Zypcom

SX-Series Advanced Network Modems

SE-Series Corporate Class Modems

User's Guide

Z34-SX
Z32t-SX
Z32b-SX
Z34-SE
Z32t-SE
Z32b-SE

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2301 Industrial Parkway West, Bldg. 7
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Part number: 18008-514A
September 1998

ZYPCOM

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Contents

About This Manual

Shown below is a chronological listing of revisions to this manual. The revision sequence, date, and synopsis of revised materials are included to provide the reader with a comprehensive manual history.

REVISION NUMBER	DATE	DESCRIPTION
18008-514A	09/98	1st Edition

Zypcom welcomes your comments concerning this manual. Although every effort has been made to keep it free of errors, some do occasionally occur. When reporting a specific problem or error, please describe it briefly and include the manual name, the document number, the paragraph or figure number, and the page number.

Mail, phone in, or fax your comments to:

Zypcom, Inc.
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Printed in U.S.A.

Warranty and Limitation of Liability

Zypcom, Inc. warrants that its products will perform in accordance with Zypcom's published specifications, for a period of twenty-four (24) months from Zypcom's original shipment date. For SX-Series modems, Zypcom will, at no cost, promptly ship a replacement unit via express courier within 24 hours on normal business days for any equipment determined by Zypcom to be defective (transportation charges prepaid by Zypcom) for destinations within the continental United States. The buyer will return defective SX-Series modem, prepaying transportation charges via United Parcel Service. For SE-Series modems the buyer will return defective equipment, prepaying transportation charges via United Parcel Service and Zypcom will return such equipment, freight prepaid, using a like method. Warranty repair on SX-Series and SE-Series modems for locations outside the continental United States, the buyer will return defective equipment, prepaying transportation charges and Zypcom will return such equipment, transportation charges prepaid via a method of its choice. A repair number must accompany all returned equipment (see "Service Information" later in this section).

This warranty shall not apply to damage resulting from abuse, negligence, accident, natural disaster (flood, lightening, wind, etc.), loss, or damage in transit. The warranty shall be voided should the Buyer attempt any repairs or alterations without prior written permission of Zypcom, Inc.

ZYPCOM MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THE BUYER AND ZYPCOM AGREE THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS SHALL BE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS UPON THE TERMS ABOVE DESCRIBED OR, AT ZYPCOM'S OPTION, REFUND OF THE PURCHASE PRICE. ZYPCOM SHALL NOT BE LIABLE FOR CONTINGENT OR CONSEQUENTIAL DAMAGES TO PERSONS OR PROPERTY, AND ITS SOLE LIABILITY IS AS SET FORTH ABOVE.

Any action by the Buyer for any alleged breach of the warranty set forth herein shall be brought to the attention of Zypcom, Inc. by the Buyer within the warranty period, but not later than thirty (30) days after the alleged breach.

THIS STATEMENT OF WARRANTY AND LIMITATION OF LIABILITY IS A COMPLETE AND EXCLUSIVE STATEMENT OF ALL WARRANTY AND LIABILITY REPRESENTATIONS OF ZYPCOM, INC. It may not be varied, supplemented, qualified or interpreted by any prior dealings between the parties, or by any usage of the trade, or upon the face or reverse of any form to which this is attached or is a part of, nor may it be modified by any agent, employee or representative of Zypcom unless such modification or representation is made in writing and signed by an officer of Zypcom, Inc.

Repairs and/or replacements under the terms of this warranty S*HALL NOT EXTEND THE WARRANTY LIFE OF THE ORIGINAL EQUIPMENT SUPPLIED.* After this warranty has expired, service can be purchased directly from Zypcom, Inc.

Service Information

In the event of malfunction or other indication of product failure, please follow this procedure:

1. Call Zypcom Technical Support at (510) 783-2501, Monday through Friday from 8:00 A.M. to 5:00 P.M. Pacific time (excluding holidays).

2. Your support representative will ask you to perform a few tests. If the tests do not solve the problem, you will be issued a Repair Order (RO) number.

3. Return the unit in a protective shipping container and send it prepaid to:

   Repair Department
   Reference: RO Number _____
   Zypcom, Inc.
   2301 Industrial Parkway West, Bldg. 7
   Hayward, CA 94545

Please mark the shipping container with the RO number and enclose a written description of the problem.

Terms

For warranty repair and/or replacements, the customer pays freight charges incurred for sending the defective modem to Zypcom. Zypcom pays freight charges for sending repaired or replaced units. Warranty replacements and/or repairs are performed at no charge to the customer.

For non-warranty repairs, charges vary according to the specific model of the modem being repaired. Repair charges are estimated before an RO number is issued. Customer prepays all freight and repair charges by means of credit card or C.O.D. terms. Zypcom can accept prepayment by company check.

FCC Part 15: Radio/Television Interference

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on, the user is encouraged to try to correct the interference by one or more of the following measures.

- ❑ Reorient or relocate the receiving antenna.
- ❑ Increase the separation between the equipment and the receiver.
- ❑ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ❑ Consult the dealer or an experienced radio/TV technician for help.

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

CAUTION: *Shielded interface cables, if any, must be used in order to comply with emissions limits.*

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FCC Part 68: Requirements For End Users

Type of Service

Your modem can be used on standard telephone lines. The modem connects to the telephone line with a standard USOC RJ11C or RJ45S jack. Connection to pay telephones is prohibited. Connection to party lines service is subject to state tariffs.

Telephone Company Procedures

The telephone company may occasionally make changes in their equipment, operations, or procedures. They will give you prior notice in writing, so you can make any necessary changes to maintain uninterrupted service. If you have any questions about your telephone line, call the telephone company.

In certain circumstances, the telephone company may request information concerning the equipment that you have connected to your telephone line. Upon their request, provide the FCC registration number and the ringer equivalence number (REN) of the modem. Both of these items are listed on the equipment label. The sum of all of the RENs on your telephone line should be less than five to ensure proper service from the telephone company. In some cases, a REN sum of five may not be usable on a given line.

When the modem is enclosed in a cabinet, a label listing the unit's registration number and ringer equivalence number must be visible from the outside of the cabinet or other enclosure, in addition to the label required on the registered device itself. Additionally, OEMs must provide their equipment, with the attached warnings, to end users.

