.22 and V.21 standards.
- B1 Use Bell 212A and 103 standards.

If you plan to use the modem in V.22 or V.22bis mode, be aware that some modems use guard tones during synchronization. If you experience problems connecting, try configuring the modem with an &G command to use one of the two available guard tones:

- &G0 No guard tone.
- &G1 Use 550 Hz guard tone.
- &G2 Use 1800 Hz guard tone.

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.32bis, V.32, V.22bis, V.22, V.21, Bell 212A, or Bell 103 connection.

The V.42 protocol includes the Link Access Procedure for Modems (LAP-M). In addition, V.42 includes the Microcom Networking Protocol (MNP) up to Class 4 as an alternate protocol. MNP provides downward 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 T3000 attempts while connecting with a remote modem:

- 0 Disable error control.
- 1 V.42 error control without detection phase.
- 2 V.42 error control with detection phase.
- 3 MNP error control.

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

- 0 If no error control is negotiated, connect in nonbuffered (direct) mode. The modem sets the DTE interface speed to match the modulation speed of the connection and flow control is disabled.

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

Data Compression

While connecting using MNP or LAP-M, data compression is negotiated between the two connecting modems. Data compression can be enabled in either the transmit or receive direction in the T3000 modem by setting the S190 register, as shown in Table 4-1. Both modems must allow data compression for data compression to occur.

Table 4-1 displays how the S190 register values are set for data compression negotiation.

Table 4-1. S190 Data Compression Values

| | | RECEIVE | | |
|----------|----------|---------|----------|------|
| | | Allowed | Required | None |
| TRANSMIT | Allowed | 1 | 2 | 5 |
| | Required | 3 | 4 | 6 |
| | None | 7 | 8 | 0 |

For example, to require data compression in both the transmit and receive directions, set S190=4. The remote modem must either require or allow compression in both the transmit and receive directions. If the remote modem is a T3000, its S190 register should be set to 1, 2, 3, or 4.

File Transfer 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 the data throughput rate 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
- X/Ymodem
- UUCP
- ENQ/ACK

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).

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. Refer to Chapter 6, AT Register Descriptions, for additional information.

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.

&Q0 Command and data modes use an asynchronous interface.

&Q1 Synchronous mode 1. The modem operates in asynchronous mode until a connection occurs, then the modem switches to synchronous mode. This transition is signaled by the OFF-to-ON transition of DCD (if enabled), or by the CONNECT message. All result codes and messages are sent as set in the S253 register.

After DCD is ON, the modem waits the amount of time set in S25 and checks DTR status. If DTR is ON, data connection is completed.

If DTR is OFF, the modem hangs up and reverts to asynchronous mode. Changing the DTR signal causes the action set by the &D command to occur. This may include going to asynchronous command state or ending the call.

Synchronous mode 1 is suited for applications that use the asynchronous mode to connect, then communicate in the synchronous mode. To establish a call, issue the &Q with the D or A command using the asynchronous mode.

To drop a connection when in data mode, press the T/D switch, disconnect the phone line, or drop DTR (if the &D is set appropriately). After the modem hangs up, it reverts to asynchronous mode.

- &Q2** Synchronous mode 2. This mode is the same as &Q1, except that it enables stored number dialing. In this mode the modem ignores S104. OFF-to-ON transitions of DTR cause the modem to dial a stored number location and attempt to connect. The modem dials the first location the A/B switch is set to A position, and it dials the second location if the switch is set to B.

In synchronous mode 2, the modem supports a synchronous-only terminal or a computer with a synchronous adapter card. After you select synchronous 2 mode, the modem goes off-hook and dials the stored number as soon as the terminal turns DTR ON.

- &Q3** Synchronous mode 3. This mode is the same as &Q1, except that it includes DTR initiation of a call attempt. The modem ignores S104. OFF-to-ON transitions of DTR cause the modem to attempt to connect based on the S1 value.

S1=0 The modem attempts to originate a call.

S1>0 The modem attempts to answer a call.

In synchronous mode 3, the DTR circuit performs as a Talk/Data switch. In this mode, the modem supports a synchronous-only data terminal or computer with a synchronous adapter card. You must have a telephone attached to the jack labeled TO PHONE on the rear of the modem if you want to dial the call when in this mode.

- &Q6** Transparent Synchronous. The modem uses a synchronous interface for data connections. The modem uses register S253 to control command mode operation. The modem interprets all RS-232

signals according to the various parameters stored in the modem except if &D1 is set, the modem ignores loss of DTR, and it will not drop the connection.

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 upper case.** Enter a ~U command to change this password.

Possible contents of the S46 register are:

- 0 Callback security disabled.
- 1 Callback security enabled.
- 2 Callback security enabled with password reverification.
- 3 Password security enabled, no call back required.

Callback telephone numbers and associated passwords are stored in the ~N number directory. When the S46 register is set to 1, the modem prompts the caller for a user password (different from the system password).

If the password entered by the caller **corresponds to a password listed in the number directory**, the answering modem hangs up the telephone, waits 10

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 originating caller for a password. If a valid password is entered, the caller is immediately connected to the local DTE. No callback occurs.

Update System Password Command

The ~U command (Update System Password) allows you to change the system callback security password, which must be given when you attempt to change the value of the S46 register.

This password is also required to change an entry in the telephone number directory when callback security is enabled (the S46 register is not equal to zero).

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

After you change the password, the modem requests a new prompt string (up to 20 characters), which appears at the caller's DTE screen. The default value of this prompt string is Enter Password: . You can retain this prompt string by pressing the return key.

Remote Access

The T3000 modem allows you to send commands to the remote modem. To negotiate and use remote access, the modems must connect using MNP error control.

The S45 register enables or disables access to the control functions of the modem from a remote modem, as follows:

- 0 Disables remote access.
- 255 Enables/negotiates remote access.

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

- Both modems must have remote access capability, and must connect with MNP.
- Register S45 must be set to 255 before establishing an MNP call.

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

Remote Modem Access Command

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.

All commands following a % character to the end of the command line are directed to the remote modem if the remote command access conditions, listed previously, are satisfied. For example, the command:

```
AT%&V
```

displays the remote modem's active configuration.

Responses from the remote modem are preceded by a % character and are controlled by the setting of the remote modem's X and Q commands.

You can enter local and remote commands on the same line. For example, to get the local modem's number of accepted packets and line quality, followed by the same information from the remote modem, enter:

```
ATS74?S78?%S74?S78?
```

Note: All commands following the % remote command modifier 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. A %OK response from the remote modem indicates that the remote command is complete.

After you issue a remote command, you cannot issue another remote command until the remote modem has finished processing the previous command.

Note: When the T3000 modem is configured for TTY configuration using the front panel switches, S45 is set to 255 (enable remote access) in the active configuration (RAM) and 0 (disable remote access) in nonvolatile memory (EEPROM). S0 is set to 1 (enable auto-answer), and S180 is set to 3 (enable MNP). This allows Technical Support to have remote access to the modem through an MNP connection, if necessary, as long as the modem is not reset.

This chapter describes the Telebit Extended AT commands used when the T3000 modem is operating in command mode. Chapter 6, *AT Register Descriptions*, contains complete descriptions of the registers.

You may enter a command line of up to 80 characters in upper or lower case. You must precede the first command in the line with an **AT** or **at** and follow the last command by pressing the return key.

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

Command Syntax

A comma (,) used between commands causes the system to pause for the amount of 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 the carriage return, do not enter the **AT** prefix or a carriage 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, type:

ATQ1

Do not type:

ATQ=1

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

Do not type parentheses.

Command Descriptions

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 system to data mode to communicate with the other party's system, you must use this command in the following way:

1. Have the other party enter AT D on their system without entering a phone number.
2. Enter ATA on your system within a few seconds. Both parties can hang up the phone. The modem sends a CONNECT result message when the connection occurs.

If no carrier signal is detected within the time-out 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. If the command is aborted, the DTE screen displays aNO CARRIER result message.

B(n) Bell/CCITT Mode Selection

Range: 0 or 1

Default: 1

The B command is used to select either Bell standards (212 and 103J) or CCITT standards (V.22 and V.21) while operating at 300 or 1200 bps transmission modes. The parameters are as follows:

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: T, P, S7

Use the D command to place a call by sending a dialing string to the modem. A valid dialing string consists of a D followed by the digits 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 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 equipment before the modems establish synchronization, the D command is canceled and the modem returns to command mode.

Because the modem can use either pulse or tone dialing, you must state 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.