If Problems Arise

If your telephone equipment is not operating properly, immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When you are notified, you will be given the opportunity to correct the problem and will be informed of your right to file a complaint with the FCC.

All repairs on your modem should be performed by Zypcom, Inc. or an authorized representative of Zypcom, Inc. For more information contact:

Customer Service
Zypcom, Inc.
2301 Industrial Parkway West, Bldg. 7
Hayward, CA 94545
(510) 783-2501

Statement of Fax Branding

The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone fax machine unless the message clearly contains a margin at the top or bottom of each transmitted page or on the first page of the transmission; the date and time the message is sent; an identification of the business, other entity, or individual sending the message; and the telephone number of the sending machine, business, other entity, or individual.

Canadian Department of Communications—Requirements For End Users

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

Before installing this equipment, the user should ensure that connection to the line is allowed by the local telecommunications company. The equipment must also be installed by using an acceptable method of connection. In some cases, the company's inside wiring, associated with a single-line individual service, may be extended by means of a telephone extension cord. Compliance with the above conditions may not prevent degradation of service in certain situations.

Equipment repairs should be made by an authorized Canadian maintenance facility designated by Zypcom, Inc. Any repairs or alterations made by the user may cause the telecommunications company to request disconnection.

The electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, should be connected together. This precaution may be particularly important in rural areas.

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

The Load Number (LN) assigned to each terminal device indicates the total load percentage that can be connected to a telephone loop. The termination on a loop may consist of any combination of devices. However, the total LN of all the devices must not exceed 100.

The Load Number and Canadian certification number are listed on the modem label. The Canadian DOC connector codes supported are CA11A, CA41A, and CA45A. For internal modems on which the agency information label cannot be seen when the modem is installed, a second agency label will be provided. The customer must attach the label to the exterior of the cabinet in which the modem is installed.

Repairs

Inquiries regarding Canadian repair centers should be addressed to:

Customer Service
Zypcom, Inc.
2301 Industrial Parkway West, Bldg. 7
Hayward, CA 94545
(510) 783-2501

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CHAPTER 1 Introduction

Description

The Zypcom SX-Series and SE-Series are versatile, very high-speed, asynchronous/synchronous modems that allow data and facsimile transmission between your local PC or host computer and other remote host computers, networks (LANs), or facsimile machines. The Z34-*SE*, Z32*t*-*SE* and Z32*b*-*SE* can operate in full- or half-duplex (simulated with V.13) on dial-up or on two-wire leased lines, and feature a variety of compatibilities and capabilities. The Z34-*SX*, Z32*t*-*SX* and Z32*b*-*SX* can operate in full- or half-duplex (simulated with V.13) on dial-up, two-wire or four-wire leased lines, and feature a variety of compatibilities and capabilities. In this manual, any differences among the six modems (Z34-SX, Z32t-SX, Z32b-SX, Z34-SE, Z32t-SE and Z32b-SE) are explained.

Features

- ❑ External modem
- ❑ 230,400 bps to 300 bps DTE operation (Z32t-Sx, Z32t-SE, Z32b-SX, Z32b-SE max. speed is 115,200 bps)
- ❑ Z34-*SX* and Z34-*SE* are software upgradeable via flash memory
- ❑ Z34-*SX* and Z34-*SE* supports line rates from 33,600 bps to 300 bps compatible with V.34+, V.34, V.32*terbo*, V.32*bis*, V.32, V.22*bis*, V.22, V.23, 212A/103, V.21, and Group 3 fax

- Z32*t-SX* and Z32t-*SE* supports line rates from 19,200 bps to 300 bps compatible with V.32*terbo*, V.32*bis*, V.32, V.22*bis*, V.22, V.23, 212A/103, V.21, and Group 3 fax
- Z32*b-SX* and Z32b-*SE* supports line rates from 14,400 bps to 300 bps compatible with V.32*bis*, V.32, V.22*bis*, V.22, V.23, 212A/103, V.21, and Group 3 fax
- Asynchronous and synchronous full- and half-duplex operation (HDX simulated with V.13 switched carrier)
- Hayes AT autodialing and Dial-on-DTR
- V.25*bis* asynchronous and synchronous autodialing
- CCITT V.42 and MNP Class 2-4 error control
- CCITT V.42*bis* and MNP 5 data compression for throughput up to 195,000 bps on the Z34-SX/Z34-SE and 125,000 bps on the Z32t-SX/Z32t-SE
- Class 1 and 2 facsimile command compatibility with Group III fax machines at 14.4 Kbps (V.17), 9600 bps (V.29), and 4800 bps (V.27ter)
- SX-Series have two-wire dial-up and two-wire/four-wire leased line operation with autodial backup and auto-restoral
- SE-Series have two-wire dial-up and two-wire leased line operation with autodial backup and auto-restoral
- Remote modem control and security
- 10 number callback security and Zscript auto-logon
- Prestored modem configurations for popular applications
- Memory and configuration security
- Automatic speed conversion and eight types of flow control

- ❑ V.54 diagnostics and V.13 switched carrier
- ❑ Nonvolatile memory for storing up to four telephone numbers and logon sequences
- ❑ Manual and automatic dialing and answering
- ❑ Built-in diagnostics that let you test the entire communications link
- ❑ Caller I.D. supported
- ❑ Hardware DIP switches for manual operation

Functional Capabilities

The Zypcom modem with its state-of-the-art technology adds unmatched versatility to your data communications network. The modem operates with any computer terminal that uses 8 to 11-bit ASCII characters and has a serial port. Since these two standards are well established, you can connect your Zypcom modem to most applications requiring data communication.

The SX-Series and SE-Series are compatible with the Hayes AT command set and with communications software that employs the AT command set. In addition, Zypcom modems support asynchronous and synchronous versions of the V.25*bis* autodialer. This autodialer works well with computers such as the IBM AS/400 and with bridge/router products, which provide V.25*bis* autodialing capability for dial backup of dedicated WAN links or bandwidth on demand.

Zypcom modems will suit most styles of data communication. It provides high-speed connectivity for IBM PCs and compatibles, Macintosh computers, and UNIX workstations. It also supports facsimile transmission in conjunction with EIA 578/592 Class 1- or 2-compatible fax software, as well as synchronous dialing for dial-up minicomputer communications. The SX-Series can operate on four-wire leased lines with dial

backup and automatic restoral for multiplexer or router links. The SE-Series can operate on two-wire leased lines with dial backup and automatic restoral for remote PC's and terminals.