The following dial modifier command characters 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 only valid 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 ATD9W5551212.
- 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 DTE screen displays the stored number when the S=(n) modifier is executed. The range of 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 five seconds of silence after a remote ring before continuing. If the modem does not detect five seconds of silence within 30 seconds, then 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 two 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.
- \ 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 and 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.

```
ATDT (415)555-1212
```

```
ATDT\HELP\
```

```
ATDTS=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.

E(n) 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.

H(n) Hook Control

Range: 0 or 1

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

H Same as H0.

H0 Go on-hook.

H1 Go off-hook.

I(n) Information Request

Range: 0–5

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 8, Warranty and Repair Procedures.

I2 Reports CONNECT status. See Appendix C, Result Codes.

I3 Responds with T3000 - Version LAx.xx, where x.xx is the firmware revision level.

I4 Reserved.

I5 Last number dialed.

L(n) Speaker Volume

Range: 0–3

Default: 2

The L command determines the speaker volume.

- L Same as L0.
- L0 Low volume.
- L1 Low volume.
- L2 Medium volume.
- L3 High volume.

M(n) Speaker Mode

Range: 0–3

Default: 1

The M command controls the modem's internal speaker.

- M Same as M0.
- M0 Speaker disabled.
- M1 Speaker enabled only when dialing and connecting.
- M2 Speaker enabled at all times.
- M3 Speaker enabled after dialing until carrier detected.

O(n) Return to Data State

Range: 0–1

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 equalizer protocol before returning to data state.

P Pulse Dialing

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

Q(n) 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.

V(n) Verbose Select

Range: 0 or 1

Default: 1

The V command determines the format of the result codes. See Appendix C, Result Codes, for more details on result code reporting.

V Same as V0.

V0 Numeric result codes enabled.

V1 English descriptions of result codes enabled.

X(n) Result Code Select

Range: 0–2, 4, 11–12

Default: 1

See also: V(n)

The X(n) command selects a set of result codes. The parameters are as follows:

X Same as X0.

X0 Supports the following result codes:

| NUMERIC | VERBOSE |
|---------|------------|
| 0 | OK |
| 1 | CONNECT |
| 2 | RING |
| 3 | NO CARRIER |
| 4 | ERROR |

X1 Adds modulation speed to the CONNECT message:

| NUMERIC | VERBOSE |
|---------|-------------|
| 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 |

X2 Supports the X1 result codes and adds the following:

| NUMERIC | VERBOSE |
|---------|-------------|
| 6 | NO DIALTONE |
| 7 | BUSY |
| 52 | RRING |
| 53 | DIALING |

X4 Supports the X11 result codes, and adds the following:

| NUMERIC | VERBOSE |
|---------|-------------|
| 6 | NO DIALTONE |
| 7 | BUSY |

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

| NUMERIC | VERBOSE |
|---------|--------------|
| 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 |

X12 Supports the X11 result codes and adds the following:

| NUMERIC | VERBOSE |
|---------|-------------|
| 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 T3000 modem performs a blind wait before dialing.

When you dial using X2, X4, or X12, the functionality associated with the enabled result codes is also enabled. In particular, the modem recognizes the BUSY signal, and it requires dial tone before dialing, even if the W modifier is not entered.

Y(n) 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 four-second break signal, then disconnects (goes on-hook).

Z(n) 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 and/or in data mode, the modem goes on-hook, drops the connection, and loads a configuration specified by the command line parameter.

Z Same as Z0.

Z0 Modem resets and recalls the default user configuration specified by the S255 register.

S255 = 0. Uses configuration A; A/B switch is disabled.

S255 = 1. Uses configuration B; A/B switch is disabled.

S255 = 255. Uses A/B switch to determine which configuration to load.

Z1 Modem resets and recalls user configuration B.

Note: The modem ignores any commands on the command line following the Z(n) command.

&C(n) Data Carrier Detect (DCD) Control

Range: 0–3

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 goes ON after the CONNECT result code is sent to the DTE. The DCD signal goes OFF when the carrier is dropped.

&C2 The DCD signal is always ON, except when it is pulsed OFF for a period of time specified by the S47 register while disconnecting a call.

&C3 DCD is the inverse of the Clear to Send (CTS) signal.

&D(n) Data Terminal Ready (DTR) Interpretation

Range: 0–3

Default: 0

See also: &Q(n), 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.) Auto answer ignores DTR.
- &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 goes ON and returns to an active state.
- &D3 The modem resets and enters command mode when the DTR signal goes from ON to OFF. This causes the modem to recall the current user configuration parameters from nonvolatile memory.

&F(n) Load Factory Defaults

Range: 0–5, 8–13, 32–34

See also: S254, S255

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

&F Same as &F0.

&F0 TTY (factory default)—Load configuration according to the S254 register. Used with most asynchronous terminals or PCs emulating asynchronous terminal operation.

&F1 Unattended Answer Mode. Used with most asynchronous Front End Processor (FEP) host ports operating at a fixed interface speed of 9600 bps.

&F2 Intelligent Answer Mode. Used with most computers running intelligent software that interprets the modem result codes and adjusts the interface speed accordingly. Modem result codes are sent to the computer. The modem interface speed follows the connect speed.

&F3 System V (HDB) UUCP. Used with most HoneyDanBer UUCP UNIX systems. (You must have: /usr/lib/uucp/Systems, Devices, and Dialers files).

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, 408-734-5200.

&F4 Ver 2 (BSD) UUCP 4.2-4-3 and SCO Xenix. Used with most Version 2 UUCP systems (You must have: /usr/lib/uucp/L.sys and L-devices files).

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, 408-734-5200.

- &F5 Transparent Synchronous. Use with most 14,400 bps synchronous terminals or devices. Operates in V.32bis transparent synchronous full-duplex mode at 14,400 bps using the DCE's clock.
- &F8 IBM PC/MAC with SW flow control (XON/XOFF). Used with most personal computer software packages that support software (XON/XOFF) flow control.
- &F9 IBM PC/MAC with HW flow control (RTS/CTS). Used with most software packages that support hardware (RTS/CTS) flow control.

Note: In order 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.

- &F10 Leased Line—Asynchronous Originate Mode. Used in any asynchronous point-to-point, 2-wire leased-line V.32bis application. The modem connects automatically on a leased line to another T3000 modem that is configured with the AT&F11 command in asynchronous V.32bis mode at 14,400 bps.
- &F11 Leased Line—Asynchronous Answer Mode. Used in any asynchronous point-to-point, 2-wire leased-line V.32bis application. The modem connects automatically on a leased line to another T3000 modem that is configured with the AT&F10 command in asynchronous V.32bis mode at 14,400 bps.

&F12 Leased Line—Synchronous Originate Mode. Used in any synchronous, point-to-point, 2-wire leased-line V.32bis application. The modem connects automatically on a leased line to another T3000 modem that is configured with the &F13 command, in synchronous V.32bis mode at 14,400 bps.

&F13 Leased Line—Synchronous Answer Mode. Used in any synchronous point-to-point, 2-wire leased-line V.32bis application. The modem connects automatically on a leased line to another T3000 modem that is configured with the &F12 command, in synchronous V.32bis mode at 14,400 bps.

&F32 Asynchronous/Synchronous &Q1. When the modem is not on-line, 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 utilizing ENQ/ACK flow control, which calls an HP 3000 host system using the same flow control.

Refer to Appendix D, *Prestored Configurations*, for additional information.

&G(n) 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.22bis mode.

&G Same as &G0.

&G0 No guard tones.

&G1 550 Hz guard tone.

&G2 1800 Hz guard tone.

&J(n) 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 must be configured correctly for proper operation. Refer to Appendix B, Interface Description.

&L(n) Leased Line

Range: 0 or 1

Default: 0

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

Use the &L command to place the modem into a mode of operation for use on leased lines.

&L1 does not take effect until you save the setting to nonvolatile memory (with command &W), and turn the modem off and on. &L1 reads the value of the S0 register to determine how it should connect to the leased line. If S0=0, the modem attempts to connect in originate mode. If S0=1, it attempts to connect in answer mode.

&L Same as &L0.

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

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

When the modem is turned on, it continuously attempts to connect. The connection may be initiated through an A or D command, DTR dialing, (see S104 and &Q) or the T/D switch.

If a loss of carrier is detected, the modem continuously attempts to re-establish the connection.

If the user disconnects the call, (T/D switch, H, Z, DTR drop) the modem does not attempt to re-establish the connection.

&M(n) Async/Sync Mode Select

Range: 0-3

Default: 0

See also: &Q(n)

The &M command determines the operating mode of the modem, either asynchronous or synchronous interface.

&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** display.

&Q(n) Async/Sync 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 mode. Asynchronous interface used for command and data modes.

&Q1 Synchronous mode 1. The modem operates in asynchronous mode until a connection is established, then the modem switches to synchronous mode. This transition is signalled by the OFF-to-ON transition of DCD (if enabled), or by the CONNECT message.

The modem sends all result codes and messages asynchronously. When DCD goes on, the modem checks DTR status after the delay specified in S25 and checks DTR status. If DTR is ON, data connection is completed. If DTR is OFF, the modem hangs up and reverts to synchronous mode.

DTR must be ON within the time specified by the S25 register.

&Q2 Synchronous mode 2. Similar to **&Q1**, but includes stored number dialing. In this mode, S104 is ignored.

An OFF-to-ON DTR transition causes the modem to dial a stored number location and attempt to establish a connection. If the A/B switch is set to A, the modem dials the first location; if the switch is set to B, the modem dials the second location. All other operation is identical to &Q1.

&Q3 Synchronous mode 3. Similar to &Q1, but adds initiation to a call attempt. In this mode, S104 is ignored. An OFF-to-ON DTR transition causes the modem to attempt to establish a connection based on the S1 value. If S1=0, the modem attempts to originate a call. If S1>0, the modem attempts to answer a call. All other operation is identical to &Q1.

&Q6 Transparent synchronous mode. A synchronous interface is used for data connections. The modem uses register S253 to control command mode operations. The modem interprets RS-232 signals according to the various parameters started in the modem, with one exception: If &D is set to 1, the modem ignores loss of DTR and the connection is not dropped.

&R(n) Clear to Send (CTS) Control

Range: 0–4

Default: 3

See also: S26, S68

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

&R Same as R0.

&R0 During a connection, the CTS signal follows the RTS signal after the delayed specified by the S26 register. CTS is ON when the modem is not connected to another modem.

&R1 The CTS signal goes ON after the modem sends the CONNECT result code, and stays ON during the connection.

&R2 Throughout a connection, the CTS signal follows the RTS signal with a fixed (200 milliseconds) delay. When the modem is not connected to another modem, the CTS signal is OFF.

Note: The **&R2** command controls the CTS signal during a connection.

&R3 CTS is always ON if hardware flow control is disabled.

&R4 During a connection, the CTS signal follows the RTS signal delayed by the period of time defined by the S26 register. CTS follows DTR when the modem is not connected to another modem.

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

&S(n) 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 drops if DTR drops or carrier is lost.

&S4 DSR is on only when a carrier is detected from the remote modem.

&T(n) Test Modes

Range: 0, 1, 3–9

Default: 4

See also: S18, H, Z

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. See the S180 register.

&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 automatically end a test 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 system to type a few sentences. If the data is sent back to the remote system without errors, the remote modem and communications link are functioning correctly.

- &T4 Grants 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 on-line. 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 three-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 three-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 This command 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.

&V(n) View Active Configuration

See also: S254, S255

The **&V** command displays the modem's active operational parameters.

&V Same as **&V0**.

&V0 Displays active RAM configuration, including S254 and S255 registers.

&W(n) 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; A/B switch is disabled.

If S255 = 1, save configuration in B; A/B switch is disabled.

If S255 = 255, use A/B switch to determine in which configuration to save.

&W1 Writes current settings to Configuration B.

&X(n) 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-232D connector.

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

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

~H(n) Help

Range: 0–9

This command displays brief descriptions of all commands and registers used in the T3000 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, then places the modem into the interactive help mode.

In interactive help mode, type P to go the previous page. Type 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.

~H(n) Display page n of help text.

Note: The modem ignores any commands on the command line following the ~H(n) command.

~L List Number Directory

The ~L command lists all entries stored in the number directory, entries from 0 through 9. Each entry appears on its own line. If no number is currently set in a particular directory, the directory entry number appears alone.

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

~M(n) 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.

~N(n)=(x) Set Number Directory

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 equal 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.

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

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

Any string, including errors, can be saved in the number directory.

When password security is enabled (S46 is not 0), you must enter the ~U (system callback security) password before the modem accepts the change.

~U Update Security 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 zero).

When you enter the ~U command, the modem asks for the old password (PEP is the factory default, entered in upper case), the new password, (entered in any combination of upper and lower case), 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:". Use a carriage return to retain this prompt string.

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

~V(n) View Nonvolatile Configurations

Range: 0 or 1

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

~V Same as ~V0.

~V0 Display Nonvolatile memory (EEPROM) configuration A.

~V1 Display Nonvolatile memory (EEPROM) configuration B.

% Remote Modem Access

See also: S45

The % command 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:

```
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 Q, 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:

```
ATS74?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.

Note: When you use the front panel switches to reset the T3000 modem to the TTY configuration (&F0), S45 is set to 255 (enable remote access). S0 is set to 1 (enable auto-answer) and S180 is set to 3 (enable MNP). This allows remote command access to the modem through an MNP connection.

This chapter describes the registers used in the Telebit Extended AT command set, which are used to store and or configure various options in the T3000 modem.

You may enter a command line of up to 80 characters in upper or lower case. You must precede the first command in the line an **AT** or **at** and follow the last command by pressing the return key.

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

Command Syntax

A comma (,) used between commands causes the system to pause for the amount of 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 the carriage return, do not enter the **AT** prefix or a carriage 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, type:

```
ATQ1
```

Do not type:

```
ATQ=1
```

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

Do not type parentheses.

How to Modify a Register

The T3000 modem supports a number of definable registers. The modem remembers the last register queried or modified. For example, to set register S11 to 70, type:

```
ATS11=70
```

This sets S11 to a value of 70. If you then type:

```
AT=95
```

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

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

```
ATS0=3
```

```
ATS=3
```

Register Inquiry

Typing 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:

`ATS11?` 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 zero and the modem responds with the value of S0. For example:

`ATS?` This displays the value of S0.

Register Concatenation

Register modifications and inquiries can be linked together on the same command line. For example:

`ATS11?=60` This displays the value of S11 and then sets it to a value of 60.

Another example follows:

`ATS11=60?`

This first sets S11 to the value of 60 and then display its contents.

Register Initialization

If you turn the power OFF then ON, press the A/B switch, or reset the modem with a Z or &T9 command, the modem resets to the values stored in the nonvolatile memory.

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

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 eight 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. If S48=0, setting this register to a value greater than 127 disables the modem's ability to recognize the escape character.

S3 Command Line Terminator

Range: ASCII Code 0–127

Default: ASCII Code 13 (carriage return)

The S3 register contains the code used as the carriage 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 contains the code output 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 0–127

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 command line character.

The last character is also removed from the command buffer. This character does not back up over the AT prefix.

The allowable values for this register are ASCII codes 0 through 127. Values greater than 127 generate an ERROR response.

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: 40 (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 also sets 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 reconnecting to the telephone line when a carrier has been detected after it has been lost. Each count represents 100 milliseconds.

S10 Carrier Loss Disconnect Time

Range: 1–255
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. Setting register S10 to 255 causes the modem to wait until explicitly told to disconnect.

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 Escape Sequence Guard Time

Range: 0–255
Default: 50 (1 second)

The escape sequence guard time is the time delay required immediately before and after entering the escape sequence. The guard time is in units of 20 milliseconds (1/50 second).

S18 Test Duration Timer

Range: 0–255

Default: 0

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 Timing

Range: 5–255

Default: 5 (50 milliseconds)

The S25 register specifies the minimum time that the DTR signal must be OFF to be recognized, and specifies the number of seconds after a connection before the modem checks for DTR ON.

The modem ignores DTR level changes with a duration of less than the value specified by the S25 register. 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 line. 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 OFF-to-ON 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, 1–254, 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 required 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 contents 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 modems disconnect.
- 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 Time-Out

Range: 0–255

Default: 0

The S41 register specifies the amount of time in tenths of hours (six 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, then it disconnects the call. This time-out prevents hung connections from running up an expensive connection cost. The register default setting of 0 disables the inactivity timer.

S45 Remote Access Enable

Range: 0 or 255

Default: 0

See also: S180, S181

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 MNP, and this register on both modems must be set to 255 before connecting.

Remote access is not enabled for a session unless these condition are met. Possible contents of this register are as follows:

0 Disables remote access.

255 Enables/negotiates remote access.

S46 Modem Security

Range: 0-3

Default: 0

See also: ~U, ~L, ~N

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 upper case. You can change the password by entering the ~U command.

Possible contents of 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 10 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 and 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 and/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 contents 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 eight 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 eight data bits with or without parity.

Note: If the local DTE is using a data format of seven 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

Default: 0

See also: S94

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

- 0 Automatic speed determination. (Refer to S94 setting).
- 1 300 bps operation (Bell 103 or V.21).
- 2 1200 bps operation (Bell 212A or V.22).
- 3 2400 bps operation (V.22bis).
- 5 1200/75 bps operation (V.23)
- 6 9600 bps operation (V.32).
- 7 14400 bps operation (V.32bis).
- 254 Attempt to connect at speed of last AT command.

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.

Set to 3, the modem operates in V.22bis mode, and starts any search sequence at 2400 bps.

Set 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. The V.25 answer sequence is used while in V.22 or V.22bis mode.

Set 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.

Set to 6, the modem operates in V.32 mode, and starts any search sequence at 9600 bps.

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

Set to 254, the modem automatically searches for the correct transmission speed starting with the speed of the last AT command. 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 greater.

S51 DTE Interface Speed

Range: 0–7, 35, 43, 46, 252–255

Default: 255

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 contents 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 |
| 251 | Reserved |
| 252 | Autobaud; type-ahead not permitted. |
| 253 | Autobaud; type-ahead permitted. Default to 38,400 bps. |
| 254 | Autobaud; type-ahead permitted. Default to 19,200 bps. |
| 255 | Autobaud; type-ahead permitted. Default to 9600 bps. |

Note: When using autobaud, you must use a speed less than 57,600, and use one of the following data formats:

8-bit data, no parity

7-bit data, even/odd parity

7-bit data, mark/space 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 occur:

- 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.
- A NO CARRIER condition is generated because connect time has expired (S7 register), dial command is aborted, or the carrier is lost.

Since the interface speed is not checked after each command line, you can enter multiple command lines without waiting for the results from the previous command. This may be useful for communications software scripting.

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 contents of 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. When CTS is ON, the modem can accept data; when CTS is OFF, the modem cannot accept data.
- 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. When CTS is ON, the modem can accept data; when CTS is OFF the modem cannot accept data.

S59 CONNECT Suffixes

Range: 0–15

Default: 0

See also: V, X

In verbose mode (V1), each of the CONNECT messages can have suffixes, which are separated by the slash (/) character and controlled by the S59 register. The numeric code associated with the root CONNECT message is the numeric result code, regardless of the value of S59. Refer to Appendix C for a description of the Result Codes.

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 contents 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 on the serial interface. Possible contents for this register are as follows:

- 0 Break is processed as defined in register S63.
- 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 contents for this register are as follows:

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

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 contents 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, 3, 4, or 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 contents of the S68 register are as follows:

- 0 No flow control.
- 2 Use full-duplex hardware flow control. The modem turns CTS OFF when it wants to stop the flow of data to it. The modem turns CTS ON when it accepts 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. The format of the XON and XOFF characters is defined by the S48 register.
- 4 Use both XON/XOFF and RTS/CTS hardware flow control.
- 255 Use the flow control specified by S58.

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 contents 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.

Note: Registers S70, S72, S74, and S78 provide statistical information. They are read-only registers and cannot be set by the user.

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 is a read-only register and contains either the current data rate if communication is currently active or the last sample made if the connection is broken. Any new connection attempt reinitializes this register.

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. S72 is a read-only register and

contains either the current data rate if communication is active or the last sample made if the connection is broken. Any new connection attempt reinitializes this register.

S74 Packet Transmission Status

The S74 register contains a count of MNP or LAP-M packets transmitted, packets received, packets retransmitted, and packets received with errors. All packets transmitted after the packet that contains errors must be retransmitted. When the connection breaks, the register retains the count until the next connection is attempted. S74 is a read-only register.

S78 Line Quality

The S78 register reports the modem's estimate of the quality of the current connection. This register is valid only in 212A, V.22, V.22bis, V.32, or V.32bis modes. 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.

S90 DSRs Behavior
(Data Signal Rate Select)
Range: 0 or 1
Default: 0

The S90 register enables or disables the DSRs pin on the RS-232 interface. Possible contents of this register are the following:

- 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.

S93 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 or 6, this register sets the amount of time the modem waits for a V.32 originate sequence before abandoning this mode. The default of 800 milliseconds works well with most V.32 modems. If you have trouble connecting with some V.22bis modems, try a shorter duration.

For manual or late-answer 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 contents of 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 forced fallback is specified, 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 contents 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.
- 1 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.

S102 Pulse Dial Make/Break Ratio

Range: 0 or 1

Default: 0

The S102 register sets the make/break ratio used when pulse dialing. Possible contents for this register are as follows:

- 0 39% make/61% break ratio (US).
- 1 33% make/67% break ratio (UK).

S104 Automatic Dialing

Range: 0, 1, 3, 4

Default: 0

See also: S100, S105

The S104 register enables automatic dialing using the DTR signal from the local DTE or from the front panel T/D switch.

Possible contents for this register are as follows:

- 0 Disable automatic dialing.
- 1 Enable automatic dialing via 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 (the actual number is determined by the A/B switch setting).
- 3 Enable automatic dialing from the front panel T/D switch. When the modem is idle (OH indicator is off), pressing the T/D switch causes the modem to go off-hook and automatically dial the first or second number in the Number Directory (the actual number is determined by the A/B switch setting).
- 4 When the DTR signal goes from OFF to ON, the modem assumes the originate mode if the setting of register S1 is equal to 0. If the setting of register S1 is greater than 0, the modem assumes the answer mode.

For values 0 through 4, the S100 register applies unless it is overridden by an R dial modifier.

S105 T/D Switch Enable

Range: 0–2

Default: 1

The S105 register enables or disables the T/D switch on the front panel. Possible contents for this register are as follows:

- 0 Disable the T/D switch.
- 1 Enable the T/D switch.
- 2 Enable the T/D switch only when the modem is on-hook (OH indicator is off).

This register does not prohibit the use of the T/D switch when initializing the modem to its factory default settings.

S111 File Transfer Protocol Support

Range: 0, 10–14, 20, 30, 40–43, 255

Default: 255

The S111 register determines which file transfer protocol, if any, should be supported during a communications session.

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 contents 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).
- 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 MNP 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 MNP error correction. To force an MNP connection, see the S180 register.

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 code 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.

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 6-1 shows how S180 values are set for error control mode. Possible contents for this register are the following:

- 0 Error control disabled.
- 1 V.42 without detection phase.
- 2 V.42 with detection.
- 3 MNP.

Table 6-1. Error Control

| 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 | | 2 | 2 |
| LAP-M only | | | 1 | 2 |
| | MNP only | | 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 6-1 shows how S181 values are set for error control fallback.

Possible contents 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: 28 (2.8 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: 0–8

Default: 1

The S190 register controls data compression negotiation in both transmit and receive directions. Possible contents of the register are as follows:

- 0 Disabled in both directions.
- 1 Enabled in both directions. Allows single on or both off.
- 2 Enabled in both directions. Allows receive only; disconnect if transmit only or both off.
- 3 Enabled in both directions. Allows transmit only; disconnect if receive only or both off.
- 4 Enabled in both directions; disconnect if not.
- 5 Enabled in transmit only; continue if not.
- 6 Enabled in transmit only; disconnect if not.
- 7 Enabled in receive only; continue if not.
- 8 Enabled in receive only; disconnect if not.

Note: In the case of MNP compression negotiation, the value of 0 disables MNP 5. If you enable any nonzero value of compression, MNP 5 is attempted.

Table 6-2 displays how the S190 register values are set for data compression negotiation.

Table 6-2. S190 Data Compression Values

| | | RECEIVE | | |
|--------------------------------------|----------|---------|----------|------|
| | | Allowed | Required | None |
| T R A N S M I T | Allowed | 1 | 2 | 5 |
| | Required | 3 | 4 | 6 |
| | None | 7 | 8 | 0 |

S253 Command Set Selection

Range: 0 or 10

Default: 10

See also: Z

The S253 register specifies the modem's command set. After the register is set, the appropriate command set becomes active (along with that command set's operational properties) the next time you power-up the modem, press the A/B switch, or enter a Z or &T9 reset. Possible contents for this register are as follows:

- 0 No command set (modem does not respond to any commands).
- 10 AT asynchronous command set.

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 contents 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 contents of this register are as follows:

- 0 Recall User Configuration A after power up or reset. Disable A/B switch.
- 1 Recall User Configuration B after power up or reset. Disable A/B switch.
- 255 Recall user configuration set by A/B switch after power up or reset. If A/B is set to A, then load A configuration on power-up; otherwise, load the B configuration on power-up.

The S255 register also determines the configuration used when 0 is specified for any of the following commands:

Reset (Z).

Write Configuration Parameters (&W).

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

This chapter describes the diagnostic tests, 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 I1 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-232D 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 (~N(n)=(x) command).
2. Turn the modem off then back on, and verify that the new numbers are still present (~L command).

Telephone Dialer Test

To check the integrity of the analog/digital circuitry and telephone line interface, perform the following:

1. Turn on the speaker (M1 command).
2. Enter the following tone dialing command:

AT DT 12345
3. Listen to the tones from the speaker to verify that the modem is tone dialing.
4. Press the RETURN key to hang up the line.

5. Enter the following pulse dialing command:

AT DP 12345

6. Listen for the relay clicking sounds to verify that the modem is pulse dialing.

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 set the S0 register back to 1 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.

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 MR (Modem Ready) indicator on the front panel lit?

The MR light indicates that the modem is operational. If the indicator is off, try issuing an AT11 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 turning the modem's power off and on. If the MR indicator still does not light, contact your technical support representative for further assistance.

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-232D port on your DTE, and that the RS-232D cable is configured correctly. Refer to Appendix B, Interface Description.

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 Chapter 3, The Basics, for configuration guidelines.

Placing a Call

Is the telephone line connected to the TO LINE connector on the modem's back panel?

A common mistake is to connect the telephone line to the TO PHONE connector, which is used for connecting a telephone to the modem for voice communications.

Connect the telephone line to the TO LINE connector on the modem's back panel. Optionally, connect a telephone set to the TO PHONE connector.

Is the modem ready to accept commands or data from the DTE? The MR (Modem Ready), DTR (Data Terminal Ready) and CTS (Clear to Send) indicators should be lit.

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. 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 OH (Off-Hook) indicator should be lit.

If the OH indicator did not light, 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 with a carriage return. Verify that the modem is properly configured to communicate with your equipment.

Placing a Call (continued)

If you did not hear a dial tone before the modem started dialing, connect a telephone to the telephone line and listen for a dial tone. If you do not hear the dial tone, the telephone line is dead. Contact your telephone company service representative for assistance.

Did the telephone ring at the remote site? You should hear a ringing signal over the speaker.

Depending on how quickly the remote site answers the call, you may not hear a ringing signal. If you hear the answering modem's answer tones, you can assume that the remote site answered 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.

Placing a Call (continued)

Did the remote modem answer the call? You should hear answer tones from the remote site over the speaker.

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 their equipment can answer the telephone.

If the ringing signal stops, but you do not hear the answer tones from the answering modem, ask the operator at the remote site to check their equipment and connections.

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.22bis-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.22bis 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.22bis.

Placing a Call (continued)

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 (Modem Ready) indicator on the modem's front panel lit?

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 indicator should be lit.

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 Data Terminal Ready (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 Ring Indicator (RI) signal line of the RS-232D interface.

If the DTR indicator on the front panel is not lit, verify that the RS-232D 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.

Answering a Call (continued)

Did the modem answer the call and then hang-up before a connection was established? This can occur very rapidly so that the OH 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.

Answering a Call (continued)

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.22bis-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.22bis 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.22bis.

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 lit), 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.

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.

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.

Call in Progress (continued)

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.

Call in Progress (continued)

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 lit), 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.

Warranty And Repair Procedures 8

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 should require 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. They 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 USA, 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 |

Telephone Network Interface

The modem is connected to the telephone network through an RJ-11 modular connector. Table B-1 presents a definition of the pins in the line connector.

Table B-1. Phone Line Connector Pin Definitions

| PIN | LINE | PHONE |
|-----|-----------|-----------|
| 1 | Not Used | Not Used |
| 2 | A or MI | A1 or MIC |
| 3 | Ring | Tip |
| 4 | Tip | Ring |
| 5 | A1 or MIC | A or MI |
| 6 | Not Used | Not Used |

Before the modem can use the A/A1 or MI/MIC function, the hardware jumpers on the modem board need to be properly positioned. Figure B-1 shows the location of the jumpers on the board and the position of the jumpers for the MI/MIC function. To use the A/A1 function, move the jumper to the opposite position.

Set the &J command to enable the selected function.

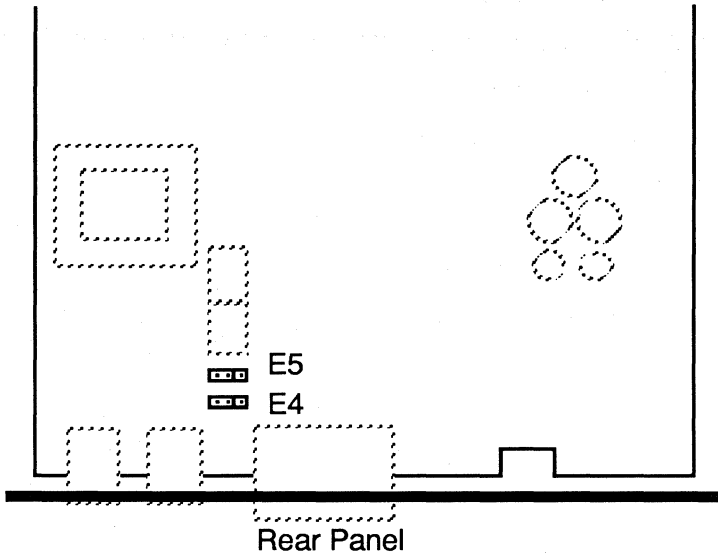


Figure B-1. Jumper Placement

RS-232D Interface

Communication between the modem and the local DTE is accomplished through a 25-pin RS-232D connector.

The RS-232D standard is a set of specifications developed by the Electronic Industries Association (EIA) that applies to the transfer of data between data terminal equipment (DTE) and data communications equipment (DCE).

It is the most common DTE–DCE interface in use in the United States, and is compatible with the International Telegraph and Telephone Consultative Committee Recommendation V.24 and V.28.

The RS-232D standard covers three specific areas:

- The electrical and mechanical characteristics of the interface.
- The function of each interchange circuit.
- Standard subsets of interchange circuit for specific communication system applications.

A DB-25 connector is required with the RS-232D interface. Table B-2 lists the RS-232D interchange signals and their associated pins.