These modems also support full manual operation: connect the telephone, pick up the handset, dial the number, and press the <DATA> key on the multifunctional front panel. All the advanced functions you need can be viewed from the indicator lights. In addition, the modems support fully automatic "hands off" operation, putting unmatched flexibility and performance into your dial-up and leased line communication links.

Physical Capabilities

The SX-Series and SE-Series are external modems. Operator inputs are through the serial port using the AT or V.25*bis* command sets. Additionally, operations such as redialing from memory location 0, complete resetting of modem options and memory, forcing of EIA options, testing, and manual dialing/answering can be performed from the front panel. The operation of the modem and DTE can be monitored using the extensive LED display (see Figure 1-1).

Figure 1-1. SX-Series and SE-Series Front-Panel Controls and Indicators

The rear panel (figure 1-2) contains a 6-pin PSTN connector labeled “WALL,” a 6-pin telephone set and leased line connector labeled “PHONE,” a power connector labeled “POWER,” and a serial port connector for the DTE interface labeled “TERMINAL.” On the side of the modem is a power ON/OFF rocker switch. On the underside of the unit is a 10-position DIP switch for manual control of the modem and a knob for manual volume control.

Figure 1-2. SX-Series and SE-Series Rear Panel

Specifications

The SX-Series and SE-Series product specifications are listed in Appendix A.

Options Selection

There are four methods of selecting or changing modem options. A large portion of this manual consists of descriptions for using each method. You should concern yourself only with the sections that pertain to the method you've selected. The most comprehensive and easiest to use is the AT command set. In addition, there are V.25*bis* autodialer commands to option the modem, a 10-position DIP switch for changing the modem's functional operation, and the front-panel keys for limited control of modem options.

AT Commands

The AT-compatible command set can be used to select telephone line type and modem options, to dial a telephone number, to hang up a call, and to store telephone numbers and user profiles into memory locations (see Chapters 5 and 6).

V.25bis Commands

The SX-Series and SE-Series support V.25*bis* operation of the modem in both synchronous and asynchronous communication. A V.25*bis* command extension—CNL (configuration local)—allows access to AT commands for configuring, viewing, and testing the modem in V.25*bis* autodialing (see Chapter 7).

Front-Panel Keys and DIP Switch

The front-panel <DATA> and <TEST> keys and the DIP switch on the modem control a variety of modem options. Using these keys and switch is simple and straightforward and requires little technical experience. However, the keys do not allow full control of modem features.

Software Programs

An extensive variety of communications software is already available, but advanced computer users can write their own software programs to interact with SE-Series memory, selecting options using either AT or V.25*bis* commands. The SX-Series and SE-Series are an EIA 578/592 Class 1- and 2-compatible device that will work with any off-the-shelf fax communications program that supports Class 1 or 2 fax commands. However, software programming methods for option selection in data or fax modes are not discussed in this manual. If you don't already own data communications or facsimile software, you should purchase the packages already preconfigured for the SX-Series or SE-Series modems (see Appendix B).

Quick Startup Procedure

A quick startup procedure in Chapter 2 provides information for quickly getting your SX-Series and SE-Series modems on-line. Otherwise, refer to Chapters 4, 5 and 6 for complete information about installation and the Hayes AT command set.

How to Use This Manual

This manual contains operating instructions for the SX-Series and SE-Series of modems. Most users will be using the modem on a personal computer or workstation running communications software in asynchronous data format. Appendix B discusses communications software compatibility. Carefully read through that information before proceeding with your installation, as it will provide you with a basic understanding of the modem's requirements and operation. For those using synchronous communication, you'll find the essential information in Chapters 7 and 8. When using the SX-Series and SE-Series in asynchronous communication, you'll probably find it useful to review the details and operating instructions in Chapters 4, 5 and 6.

Conventions

In this manual, the < > symbols are used to designate the name of a key on the modem or on your computer or terminal keyboard. For example, when you see <ENTER>, it means *press the ENTER key*. Bold characters are used to specify a command sequence sent to the modem. For example, an instruction to dial a telephone number would appear like this:

type **ATDT9,510 783 2538 <ENTER>**

CHAPTER 2 Quick Installation and Operation

Introduction

The Zypcom external modem has many powerful features for mission critical corporate networks. The more you know about your modem, the more you can do with it. But like most people, you are probably anxious to get your modem on-line as soon as possible and will consult the manual only as necessary. This chapter, therefore, contains only the information you'll need to get the modem up and running on an asynchronous dial-up communication link.

You'll learn about the communication software you might need, how to connect the modem to your terminal or computer, and how to run basic tests. You'll also be presented with some setup tips, dialing commands, and other ready information. Once the modem is operational, you can browse through the rest of the manual at your leisure.

Your Data Terminal Equipment

Before beginning the installation, you must first determine what kind of communications connector your data terminal equipment (DTE) has. Most likely your DTE will be a terminal, PC or workstation. Consult the manual that came with your DTE or look on the back panel to determine what kind of communications interface is there. Terminals are generally outfitted with a serial interface port and do not require any special

interface software. Most desktop computers are equipped with one, but if yours isn't, you might have to purchase an *asynchronous communications* or *serial* card. This is a circuit board that fits into a slot on your computer's internal bus. It should have a connector to which you can attach a cable for a serial printer, modem, or other device.

An interface cable is not supplied with the modem because different computers have different interface connectors. You can buy a pre-wired serial cable (normally called a modem cable) from a computer store. There are cables for many common computers. A shielded cable should be used with the modem to maintain FCC Class B operation. The cable end that connects to your computer should have whatever connector—DB25, DB9 or DIN—is suitable for that equipment. The end that connects to the modem should terminate in a male DB25-type connector. Cable length should not exceed 50 feet.

PC Software for Modem Communication

Terminals don't usually require communications software, but most personal computers and work-stations do. Brands such as Netscape, Explorer, Carbon Copy, COMit, Crosstalk, PROCOMM, QModem, Windows Hyperterminal and many others are based on the AT command set and are supported by the SX-Series and SE-Series modems. Most of them can emulate different terminals and let you issue AT commands directly from the keyboard, but you can also place the modem entirely under the control of the communications software for more "transparent" operation.