Note: RS-423 drivers are used through the DB-25 connector, to emulate RS-232D functionality between the T3000 modem and the DTE interface.

Table B-2. RS-232D Connector Pin Assignments

| Pin | EIA Circuit | CCITT Signal | Description | From DCE | To DCE |
|-----|----------------|-----------------|------------------------------------|-------------|-----------|
| 1 | AA | 101 | Protective Ground | X | X |
| 2 | BA | 103 | Transmitted Data (TD) | | X |
| 3 | BB | 104 | Received Data (RD) | X | |
| 4 | CA | 105 | Request to Send (RTS) | | X |
| 5 | CB | 106 | Clear to Send (CTS) | X | |
| 6 | CC | 107 | Data Set Ready (DSR) | X | |
| 7 | AB | 102 | Signal Ground | X | X |
| 8 | CF | 109 | Data Carrier Detected (DCD) | X | |
| 9 | - | - | Reserved for Test | | |
| 10 | - | - | Reserved for Test | | |
| 11 | - | - | Unassigned | | |
| 12 | CI | 122 | DCE Signal Rate Select | X | |
| 13 | SCB | 121 | Unassigned | | |
| 14 | SB | A118 | Unassigned | | |
| 15 | DB | 114 | DCE Transmit Signal Element Timing | X | |
| 16 | SBB | 119 | Unassigned | | |
| 17 | DD | 115 | Receiver Signal Element Timing | X | |
| 18 | LL | 141 | Local Analog Loopback | | X |
| 19 | SCA | 120 | Unassigned | | X |
| 20 | CD | 108.2 | Data Terminal Ready (DTR) | | X |
| 21 | RL/CG | 140 | Remote Digital Loopback | | X |
| 22 | CE | 125 | Ring Indicator (RI) | X | |
| 23 | CH | 111 | DTE Signal Rate Selector | | X |
| 24 | DA | 113 | DTE Transmit Signal Element Timing | | X |
| 25 | TM | 142 | Test Mode | X | |

Test Signals

Remote Digital Loopback

The local DTE uses Pin 21 (Remote Digital Loopback) to place the modem into remote digital loopback. The modem must be connected to a remote modem, and must be in the data mode. When Pin 21 is turned ON, the modem requests that the remote modem loop back all data sent from the local modem. When Pin 21 is turned OFF, the modem returns to the data mode.

Local Analog Loopback

The local DTE uses Pin 18 (Local Analog Loopback) to put the modem into local analog loopback. Ensure that the modem is off-line and in the command mode. When Pin 18 is turned ON, the modem enters local analog loopback. All data received on the primary transmit data pin (Pin 2) is modulated, demodulated, then looped back on the primary receive data pin (Pin 3). When Pin 18 is turned OFF the modem returns to the off-line condition.

Test Mode

Pin 25 (Test Mode) is a signal from the modem to the local DTE signifying that the modem is in a test mode. The test mode may be initiated either through the &T commands, or the Remote Digital or Local Analog Loopback RS-232 pins.

Rate Select Signals

DTE Signal Rate Select

The local DTE uses Pin 23 (DTE Signal Rate Select) to select between a primary signalling rate and the fallback rate. The only modulation modes that use Pin 23 are V.32bis (14,4000 bps with 12,000 fallback), V.32 (9600 bps with 4800 bps fallback) and V.22bis (2400 bps with 1200 bps fallback). Pin 23 is enabled by setting S90=1 (for V.22bis, B0 must also be set). If Pin 23 is ON prior to the completion of a connection, the T3000 attempts to connect only at the primary rate.

If Pin 23 is OFF, the modem attempts only the fallback rate. If this pin is not driven by the local DTE, it assumes the ON condition.

DCE Signal Rate Select

Pin 12 (DCE Signal Rate Select) is generated by the modem to inform the local DTE of the current connection rate. The only modulation modes that use Pin 12 are V.32bis (14,400 bps with 12,000 bps fallback), V.32 (9600 bps with 4800 bps fallback) and V.22bis (2400 bps with 1200 bps fallback). When Pin 12 is ON, the modems connect at the primary rate. When Pin 12 is OFF, the modems connect at the fallback rate.

RS-232D Primary Interchange Signals

The modem hardware supports all data, control, and timing signals defined by the RS-232D standard. However, when operating in Asynchronous Mode, the modem uses only the primary interchange circuits defined in Figure B-2. This figure shows the cable configuration for connecting the modem to a standard DTE device.

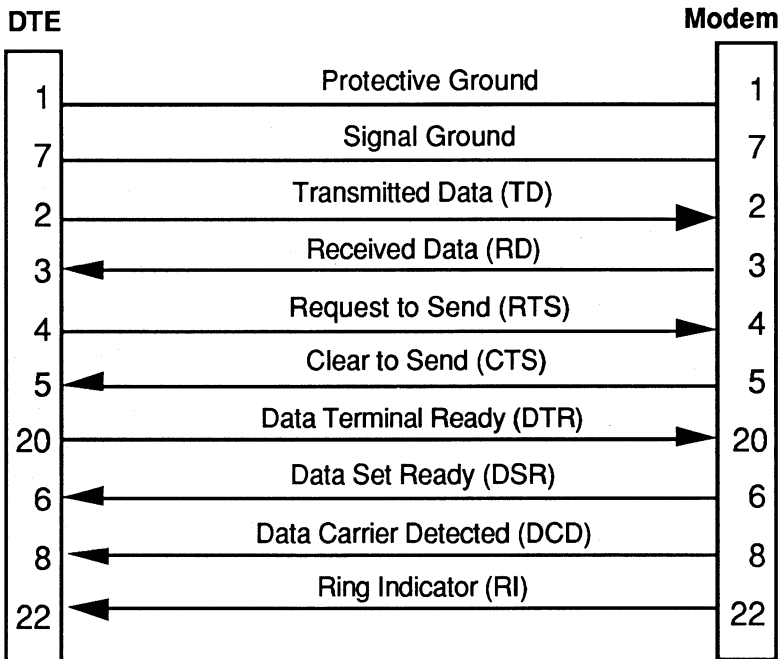


Figure B-2. Asynchronous RS-232D Cable Diagram

For systems that require the modem to act as a DTE connected to a DCE device, a specially modified RS-232D cable must be used. Figure B-3 shows a recommended cable arrangement for this case. Your system may require a different cable configuration. Consult your equipment manual for specific cabling requirements.

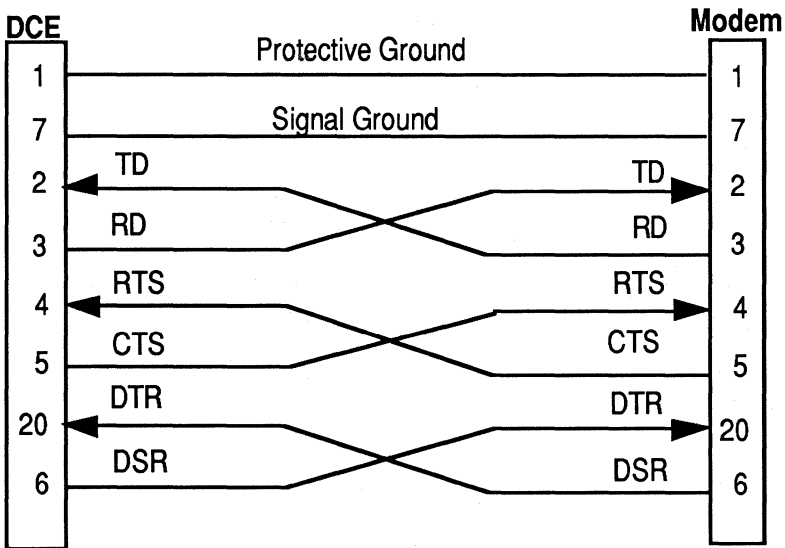


Figure B-3. Asynchronous Modified RS-232D Cable Diagram

The primary interchange signals used by the modem in asynchronous mode are described in the following sections.

Protective and Signal Ground

Pin 1 (Protective Ground) should be electrically connected to the frame or chassis of the equipment. The equipment may be further connected to an external earth ground as required by local electrical codes. Pin 7 (Signal Ground) is the common reference signal ground for all of the other pins. This line should be connected at both ends to complete the signal circuits.

Transmitted Data (TD) and Received Data (RD)

These two signal lines transfer data between the DTE (computer or terminal) and the DCE (modem). All signal names are as viewed from the DTE. Therefore, the DTE transmits data on the Transmitted Data line (pin 2), and receives data on the Received Data line (pin 3). However, the DCE receives data from the DTE on the Transmitted Data line (pin 2), and sends data to the DTE on the Received Data line (pin 3).

Request to Send (RTS) and Clear to Send (CTS)

According to the RS-232D standard, the DTE asserts Request to Send (RTS) on pin 4 when it has data to transmit. It then waits for the DCE to respond by asserting Clear to Send (CTS) on pin 5 before sending data to the DCE via the Transmitted Data (TD) line. Depending on its register settings while operating in Asynchronous Mode, the modem uses RTS and CTS to implement hardware flow control between the DTE and the modem.

Data Terminal Ready (DTR) and Data Set Ready (DSR)

The DTE uses Pin 20 (Data Terminal Ready) to indicate its readiness to transmit or receive data. In automatic answer mode, DTR is activated in

response to the ring indicator to tell the modem to answer the call. The DTR signal may be turned ON when the DTE is ready to transfer data over the interface, or simply used to indicate that the DTE has been turned on.

You can configure the modem to interpret the DTR in different ways, thus allowing it to interface with a variety of DTE devices that may use DTR differently.

The modem uses Pin 6 (Data Set Ready) to indicate its readiness to transmit or receive data. Data Set is another term for modem, typically used by the Bell Operating Companies.

Data Carrier Detected (DCD)

Although this signal line is actually named Received Line Signal Detector in the RS-232D standard, the term Data Carrier Detected (DCD) is more commonly used. When pin 8 (Data Carrier Detected) is active (DCD is ON), the DTE recognizes that the modem has received a signal over the telephone network, which meets its criteria for an acceptable carrier signal.

Depending on the requirements of the DTE device, you can configure the modem to hold DCD ON whether or not a carrier is detected, or to turn DCD ON only when an acceptable carrier signal is detected.

Ring Indicator (RI)

The modem uses Pin 22 (Ring Indicator) to inform the DTE that the telephone is ringing. The Ring Indicator (RI) signal goes ON in cadence with the

ringing signal on the telephone line. When the ringing voltage is present, RI is active. Between rings, RI is OFF.

You can configure the modem can be configured to automatically answer an incoming call, or to answer the call only when the DTE indicates that it is ready to accept the call by turning DTR ON.

RS-232D Timing Interchange Signals

When operating in one of the synchronous modes, the modem uses the RS-232D timing signals in addition to the primary interchange signals described previously. Figure B-4 shows the recommended cable configuration for connecting the modem to a synchronous device.

The timing interchange signals that the modem uses in synchronous modes are described in the following sections.

Receiver Signal Element Timing (RxC)

The modem uses Pin 17 (Receiver Signal Element Timing) to provide the local DTE with received signal element timing information. The transition from an ON-to-OFF condition indicates the center of each signal element on the Received Data (RD) signal line.

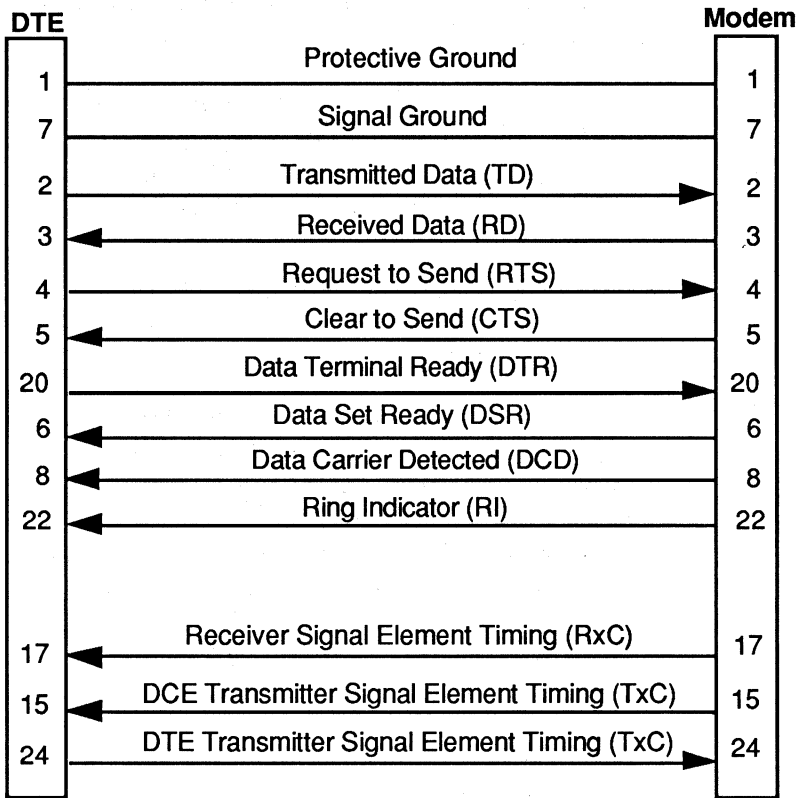


Figure B-4. Synchronous RS-232D Cable Diagram

Transmitter Signal Element Timing (TxC)

The modem can be configured to either provide the Transmitter Signal Element Timing signal to the DTE via pin 15, or accept the Transmitter Signal Element Timing signal from the DTE via pin 24.

The &X command determines which Transmit Clock is used. The default setting for this command is to use the DCE Transmit Clock (pin 15) to control the timing of the DTE's transmissions.

An ON-to-OFF transition on pin 15 (DTE Transmitter Signal Element Timing) indicates the center of each signal element that is sent over the Transmitted Data (TD) signal line.

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

The current setting of the X(n) 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 C-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 10–12 to the first five basic result codes (0–4) listed in Table C-1.
- X2 Supports all of the X1 result codes and adds result codes 6, 7, 52, and 53 to the result codes of X1.
- X11 Includes the DTE interface speed in the CONNECT message. Adds result codes 5, 10–16, 48, and 49 to the first five basic result codes (0–4) listed in Table C-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 C-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 connection is busy. |
| 8 | NO ANSWER - Five seconds of silence was not detected within 30 seconds when an @ 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 |
| 46 | CONNECT 7512 |
| 47 | CONNECT 1275 |
| 48 | CONNECT 7200 |
| 49 | CONNECT 12000 |
| 52 | RRING - Remote connection is ringing. |
| 53 | DIALING |
| 54 | NO PROMPTTONE |

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 five seconds of silence is not detected within 30 seconds after a remote ring.
- **\$**—Always returns a NO PROMPTTONE result code if the calling card prompt tone is not detected within 30 seconds after the \$ starts execution.

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

When dialing using X2 or X12, the functionality associated with the enabled result codes is also enabled. In particular, the BUSY signal is correctly detected, and the T3000 modem performs dial tone detection before it dials, whether or not you entered the W dial modifier.

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

Table C-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 cmd speed) / (link)
/ (compression) / (other speed)

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

The following presents the possible CONNECT message suffixes for link protocol, compression, DTE protocol, and other speeds for the format specified.

Possible link protocol suffixes:

nothing
REL
LAPM

Possible compression suffixes:

nothing
COMP

Possible DTE protocol suffixes:

nothing
KERM
XMDM
UUCP
ENQ
ACK

Possible other speed suffixes (depending on the value of X).

| <u>X2</u> | <u>X12</u> |
|-----------|------------|
| nothing | nothing |
| 300 | 300 |
| 1200 | 1200 |
| 2400 | 2400 |
| 4800 | 4800 |
| 7200 | 7200 |
| 9600 | 9600 |
| 12000 | 12000 |
| 14400 | 14400 |
| 19200 | |
| 38400 | |
| 57600 | |

The T3000 modem provides you with prestored configurations. You can select configurations by using the AT command &F or powering up the modem, pressing the T/D switch. Refer to Chapter 3, *The Basics*, for procedures on using the modem's front panel to select a prestored configuration.

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.

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. Screen display is as follows:

```
T3000SA - Version LA3.00 - 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=40
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S047=4 S048=0 S050=0 S051=255 S056=17
S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0 S064=0
S068=255 S069=0 S090=0 S093=8 S094=1 S100=0 S102=0 S104=0
S105=1 S111=255 S112=1 S180=2 S181=1 S183=25 S190=1 S252=0
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 14,400 bps. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
 B1 E0 L2 M1 P Q2 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q0 &R2 &S4 &T4 &X0
S000:1 S001=0 S002=255 S003=13 S004=10 S005=8 S006=2 S007=40
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S047=4 S048=0 S050=0 S051=255 S056=17
S057=19 S058=3 S059=0 S060=0 S061=0 S062=15 S063=0 S064:1
S068=255 S069=0 S090=0 S093=8 S094=1 S100=0 S102=0 S104=0
S105=1 S111=255 S112=1 S180=2 S181=1 S183=25 S190=1 S252=0
S253=10 S254=255 S255=255
```

Configuration: Intelligent Answer Mode
Command: &F2

The &F2 configuration is used with most computers running intelligent software that interprets the modem result codes and adjusts the interface speed accordingly. Set to this configuration, modem result codes are sent to the computer.

The modem serial interface speed follows the connect speed. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
 B1 E1 L2 M1 P Q0 V1 X1 Y0
&C1 &D2 &G0 &J0 &L0 &Q0 &R2 &S4 &T4 &X0
S000:1 S001=0 S002=43 S003=13 S004=10 S005=8 S006=2 S007=40
S008=2 S009=6 S010=14 S011=70 S012=50 S018=0 S025=5 S026=1
S038=0 S041=0 S045=0 S047=4 S048=0 S050=0 S051=255 S056=17
S057=19 S058=3 S059=0 S060=0 S061=1 S062=15 S063=0 S064=0
S068=255 S069=0 S090=0 S093=8 S094=1 S100=0 S102=0 S104=0
S105=1 S111=255 S112=1 S180=2 S181:0 S183=25 S190=1 S252=0
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, 408-734-5200.

**Configuration: System V (HDB-UUCP)
Command: &F3**

The &F3 configuration is used with most HoneyDanBer UUCP UNIX systems. (you must have: /usr/lib/uucp/Systems, Devices, and Dialers files in your operating file system). Screen display is as follows:

```
T3000SA - Version LA3.00 - 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=43  S003=13  S004=10  S005=8   S006=2   S007=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=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   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111:30  S112=1   S180:3   S181=1   S183=25  S190=1   S252=0
S253=10  S254=255 S255=255
```

Configuration: Ver. 4.2-4.3 (BSD-UUCP) and SCO Xenix Command: &F4

The &F4 configuration is used with most Version 2 UUCP systems (you must have: /usr/lib/uucp/L.sys and L-devices files in your operating system). Screen display is as follows:

```
T3000SA - Version LA3.00 - 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=43  S003=13  S004=10  S005=8   S006=2   S007=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=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   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111:30  S112=1   S180:3   S181=1   S183=25  S190=1   S252=0
S253=10  S254=255 S255=255
```

Configuration: Transparent Sync 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's clock. Screen display is as follows:

```
T3000SA - Version LA3.00 - 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=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=0   S047=4   S048=0   S050:7   S051=255 S056=17
S057=19  S058=3   S059=0   S060=0   S061=1   S062=15  S063=0   S064=0
S068=255 S069=0   S090=0   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111=255 S112=1   S180:0   S181:0   S183=25  S190=1   S252=0
S253:0   S254=255 S255=255
```

**Configuration: IBM PC/Mac
with SW Flow Control (XON/XOFF)
Command: &F8**

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

T3000SA - Version LA3.00 - 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=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=0   S047=4   S048=0   S050=0   S051=255 S056=17
S057=19  S058=3   S059=0   S060=0   S061=1   S062=15  S063=0   S064=0
S068=255 S069=0   S090=0   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111=255 S112=1   S180=2   S181=1   S183=25  S190=1   S252=0
S253=10  S254=255 S255=255
```

**Configuration: IBM PC
with HW Flow Control (RTS/CTS)
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 (400). Screen display is as follows:

T3000SA - Version LA3.00 - 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=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=0   S047=4   S048=0   S050=0   S051=255 S056=17
S057=19  S058:2   S059=0   S060=0   S061=1   S062=15  S063=0   S064=0
S068=255 S069=0   S090=0   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111=255 S112=1   S180=2   S181=1   S183=25  S190=1   S252=0
S253=10  S254=255 S255=255
```

Configuration: Leased-Line Async Originate Mode Command: &F10

The &F10 configuration is used in any asynchronous point-to-point, 2-wire leased-line, V.32bis application. The modem connects automatically on a leased line to another T3000 modem, configured with the AT&F11 command, in asynchronous V.32 mode at 14,400 bps. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
  B1 E0 L2 M1 P Q2 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q0 &R3 &S1 &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 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 S093=8 S094:0 S100=0 S102=0 S104=0
S105=1 S111=255 S112=1 S180=2 S181=1 S183=25 S190=1 S252=0
S253=10 S254=255 S255=255
```

Configuration: Leased-Line Async Answer Mode Command: &F11

The &F11 configuration is used in any asynchronous point-to-point, 2-wire leased-line, V.32bis application. The modem connects automatically on a leased line to another T3000 modem, configured with the AT&F10 command, in asynchronous V.32bis mode at 14,400 bps. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
  B1 E0 L2 M1 P Q1 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q0 &R3 &S1 &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 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 S093=8 S094:0 S100=0 S102=0 S104=0
S105=1 S111=255 S112=1 S180=2 S181=1 S183=25 S190=1 S252=0
S253=10 S254=255 S255=255
```

Configuration: Leased-Line Sync Originate Mode Command: &F12

The &F12 configuration is used in any synchronous point-to-point, 2-wire leased-line, V.32bis application. The modem connects automatically on a leased line to another T3000 modem, configured with the &F13 command, in synchronous V.32bis mode at 14,400 bps. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
  B1 E0 L2 M1 P   Q0 V1 X1 Y0
&C1 &D0 &G0 &J0 &L1 &Q0 &R3 &S1 &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   S047=4   S048=0   S050:7   S051=255 S056=17
S057=19 S058=3   S059=0   S060=0   S061=1   S062=15  S063=0   S064=1
S068=255 S069=0   S090=0   S093=8   S094:0   S100=0   S102=0   S104=0
S105=1   S111=255 S112=1   S180:0   S181:0   S183=25  S190=1   S252=0
S253:0   S254=255 S255=255
```

Configuration: Leased-Line Sync Answer Mode Command: &F13

The &F13 configuration is used in any synchronous point-to-point, 2-wire leased-line, V.32bis application. The modem connects automatically on a leased line to another T3000 modem, configured with the &F12 command, in synchronous V.32bis mode at 14,400 bps. Screen display is as follows:

```
T3000SA - Version LA3.00 - Active Configuration
  B1 E1 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   S047=4   S048=0   S050:7   S051=255 S056=17
S057=19 S058=3   S059=0   S060=0   S061=1   S062=15  S063=0   S064=1
S068=255 S069=0   S090=0   S093=8   S094:0   S100=0   S102=0   S104=0
S105=1   S111=255 S112=1   S180:0   S181:0   S183=25  S190=1   S252=0
S253:0   S254=255 S255=255
```

Note: The following three prestored configurations are command selectable only; i.e., they are not accessible from the front panel.

**Configuration: Async /Sync Hayes &Q1
Command: &F32**

The &F32 configuration is used when an asynchronous device instructs the modem to establish a connection, which is then used by a synchronous device. It is the user's responsibility to switch the serial interface between the asynchronous calling unit and the synchronous data unit. Screen display is as follows:

```
T3000SA - Version LA3.00 - 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=40
S008=2  S009=6  S010=14  S011=70  S012=50  S018=0  S025=5  S026=1
S038=0  S041=0  S045=0  S047=4  S048=0  S050=7  S051=255 S056=17
S057=19 S058=3  S059=0  S060=0  S061=1  S062=15  S063=0  S064=0
S068=255 S069=0  S090=0  S093=8  S094=1  S100=0  S102=0  S104=0
S105=1  S111=255 S112=1  S180:0  S181:0  S183=25  S190=1  S252=0
S253=10 S254=255 S255=255
```

**Configuration: HP 3000 (host)
Command: &F33**

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

```
T3000SA - Version LA3.00 - 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=40
S008=2  S009=6  S010=14  S011=70  S012=50  S018=0  S025=5  S026=1
S038=0  S041=0  S045=0  S047=4  S048=0  S050=0  S051=255 S056=17
S057=19 S058=3  S059=0  S060=0  S061=1  S062=15  S063=0  S064:1
S068=255 S069=0  S090=0  S093=8  S094=1  S100=0  S102=0  S104=0
S105=1  S111:40 S112=1  S180:3  S181=1  S183=25  S190=1  S252=0
S253=10 S254=255 S255=255
```