For the operation you require, consult the installation procedure for the communications software you have chosen. If your software doesn't have a Zypcom modem listed in the modem setup menu, try the following initialization string for a standard async dial-up application. Select your modem type as CUSTOM or OTHER, whichever is available to you that allows for a your own initialization sequence, and enter this command string:

AT&F0&C1&D2&S1&K3&Q6S7=90S0=0&W<ENTER>

If this command string doesn't work try inserting the following commands E0Q0V1 to the above string right after the S0=0 but before the &W.

Modem Connections

Detailed installation instructions are found in Chapter 3. For quick dial-up line setup, refer to figure 2-1 and follow these easy steps:

1. Plug one end of the included modular phone cable (part no. 15047-004) into the jack marked "WALL" on the back of the modem. Plug the other end into the telephone wall jack of your home or office.

2. Plug the end of the serial cable terminating in the 25-pin male connector to the modem port marked "TERMINAL." Plug the end of the cable outfitted for your particular computer or terminal into its connector. (Th*is cable is not supplied with the modem*.)

3. Plug the small end of the power adapter into the socket marked "POWER" on the modem. Plug the transformer end into a 110 VAC outlet and turn on the modem's power switch (located on the side).

4. Optionally, you may plug a standard telephone into the jack marked “PHONE” on the back of the modem. This will allow you to talk over the telephone line without having to unplug the modem or install another wall jack. With a telephone connected, you can dial and answer and place voice calls manually. The telephone works in a normal fashion, even when the modem is turned off.

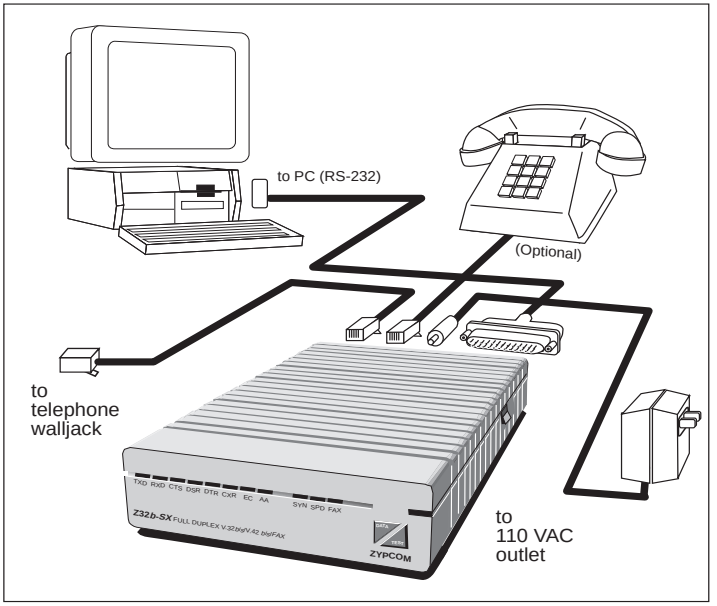

Figure 2-1. Connecting the SX-Series and SE-Series

Computer/Terminal Setup

For existing applications, all you need to do is change the speed of your DTE to 230,400, 115,200, 57,600 or 38,400 bps, whichever is the highest speed supported by your DTE. For new applications, set your DTE's data bits per character (usually 8) and parity (usually no parity) to whatever is required by the remote connection and set flow control to RTS/CTS (hardware).

Powering Up and Checking Out Your Modem

Turn on your computer and modem. If any LED flashes frequently, refer to Chapter 10, "Troubleshooting and Testing." A quick way to ensure that your modem and most of its critical components are functional is to perform an analog loopback (ALB) data test, which checks the modem's transmitter, receiver, and interface to the DTE. The modem will perform this test with or without speed conversion if you are using the keyboard of a DTE. To start the ALB data test, type:

AT&T1<Enter>

The modem responds with a CONNECT XXXX message, where XXXX varies according to the setting of the Wn and Nn commands and register S37=nn. During an ALB test, characters you type from the keyboard go to the modem and are sent back to the DTE screen. If correctly modulated and demodulated, the same characters you type will appear on the screen. If a problem occurs during modulation and demodulation or on the interface to the DTE, characters different from what you typed will appear. In this case, refer to Chapter 3, "Installation," and Chapter 10, "Troubleshooting and Testing."

To exit an ALB test, type:

+++

Wait for the OK message and then type:

AT&T0<ENTER>

Wait for the OK message. If the ALB data test was successful, then the modem is functioning normally and you can proceed with using the modem for dialing.

This checkout procedure assumes your communications software can allow terminal emulation so that direct communication with the serial port of the modem is possible.

Dialing

Dialing From a Computer or Terminal

You can dial a number from your computer or terminal keyboard. If you are a PC user and have not already done so, begin by loading your communications software. Before entering terminal emulation mode, set your software (or DTE) for its highest speed and select RTS/CTS (hardware) flow control. The modem supports serial port speeds from 230.4Kbps to 300 bps. If this is your first time communicating, make sure your data bits and parity are also set correctly. If you do not know how to invoke the terminal emulation mode, refer to the documentation for your communications software.

With the communications software (or DTE) in terminal emulation mode, type:

AT <ENTER>

If the PC or terminal is correctly set up, you will get an OK message. To begin dialing, type:

ATDT telephone number <ENTER>

The modem dials the number you entered. The AT in the above commands means "attention." This alerts the modem that more commands are on the way. The D is the dial command, and the T following the D forces the modem into tone dialing.

To automatically redial the number, type:

ATDL <ENTER>

The modem retrieves the number from its "dialed last" buffer and dials it.

Note that you can enter commands in either lower- or uppercase. It is not necessary to enter spaces or punctuation, but you are permitted to do so as they are ignored. For example, if you wanted to call (510) 783-2538, the format would typically be:

ATDT 1 510 783 2538<ENTER>

or

atdt 1 510 783 2538<ENTER>

If you are calling another modem, you'll hear it answer through the internal speaker on the modem. It will send a high-pitched tone to which the modem responds with a like tone. During this handshaking, the highest common speed is detected unless the modem is configured to force a selected speed (by means of N0 and the setting of register S37). The speaker turns off, and a CONNECT XXXX message appears on the terminal or computer screen. You can obtain additional messages that tell you the error control, data compression, and

port speed status by entering an *ATW1* command prior to dialing. You can dial telephone numbers of any combination of characters, to a maximum of 68 characters, including digits 0 through 9, *, #, A, B, C, D, and dial modifiers (,), @, !, ;, W, R, T, and P.

You can adjust the speaker volume by turning the volume control knob on the bottom of the modem.

Dialing From a Telephone

To manually dial a number, insert a telephone T-adapter in-line with the telco cable and install a telephone in the extra opening. Pick up the telephone's handset, listen for dial tone, dial the telephone number, press the <DATA> key on the modem's front panel immediately after dialing the telephone number, and quickly return the telephone handset to the cradle. If the handset isn't returned to the cradle quickly, it can cause a faulty handshake to occur. The modem will connect to the remote modem and issue a CONNECT XXXX message to the DTE, where XXXX equals the speed of the last autobaud. Note that when you first unpack your modem, it is set for autobaud at 230,400 bps. If your DTE doesn't support 230,400 bps, you must send the *AT<ENTER>* command to the modem so that it can match the speed you've selected for your DTE, or you must use the %X command to set a new speed before manually dialing a call.

Storing a Telephone Number

You can store a maximum of four telephone numbers in nonvolatile memory unless the security feature (S34=0) is in use then you can store 10 numbers. For example, to store a telephone in memory location 1, type:

AT&Z1=1 510 783 2538 <ENTER>

&Z1 is the number of the memory location, which can be from 0 to 3, and 1 510 783 2538 is a telephone number (68 characters maximum). This command stores the telephone number in memory, where it remains even if power is off.

Dialing a Stored Number

To dial a stored number, simply use the ATDSn command, where S tells the modem to dial the number stored in location *n*, and *n* can be from 0 to 3. For example:

ATDS1<ENTER>

The modem dials the number stored in location 1, and the screen displays:

1 510 783 2538

Automatic Answering

If your modem does not answer incoming calls, you can enable it to automatically answer by typing:

ATS0=n <ENTER>

This command sets the modem to answer a call after n (1-255) rings. The modem answers an incoming call, determines the speed of the remote modem, and prepares to communicate data. For example, if you type

ATS0=1<ENTER>

the modem answers a call after one ring. When the modem is set to automatically answer, the LED indicator over AA is on. Issuing *ATS0=0<ENTER>* disables auto answer.

Line Speed, Port Speed, and Error Control Negotiations

Line Speed

The modem can have three basic types of line speed negotiations. Type 1, the default, (S37=0N1) is where the line speed negotiations start at the maximum speed supported by the modem and can go lower depending on the maximum speed of the remote modem. With Type 2 (S37=nnN1) the line speed negotiations start at speed selected by the user and goes lower depending on the remote modem. Type 3 (S37=nnN0) forces the line speed negotiations to a speed selected by the user.

The modem supports many line speeds; therefore, flow control should always be enabled on your DTE and modem. RTS/CTS (hardware) flow control is preferred when both your DTE and modem can support it.

The modem operates automatically (in default mode) and will attempt to send data at the highest possible line speed. In default mode the modem will automatically match the highest common data transmission rate of the remote modem. The sequence of data transmission rates it will seek is 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, 2400, 1200 and 300 bps, no matter what the speed of the last autobaud (AT command).

The modem can be optioned to start handshake negotiations at the speed selected by you with commands N1 and S37=1 to 36. These commands tell the modem to start the handshaking at the selected speed and connect at the highest common speed available. The Z32t-SX, Z32t-SE, Z32b-SX and Z32b-SE do not support the line speed ceiling Type 2 commands (S37=nnN1).

In addition, the modem can be optioned to force a particular line speed with the N0 command and with S37 set to equal a desired line speed. These commands tell the modem to connect only at the speed of register S37.

Serial Port Speed

The modem has asynchronous speed conversion (&Bn) that will automatically convert the modem line speed to match the DTE's, based on the speed of the last AT command. In its default setting (&B1), the modem converts from the last autobaud (set at the factory to 115,200 bps) to the line speed of the modem to which it connects.

Error Control (EC) Negotiations

The &Qn command controls how the modem negotiates an error controlled link. In its default setting, the modem automatically attempts the highest possible error control level. The priority is V.42 first, MNP second, and normal buffered asynchronous operation third. The default setting (&Q6) causes the modem to first attempt a V.42 negotiation. If that fails, an MNP negotiation is attempted. If that fails, the modem establishes a buffered asynchronous link. The &Q5 command eliminates the V.42 negotiation and attempts an MNP negotiation first. If that fails, it establishes normal buffered asynchronous operation. The &Q7 command eliminates the MNP negotiation. If that fails, it establishes normal buffered asynchronous operation. &Q0 establishes a normal buffered asynchronous operation.

When communicating with lots of different types of modems, it is important to understand how the line speed, port speed, and error control negotiations occur in the modem. Select the line speed, port speed, and error control negotiations required for your application; you can then begin using the modem.

The modem monitors the condition of the phone line at initial handshake and during the call to ensure that data can be sent with few errors at the fastest speed. If it senses that data integrity could be compromised by line conditions, it will fall back to the next lower transmission rate. The modem will negotiate a higher data transmission rate when conditions improve.

Testing the Modem

The modem performs an automatic self-test whenever power is applied and the modem is in idle mode (not transmitting or receiving). This procedure ensures proper operation of the modem's major components. If the modem fails the self-test, it will busy the telephone line out and will flash the FAX LED.

After following the connection procedure and applying power (remember to flip the ON/OFF switch on the side), look at the front panel of the modem. If any LED flashes, the modem has failed self-test and will not operate correctly. If this happens regularly, contact Zypcom Customer Service, listed in the front of this manual.

CHAPTER 3 Installation

Unpacking

The SX-Series and SE-Series modem box comes with a modem, a manual, a detachable telephone cord and an AC power adapter. Depending on the model you ordered, your modem could include fax and data communications software. Check that the package agrees with the number and type of items included: User Guide, telephone cable (15047-004), power transformer (110V is P/N 94200-090 and 220/240V is 94200-092) and a modem. The serial cable that connects the modem to the computer or terminal must be supplied separately. Check with your dealer for the correct interface cable for the computer or terminal you are using. Normally, a modem cable will include pins 1 through 8, as well as pins 15, 17, 20, and 22. You can also make your own interface cable based on the pinout information supplied in table 3-1.