**Configuration: HP 3000 (terminal)
Command: &F34**

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

T3000SA - Version LA3.00 - 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=40
S008=2   S009=6   S010=14  S011=70  S012=50  S018=0   S025=5   S026=1
S038=0   S041=0   S045=0   S047=4   S048=0   S050=0   S051=255 S056=17
S057=19  S058=3   S059=0   S060=0   S061=1   S062=15  S063=0   S064=0
S068=255 S069=0   S090=0   S093=8   S094=1   S100=0   S102=0   S104=0
S105=1   S111:41  S112=1   S180:3   S181=1   S183=25  S190=1   S252=0
S253=10  S254=255 S255=255
```


When connecting the modem to private or leased lines, the modem output power level can be adjusted by changing a plug-in resistor on the modem board shown in Figure E-1.

Table E-1 lists the resistor values that correspond to various output power levels.

Table E-1. Internal Resistor (R32) Values

| Power Limit (dBm) | Resistor (1%) |
|-------------------|---------------|
| 0 dBm | 7.50K |
| -2 dBm | 8.45K |
| -3 dBm | 9.31K |
| -4 dBm | 10.5K |
| -5 dBm | 11.8K |
| -6 dBm | 13.3K |
| -7 dBm | 14.7K |
| -8 dBm | 16.5K |
| -9 dBm | 18.7K |
| -10 dBm | 21.0K |
| -11 dBm | 23.7K |
| -12 dBm | 26.7K |
| -13 dBm | 29.4K |
| -14 dBm | 33.2K |
| -15 dBm | 37.4K |

For leased line applications, configure the modems as shown in Table E-2.

Table E-2. Leased-Line Modem Configuration

| Originate Modem | Answer Modem |
|-----------------|--------------|
| S7=255 | S7=255 |
| S50=6 | S50=6 |
| S0=0 | S0=1 |
| &L1 | &L1 |

This configuration allows the modems to attempt a V.32 connection whenever DTR is raised and a carrier is not present. For additional information, read the descriptions of the above registers and commands.

Refer to Chapter 5, AT Command Descriptions, for complete descriptions of the commands used in the Telebit Extended AT command set. Refer to Chapter 6, AT Register Descriptions, for complete descriptions of the registers used in the Telebit Extended AT command set.

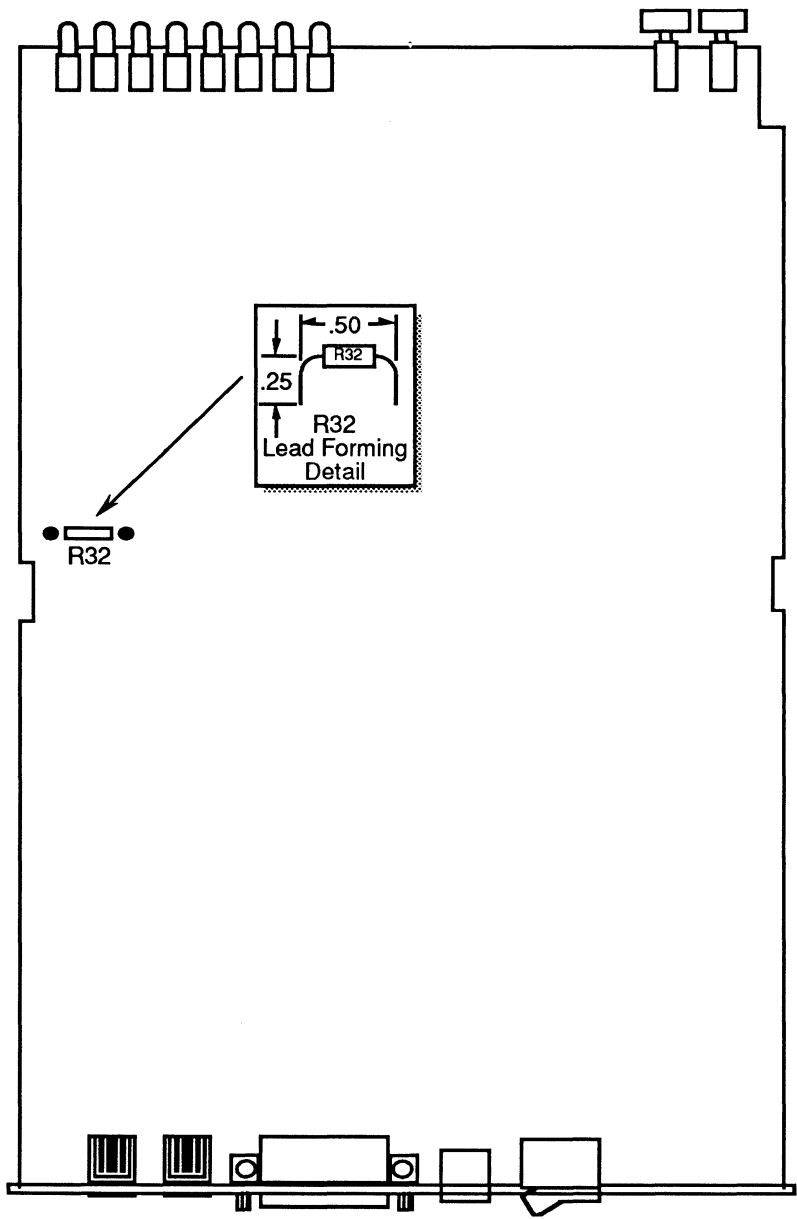


Figure E-1. Resistor R32.

Technical Specifications

F

Environmental Limits

| | |
|-----------------------|--|
| Operating Temperature | 50 to 120° Fahrenheit 10 to 50° Celsius |
| Storage Temperature | -40 to 149° Fahrenheit -40 to 65° Celsius |
| Relative Humidity | 5 to 95% noncondensing |
| Altitude (maximum) | 20,000 feet (6,096 meters) |

Power Requirements

| | |
|-----------------|--|
| 60 Hz Operation | 115 VAC (+10%/-15%) @ 0.5 Amps maximum |
| 50 Hz Operation | 230 VAC (+10%/-15%) @ 0.25 Amps maximum |

Physical Dimensions

| | |
|--------|-----------------------|
| Height | 2.4 inches (6.1 cm) |
| Width | 8.5 inches (21.6 cm) |
| Depth | 13.0 inches (33.0 cm) |
| Weight | 2.8 pounds (1.27 Kg) |

Interface

| | |
|-------------|----------------|
| Serial Port | 25-pin RS-232D |
| Phone Line | 6-pin RJ11C |

Operation

Asynchronous or synchronous binary

Transmission Modes

Bell 103 or V.21 (300 bps)
Bell 212A or V.22 (1200 bps)
V.22bis (2400 bps)
V.23 (1200/75 bps)
V.32 (9600, 4800 bps)
V.32bis (14,400, 12,000, 9600, 7200 bps)

Standard Character Format

1 start bit, 7 or 8 data bits,
plus 1 parity bit and 1 stop bit

Modulation

FSK (Bell 103, V.21, V.23)
DPSK (Bell 212A, V.22)
QAM (V.23bis, V.32, V.32bis)

Receiver Sensitivity

-43dBm

Frequencies

Bell 103

| | <u>Tx Frequency</u> | <u>Rx Frequency</u> |
|----------------|-----------------------------------|-----------------------------------|
| Originate Mode | 1070 Hz = space 1270 Hz = mark | 2025 Hz = space 2225 Hz = mark |
| Answer Mode | 2025 Hz = space 2225 Hz = mark | 1070 Hz = space 1270 Hz = mark |

Bell 212A/V.22/V.22bis

| | <u>Tx Frequency</u> | <u>Rx Frequency</u> |
|----------------|---------------------|---------------------|
| Originate Mode | 1200 Hz (carrier) | 2400 Hz (carrier) |
| Answer Mode | 2400 Hz (carrier) | 1200 Hz (carrier) |

V.32/V.32bis

| | <u>Tx Frequency</u> | <u>Rx Frequency</u> |
|----------------|---------------------|---------------------|
| Originate Mode | 1800 Hz (carrier) | 1800 Hz (carrier) |
| Answer Mode | 1800 Hz (carrier) | 1800 Hz (carrier) |

V.21

| | <u>Tx Frequency</u> | <u>Rx Frequency</u> |
|----------------|-----------------------------------|-----------------------------------|
| Originate Mode | 1180 Hz = space 980 Hz = mark | 1850 Hz = space 1650 Hz = mark |
| Answer Mode | 1850 Hz = space 1650 Hz = mark | 1180 Hz = space 980 Hz = mark |

Frequency Offset

Can tolerate up to +/-7 Hz

Certifications

FCC Part 15J Class A, part 68
ER95W5-17716-MD-E
DOC CS-03, Issue 05
CSA #LR66104-7
UL#E104318 (S)

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 U.S.A.

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 — An acronym for 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-232D 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-232D 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 (CD) — RS-232D 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-232D 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.

dibit — A grouping of two bits.

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.

Forward Error Correction (FEC) — Technique of transmitting additional information with the original data such that if small errors are detected, the correct information can be re-created by the receiving end without requiring a retransmission.

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.

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.

Horizontal Redundancy Checking (HRC) — Technique in which redundant information is included with a block of data for validating the transmitted data at the receiving end.

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.

J

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.

Longitudinal Redundancy Check (LRC) — Error detection technique that consists of a byte where each bit is calculated on the basis of the parity of all bits in the block in the same position.

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.

multidrop line — Single communications circuit interconnecting many stations (nodes), each containing terminal devices.

N

NAK — Negative Acknowledgement. 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.

O

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.

point-to-point — A connection between two points as opposed to a multipoint or multidrop line.

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.

Q

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-232D 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-232D 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.

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.

Trellis Code 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

Vertical Redundancy Check (VRC) — A method of character parity checking.

voice grade line — Channel with a frequency range of 300 to 3400 Hz suitable for the transmission of speech or data in analog form.

W

X

XMODEM — A file transfer protocol. Also see protocol.

XOFF/ XON — The control characters used to stop or resume transmissions.

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T3000 Quick Reference Card

You may enter a command line of up to 80 characters in upper or lower case with the first command in the line preceded by an AT or at and the last command followed by a carriage return.

The notation (n) in the descriptions represents a decimal numeric option, and (x) represents an assigned value. The parentheses should not be typed. If a command is typed without a value when one is expected, the modem will assume a value of 0.

The option should immediately follow the command. For example, to turn off the result codes, type Q1 not Q=1.

You can repeat the last command line issued by entering A/ or a/. Do not begin the A/ with the AT prefix, and do not follow the A/ with a return.

Result Codes

The following are the basic result codes returned when the Q command setting is Q0 or Q2.

| 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 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 DIALTONE — No dial tone was detected. |
| 7 | BUSY — Remote connection is busy. |
| 8 | NO ANSWER — Five seconds of silence was not detected within 30 seconds when an @ 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 |
| 46 | CONNECT 7512 |
| 47 | CONNECT 1275 |
| 48 | CONNECT 7200 |
| 49 | CONNECT 12000 |
| 52 | RRING — Remote connection is ringing. |
| 53 | DIALING |
| 54 | NO PROMPTTONE |

Command Summary

| Command | Parameter | Description | Default |
|---------|--------------------------|---|---------------|
| A | | Answer | |
| A/ | | Repeat previous command | |
| B(n) | 0 or 1 | Bell/CCITT Mode Select 0 Off 1 On | B1 |
| D(n) | 0-9, A-D, # Modifiers | Dial number S= Reference number in number directory P=Pulse dialing T=Tone dialing W=Wait for dial tone , =Timed wait set by S8 @=Wait for quiet answer R=Switch to answer mode when remote modem answers ; =Remain in command mode after dialing ! =On-hook flash \$=Calling and billing prompt \ =Reference a number in number directory | Pulse dialing |
| E(n) | 0 or 1 | Command Echo 0 Off 1 On | E1 |
| H(n) | 0 or 1 | Hook Control 0 Hang up (on-hook) 1 Pick up phone line (off-hook) | |
| I(n) | 0-3, 5 | Information 0 Return product ID code 1 Return diagnostic status 2 Report CONNECT status 3 Return firmware version level 5 Last number dialed | |
| L(n) | 0-3 | Speaker Volume 0 Low volume 1 Low volume 2 Medium volume 3 High volume | L2 |
| M(n) | 0-3 | Speaker Mode 0 Speaker off 1 Speaker on while connecting 2 Speaker always on 3 Speaker on after dialing until carrier detected | M1 |
| O(n) | 0-1 | On-Line 0 Modem in data mode 1 Retrain Equalizers | |
| P | | Pulse Dialing | |

Command Summary

| Command | Parameter | Description | Default |
|---------|---------------------|---|---------|
| Q(n) | 0-2 | Quiet Enable 0 Return result code for both local and remote modems 1 No result codes are reported 2 Orig modem reports results codes | Q0 |
| T | | Tone Dialing | |
| V(n) | 0 or 1 | Verbose ON/OFF 0 Return numeric response 1 Return English response | V1 |
| X(n) | 0-2, 4, 11-12 | Result Code Format 0 0-4 result codes 1 Mod speed to 0-5,10-12,48 2 Same as X1, with 6-7, 52-55 4 Same as X11, with 6-7 11 DTE speed, 0-5,10-16, 48, 49 12 Same X11 with 6-7, 52-53 | X1 |
| Y(n) | 0 or 1 | Long Space Disconnect 0 Modem ignores break 1 Modem disconnects on break | Y0 |
| Z(n) | 0-1 | Reset 0 Reset specified by S255 1 Reset and recall profile B | |
| &C(n) | 0-3 | DCD Control 0 DCD signal is on 1 DCD on after connect 2 DCD on/off specified by S47 3 DCD inverse of CTS | &C0 |
| &D(n) | 0-3 | DTR Interpretation 0 DTR is always true 1 DTR on/off to command mode 2 DTR on/off disconnects 3 DTR on/off resets modem | &D0 |
| &F(n) | 0-5, 8-13, 32-34 | Load Factory Defaults See Reference Manual | |
| &G(n) | 0-2 | Guard Tone Select 0 No guard tones 1 550 Hz guard tone 2 1800 Hz guard tone | &G0 |
| &J(n) | 0-2 | Jack Type Select &J00 Aux telco leads disabled 1 A/A1 control selected 2 M/MIC control selected | &J0 |
| &L(n) | 0 or 1 | Leased Line 0 Dial-up line 1 Leased line | &L0 |
| &M(n) | 0-3 | Async/Sync Mode Select 0 Equivalent to Q0 1 Equivalent to Q2 3 Equivalent to Q3 | &M0 |

Command Summary

| Command | Parameter | Description | Default |
|-----------|-----------|---|---------|
| &Q(n) | 0-3, 6 | Async/Sync Mode Select 0 Async mode 1 Sync mode 1 2 Sync mode 2 3 Sync mode 3 6 Transparent sync mode | &Q0 |
| &R(n) | 0-4 | CTS Control 0 CTS follows RTS per S26 1 CTS is on after CONNECT 2 CTS follows RTS, fixed delay 3 CTS is always on 4 Same as &R; CTS follows DTR when modem is not connected | &R3 |
| &S(n) | 0-4 | DSR Control 0 DSR is always on 1 DSR on after answer tone 2 DSR on/off specified by S47 3 DSR on/off depends on DTR 4 DSR follows DCD | &S0 |
| &T(n) | 0, 1, 3-9 | Test Mode 0 Terminate test in progress 1 LAL 3 RDL 4 RDL request 5 Deny RDL request 6 Request RDL 7 Request RDL with self test 8 LAL with self test 9 Run diagnostics test | &T4 |
| &V(n) | 0 | View Active Profile 0 Display active RAM profile | |
| &W(n) | 0 or 1 | Write Current Profile 0 Save to profile specified by S255 1 Save to profile B | |
| &X(n) | 0-2 | Select Clock Source 0 Generates clock signal 1 DTE generates clock signal 2 Modem derives clock signal | &X0 |
| ~H | | Description of the Commands and Registers | |
| ~L | | List Number Directory | |
| ~M(n) | 0 or 1 | Modify Stored Profile 0 Modify profile A 1 Modify profile B | |
| ~N(n)=(x) | 0-9 | Set Number Directory | |
| ~U | | Update Security Password | |
| ~V(n) | 0 or 1 | View Nonvolatile Profile 0 Display nonvolatile profile A 1 Display nonvolatile profile B | |
| % | | Remote Modem Access | |

Register Summary

| Register | Parameter | Description | Default |
|----------|---------------|--|---------|
| S0 | 0-255 | Answer on Ring Number | 0 |
| S1 | 0-255 | Ring Count | |
| S2 | 0-255 | Escape Character (ASCII) | 43 |
| S3 | 0-127 | Command Line Terminator (ASCII) | 13 |
| S4 | 0-127 | Line Feed Character (ASCII) | 10 |
| S5 | 0-127 | Command Line Character (ASCII) | 8 |
| S6 | 2-255 | Pause Before Dialing (sec) | 2 sec |
| S7 | 1-255 | Wait for Connection Time (sec) | 40 sec |
| S8 | 0-255 | Comma Pause Time (sec) | 2 sec |
| S9 | 1-255 | Carrier Detect Time (100 ms) | 6 |
| S10 | 1-255 | Carrier Loss Disconnect Time (100 ms) | 14 |
| S11 | 50-255 | DTMF Dialing Timing (ms) | 70 |
| S12 | 0-255 | Escape Sequence Guard Time (1/50 sec) | 50 |
| S18 | 0-255 | Test Duration Timer | 0 |
| S25 | 5-255 | DTR Delay Timing (10 ms) | 5 |
| S26 | 0-255 | RTS-to-CTS Delay Interval (100 ms) | 1 |
| S38 | 0-255 | Delay Before Disconnecting | 0 |
| S41 | 0-255 | Inactivity Time-Out (1/10 hour) | 0 |
| S45 | 0, 255 | Remote Access Enable 0 Disable remote access 255 Negotiate remote access ans | 0 |
| S46 | 0-3 | Call Security 0 Callback security disabled 1 Callback security enabled 2 Callback security enabled with password reverification 3 Passthrough security enabled, no callback required | 0 |
| S47 | 0-255 | DSR/DCD Delay Time (50 ms) | 4 |
| S48 | 0 or 1 | Control Character Mask 0 Most significant bit is marked 1 Compare all eight bits | 0 |
| S50 | 0-3, 6-7, 254 | Modulation Mode 0 Auto Speed Determination 1 300 bps (Bell 103) 2 1200 bps (Bell 212A of v.22) 3 2400 bps (V.22bis) 6 9600 bps (V.32) 7 14,400 bps (V.32bis) 254 Use last AT comand speed | 0 |

Register Summary

| Register | Parameter | Description | Default |
|----------|--------------------------|--|---------|
| S51 | 0-7, 35, 43, 46, 251-255 | 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 251 Reserved 252 Autobaud (no type-ahead) 253 Autobaud (38,400 bps default) 254 Autobaud (19,200 bps default) 255 Autobaud (9600 bps default) | 255 |
| 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 Use RTS/CTS flow control in half-duplex mode 2 Use RTS/CTS flow control in full-duplex mode 3 Use XON/OFF protocol 4 Use both XON/XOFF and 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 | 0-1 | Local Action of Break 0 Break processed as set in S63 1 Go into Command mode | 1 |
| S62 | 0-255 | Default Break Length (10 ms) | 15 |
| S63 | 0-3 | Link Layer Action on Break 0 Break in sequence 1 Send break immediately 2 Discard data, break 3 Ignore break | 0 |
| S64 | 0-1 | Dial/Answer Sequence Abort 0 Abort dial/answer sequence if character went by DTE before connection is established 1 Ignore characters sent by DTE while dialing or answering a call | 0 |

Register Summary

| Register | Parameter | Description | Default |
|----------|-------------|---|---------|
| S68 | 0, 2-4, 255 | DCE Flow Control 0 No flow control 2 Full duplex HW flow control 3 XON/XOFF flow control 4 Both XON/XOFF and RTS/CTS HW 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 | |
| S72 | | Recieve Modulation Rate | |
| S74 | | Packet Transmit Status | |
| S78 | | Line Quality | |
| S90 | 0 or 1 | DSRS Behavior 0 Disable DTE/DSRS input 1 Enable DTE/DSRS | 0 |
| S93 | 3-255 | V.32 AC Transmit Duration (100 ms) | 8 |
| S94 | 0-3 | Modulation Speed Negotiation 0 Negotiation disabled 1 Allows a connection 2 Fallback within a mod scheme 3 Use appropriate fallback | 1 |
| S100 | 0 or 1 | Reverse Answer/Originate Mode 0 Normal mode 1 Reverse mode | 0 |
| S102 | 0 or 1 | Pulse Dial Make/Break Ratio 0 39% make/61% break ratio-US 1 33% make/67% break ratio-UK | 0 |
| S104 | 0-1, 3, 4 | Automatic Dialing 0 Disable automatic dialing 1 DTR automatic dialing 3 T/D switch automatic dialing 4 DTR starts connection attempt | 0 |
| S105 | 0-2 | T/D Switch Enable 0 Disable T/D switch 1 Enable T/D switch 2 Enable T/D switch when on-hook | 1 |

Register Summary

| Register | Parameter | Description | Default |
|----------|------------------------------|--|---------|
| S111 | 0, 10-14, 20, 30, 40-43, 255 | Protocol Support 0 No protocol support 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 255 Remote modem protocol | 255 |
| S112 | 0-255 | Kermit Mark Character | 1 |
| S180 | 0-3 | Error Control Request 0 Error control disabled 1 V.42 without detection phase 2 V.42 with detection 3 MNP | 2 |
| S181 | 0-2 | Originator Error Control Alternatives 0 If no error control, direct 1 If not error control, buffer 2 Error control required | 1 |
| S183 | 8-255 | Error Control Detection Timer (100 ms) | 28 |
| S190 | 0-8 | Data Compression Enable 0 Disabled in both directions 1 Enable both but single or none 2 Enable both but receive only 3 Enable both but transmit only 4 Enable in both directions 5 Enable in transmit, accept none 6 Enable in transmit only 7 Enable in receive, accept none 8 Enable in receive only | 1 |
| S253 | 0, 10 | Command Set Selector 0 No command set 10 AT sync command set | 10 |
| S254 | 0, 1, 255 | &F0 Profile Select 0 Load profile A 1 Load profile B 255 Load factory defaults | 255 |
| S255 | 0, 1, 255 | Profile Select 0 Load profile A 1 Load profile B 255 Recall profile A/B switch | 255 |



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