Inspect the modem and power adapter to make sure that neither has been damaged. Also look at the carton. If the carton is heavily damaged, the modem may be damaged as well. Return the box and modem to your dealer or shipping carrier if you suspect any damage. Inspect your option packages closely for damage. If damage is detected, return the merchandise to your dealer.

Site Selection

Place the modem so that its cables reach the telephone wall jack, the power adapter, and your computer or terminal. There should be no strain on the cables. Allow at least four inches of space behind the modem to accommodate cables and permit airflow.

Install the modem close to your computer or terminal so that you can easily reach the controls on the modem's front and underside.

Do not obstruct the cooling vents on the top or bottom of the modem and make sure the modem never gets warmer than 50°C (122°F) or cooler than 0°C (32°F) when in use. Do not expose it to excessive humidity, shock, vibration or electromagnetic interference (EMI).

Connecting the Modem

This section shows how to connect the modem to the AC power transformer, telephone line, and to the computer, terminal or other data terminal equipment (DTE) device with a serial port.

Before connecting the modem, make sure the power switch located on the side of the modem is in the off position (rocker switch down).

Figure 3-1 shows the back of the modem and the connections that go to it. Refer to this figure when following procedures in this section.

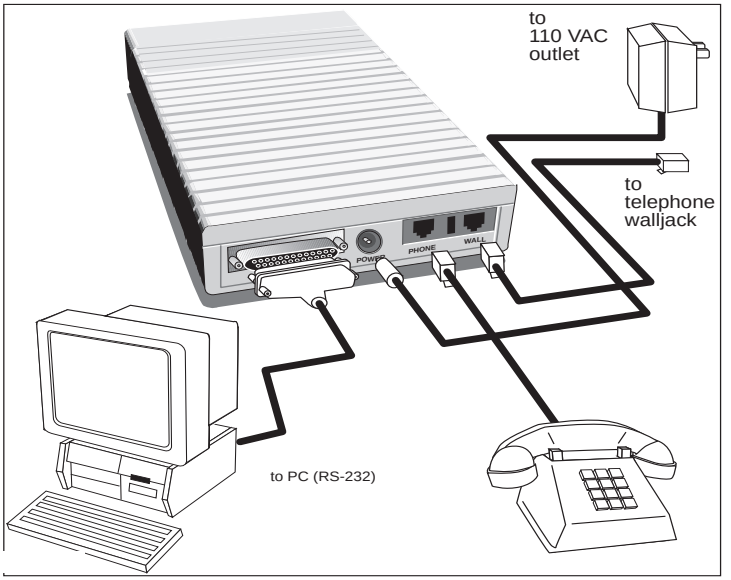

Figure 3-1. Dial-up Modem Connections

AC Power Adapter

Power is supplied through a 6-foot cable with an AC transformer molded into one end. The transformer should have a two-prong AC connector on one end and a phono-type plug on the other. The transformer should bear the Zypcom name and have the part number 94200-090 for 110VAC and 94200-092 for 220/240VAC.

DTE Connection

The DTE is the computer, terminal or other device having a serial data port that you will be connecting to the modem. The connection is made through a 25-pin D-series type connector conforming to V.24/RS232-D specifications. The interface cable for this connection is not supplied with the modem but can be purchased for your particular DTE through almost any computer store.

As shown in figure 3-1, plug the male connector of the interface cable into the female connector on the back of the modem labeled "TERMINAL." Tighten the retaining screws on each side of the connector to ensure a good connection. Plug the other end of the interface cable into the serial port of your DTE and tighten the retaining screws, if any.

Table 3-1 lists the assignment of each pin and table 3-2 lists the pin assignment of the wall and telephone jacks on the modem.

Strap and Switch Inspection

There are ten DIP switches on the underside of the modem and hardware straps (jumpers) on the modem circuit board that may have to be changed before installation begins. Refer to Chapter 4 for the locations of these switches and straps and for instructions on how to configure them.

Telephone Line Connection

The modem accommodates permissive and programmable connections. It doesn't support programmable service on the public switched telephone network. When connected to a programmable jack, the transmit level is –10 dBm.

TABLE 3-1. PIN ASSIGNMENTS

PIN	ZYPCOM DESIG.	EIA/BELL DESIG.	DESCRIPTION	SIGNAL GROUND	MODEM TO DTE	DTE TO MODEM
1	FG	AA	Protective Ground	X		
2	TXD	BA	Transmitted Data			X
3	RXD	BB	Received Data		X	
4	RTS	CA	Request to Send			X
5	CTS	CB	Clear to Send		X	
6	DSR	CC	Data Set Ready		X	
7	SG	AB	Signal Ground	X		
8	CXR	CF	Carrier Detect		X	
9	+V	+P	+12 V Testing Voltage		X	
10	-V	-P	-12 V Testing Voltage		X	
11			No Connection			
12			No Connection			
13			No Connection			
14			No Connection			
15	SCT	DB	Serial Transmit Clock		X	
16			No Connection			
17	SCR	DB	Serial Receive Clock		X	
18			No Connection			
19			No Connection			
20	DTR	CD	Data Terminal Ready			X
21			No Connection			
22	RI	CE	Ring Indicator		X	
23			No Connection			
24	SCTE	DA	External Serial Transmit Clock		X	
25			No Connection			

TABLE 3-2. TELEPHONE LINE INTERFACE (AT REAR OF MODEM OR ADAPTER 15080-001)

PERMISSIVE CONNECTION	MODEM JACK LABELED WALL—PIN NO.	COLOR	SIGNAL
Permissive RJ11C voice jack to modem wall jack (from rear, read pins left to right)	1	Brown	No Connection
	2	Yellow	MIC
	3	Green	Ring
	4	Red	Tip
	5	Black	MI
	6	Orange	No Connection

2-WIRE LEASED LINE CONNECTION	MODEM JACK LABELED PHONE—PIN NO.	COLOR	SIGNAL
2-wire Leased Line RJ11C to modem phone jack. Hard-ware straps must be set to enable 2-wire leased line (from rear, read pins leftto right)	1	Brown	No Connection
	2	Yellow	No Connection
	3	Green	No Connection
	4	Red	No Connection
	5	Black	2-wire TX(Tip)
	6	Orange	2-wire RX(Ring)

4-WIRE LEASED LINE ADAPTER CONNECTION	15080-001 JACK LABELED LINE—PIN NO.	COLOR	15080-001 SIGNAL
4-wire Leased Line Requires optional adapter P/N 15080-001 installed into modem phone jack. Hardware straps must be set to enable 4-wire leased line (from line side of 15080-001 adapter read pins from left to right)	1	Brown	No Connection
	2	Yellow	4-wire RX
	3	Green	4-wire TX
	4	Red	4-wire TXC
	5	Black	4-wire RXC
	6	Orange	No Connection

Permissive Connection

Most homes and offices use the two-wire dial-up line called a “permissive” connection, where a cord terminated with a modular 6-pin plug carries the

signals from the modem to the wall jack. This is the simplest type of connection and is used on most standard telephones. The modem transmits over this type of line at a fixed level of -10dBm ± 1dB. Signal loss between the modem and the central office is not controlled in permissive connections.

Permissive cables terminate in modular 6-pin RJ11C-type plugs that can fit into RJ11C, RJ12C, RJ13C, RJ16X, RJ41S or RJ45S wall jacks. Supplied with the modem is a 7-foot cable (Zypcom part no. 15047-004) with an RJ11C plug on each end.

Plug one end of the 7-foot cable into the jack marked "WALL" on the back of the modem. Plug the other end into the wall jack normally used for a telephone.

You can use the wall jack for both the modem and a phone by connecting the modem to the wall jack as directed above and plugging the telephone into the jack marked "PHONE" on the back of the modem. This allows you to use the phone for voice communication whenever the modem is not in use.

Do not interrupt the data connection with voice communication. Voice communication destroys the flow of data, causing errors. Sometimes it can force the modem to break the connection. Picking up any other telephone connected to the same telephone line, such as an extension telephone, can cause data errors.

The interrupt signal from the telephone company can break the connection or cause errors in the data. Turn off call waiting, if possible. If not, consider canceling the feature or installing a second telephone line.

Programmable Connection

A programmable connection corrects for the signal loss between the modem and the PSTN central office. The loss is compensated by boosting the modem's transmission level to ensure that a –12 dBm signal reaches the telephone company's central office. The modem will accommodate this type of connection but will not boost the transmission level beyond –10 dBm.

2-Wire Leased Line Connection

Leased lines (private lines) are installed at your site by the phone company and must be the two-wire type connection. A 2-wire leased line cable which conforms to the pinout information on Table 3-2, 2-wire Leased Line (PHONE connector, pins 5 and 6) can sourced locally, or call the factory to purchase the optional 2-wire leased line cable (91009-202).

4-Wire Leased Line Connection

Only the SX-Series (Z34-SX, Z32t-SX, Z32b-SX) modems will operate on 4-wire leased lines. A 4-wire leased connection requires the use of adapter P/N 15080-001. This required adapter comes with two additional cables (P/N 91009-105 a modular-to-spade lug cable, P/N 15080-002 a modular RJ11-to-RJ45 cable), one of which will be required to complete the connection to the 4-wire leased line termination point. Plug the modem side of the 15080-001 adapter into the modem jack labelled PHONE. The line side pinouts are listed on Table 3-2, 4-wire Leased Line.

Powering Up

Turn the modem and the computer equipment on. As the modem powers up, it will start a self-test diagnostic. The modem will continually flash one of several LED's if errors occur. Regular occurrence of LED flashes while the modem is powering up while on-hook indicates a problem (refer to Chapter 10). In addition, the modem will can power up with the FAX LED on which indicates that the FLASH memory failed to load properly. Cycle the modems power several times, if the problem continues return your modem to your reseller.

Upon power up with default options (&F0), you should see the CTS, DSR, CXR, and AA LEDs on. If the LEDs do not turn on, then recheck your AC power cord and serial cables to ensure solid connections. If you still have a problem, then reset the modem by pressing <DATA> and <TEST> while cycling power.

Checking Your Connections

There are several quick steps that you can follow to ensure that your modem and computer are properly connected to the telephone network.

Checking the Telephone Line

Press the <DATA> key momentarily and then release it. The modem will go off-hook and connect you to the telephone line. You should hear a dialtone from the modem's speaker even on a PBX line. If you don't hear dialtone, your line is probably not active and you need to change to another line. Once you hear dialtone, you can be assured that you have a good line. Press the <DATA> key again and the modem will go back on-hook.

Checking Your Computer to Modem Link

To check the asynchronous link between the DTE and modem, you must set up your DTE's communication parameters, the most important of which are data type, speed, character length, parity and flow control. Match the requirements of the remote computer or use these settings for installation checkout: DTE speed = 115,200 bps, character length = 8 bits, parity = none, stop bits = 1, and flow control = RTS/CTS (hardware).

If these settings don't work, refer to Chapter 5 and reset them to conform with your application.

Once you have set the communication parameters, enter terminal emulation mode if using a PC and from your keyboard, type:

AT<ENTER>

The modem should respond with an OK message. If it doesn't, you may have encountered a common problem (see section entitled, Common Problems and Solutions). On the other hand, if you receive the OK message, your computer to modem link is working.

Checking Your Modem

A quick way to ensure that your modem is functioning properly is to perform a diagnostic called an analog loopback (ALB) data test. To start this test, type:

AT&T1<ENTER>

After several seconds, the modem responds with CONNECT XXXX (where XXXX equals the speed), which indicates the modem has entered test mode. Now send

data from your DTE keyboard. What you send to the modem should be echoed back to the DTE screen if your modem is working properly. If the modem passes this test, you can begin using it with confidence. To exit ALB, type:

+++

Wait for the OK message and then type:

AT&T0<ENTER>

Wait for the second OK message. You are now back in command mode and the modem may be used for dialing.

If the modem didn't perform the ALB data test correctly, then there is probably a simple problem that needs correcting. Review "Common Problems and Solutions" first. If that doesn't correct the problem, then refer to the chapter on diagnostics.

Common Problems and Solutions

Problems

During setup and checkout, several areas are cause for making the modem function improperly.

1. Your communications software doesn't have terminal emulation mode with which to check the modem.

2. The communications software may be set to the wrong COM port.

3. The cable linking the modem to the computer is the wrong type.

4. Some modem options may be preventing you from communicating properly.

Solutions

If your communications software doesn't provide terminal emulation, set your software to 115,200 bps and then press the <TEST> key on the modem to put it into an analog loopback test (ALB), indicated by the alternating red/green/red SPD LED. When the modem is ready to be tested, it issues a CONNECT 115200 message. Once you see this message on your screen, you should be able to type anything from your keyboard and see the exact characters echoed from the modem back to your terminal screen. If this occurs, you have successfully checked your modem-to-DTE connection.

However, if you get garbage instead of a CONNECT 115200 message, then the speed of your communications port is set incorrectly and you need to correct it. If your software will not operate at 115,200 bps, then set it to the maximum speed setting and then type AT<ENTER> to indicate to the modem the speed at which you will be operating. To stop the ALB test, press the <DATA> key momentarily one time. The SPD LED goes off.

The second problem can easily be changed by changing the COM port in your communications software. Once you have verified that you have the proper COM port setting and you still don't see AT echoed onto your screen as you type it, check to see if you have encountered the third problem.

To verify that the modem cable is the correct one (with at least straight-through pins 1 through 8 and 20), see RS232-D pin assignments in table 3-1. You can verify that the pins are straight-through with an ohmmeter. Once you verify that you have the proper cable, check for the next problem.

To determine whether or not you have an option setting problem, start by typing any keyboard character repeatedly and watch the TXD LED on the modem. If it's flashing faintly, your keyboard is communicating with the modem. The RXD LED should also be flashing simultaneously. If it isn't, type *ATE1<ENTER>*. With your TXD and RXD lights now flashing as you repeatedly strike a keyboard character, you should see the character on your screen. If you don't, you probably have an EIA option incorrectly set. Be sure that pin 4 (RTS) is in your modem cable. To force on the modem's EIA signals (CTS, DSR, CXR, DTR, SO=1), press the <DATA> and <TEST> keys on the front panel for five seconds. Now type *AT<ENTER>* and you should see the modem's OK message. If you continue to have problems, refer to Chapter 10.

Setting Up Communication Software

Once you can send AT commands to your modem and receive back modem response messages and result codes, you probably want to set up your software for automatic modem control. This will entail building initialization, dialing, and automatic answer script files to control the modem automatically. Call your software supplier and ask for the Z32*b-SE* or Z32*t-SE or Z34-SE* initialization files (Z32b-SX or Z32*t-SX or Z34-SX* files will also work). Most software companies have had access to this modem and probably will have script files already completed. If your software vendor doesn't have

these files already developed and your software will allow user-defined modem initialization files, read Chapter 2 and Appendix B for information about developing your own or call Zypcom Technical Support.

CHAPTER 4 Basic Operation

General

The modem can be operated in three primary ways:

- Manual operation
- V.25*bis* commands
- AT commands

The AT command set, the industry standard for full duplex modems, operates using asynchronous data at speeds from 230,400 bps to 300 bps (maximum DTE speed for the Z32t-SX, Z32t-SE, Z32b-SX and Z32b-SE is 115,200 bps). The AT command set allows for automatic dialing and control by software applications. It has robust option setting capabilities and provides detailed call progress and monitoring and testing.

The V.25*bis* command set is a CCITT standard that functions in asynchronous and synchronous communications. Asynchronous communication is primarily used in international applications. Domestically the V.25*bis* dialer is used primarily in synchronous communication for minicomputer dial-out applications, bridge router dial backup applications, and other synchronous dial-up applications.

The V.25*bis* command set provides for dialing capabilities as well as some call progress features. The standard does not specify modem option capabilities. Many

modem manufacturers who supply V.25*bis* dialers have extended the V.25*bis* command set to include modem option capabilities. The Zypcom MODEM provides for modem options using the CNL command in either synchronous or asynchronous communication.

The modem can also be operated manually using a combination of front-panel switches and DIP switches on the modem. In some cases, both DIP switches and AT commands have to work in conjunction, for example, in 2-wire leased line operation with dial backup enabled.

Autodialing Command Sets

The modem supports the industry-standard AT command set and also provides some extended AT commands. These extended AT commands control capabilities not found in Hayes modems. The V.25*bis* standard is an internationally recognized standard for serial automatic call origination and answering. The V.25*bis* autodialer incorporated in the modem encompasses the V.25*bis* recommendation, as well as a great number of extensions that allow you to store and dial telephone numbers, option the modem, or automatically dial a previously stored telephone number. The protocols supported by the V.25*bis* dialer are asynchronous, character-oriented synchronous (bisynchronous), and bit-oriented synchronous (HDLC).

Important Communication Parameters

Before sending data to a remote computer or terminal, set your modem to match the parity of the remote site. The speed setting for your computer or terminal should be set for the maximum speed supported, as long as you

are in asynchronous communication and have speed conversion enabled (see AT command &B*n*). Common communication settings are 8N1 (8 data bits, no parity, and 1 start bit and 1 stop bit) or 7O1 (7 data bits, odd parity, and 1 start bit and 1 stop bit). The modem automatically matches the speed and parity settings of your computer or terminal after an autobaud (AT<ENTER>).

Front-Panel Keys

The modem has two front-panel switches (keys) that allow you to control several modem functions.

DATA Key

Press the <DATA> key and immediately hang up. Pressing the <DATA> key when you are on-line disconnects the data link and places the modem back on-hook. Pressing the <DATA> key for three seconds or longer causes the modem to dial the telephone number stored in memory location 0. The <DATA> key can also be pressed immediately after the <TEST> key to initiate the self-test capability when &Q0 is set. In this case, the modem generates a self-test pattern to be transmitted and received while the test is in progress. The modem flashes the EC LED each time an error is detected.

TEST Key

This key causes the modem to enter test mode. If <TEST> is pressed while the modem is on-hook, the modem enters an analog loopback (ALB) test. If the modem in on-line, pressing this key causes the modem to initiate a remote digital loopback test in all speeds except 300 bps.

Recall Factory Options

To reset the modem to factory settings, type:

AT&F0&W<ENTER>

If the modem was previously optioned for synchronous dialing (V.25*bis* / bisynchronous) or dumb mode, then it will not accept command strings. To reset factory settings, perform a manual power reset. Turn the modem off, then press in the <DATA> and <TEST> keys while turning the modem on. After 10 seconds release both keys.

Front-Panel Lights (LEDs)

The modem has eleven front-panel LEDs to indicate the status of the modem and the data link. In default mode LEDs indicate the status of the modem's EIA options. For example, AT&C0 forces the CXR LED (and pin 8 on the EIA) on, even if the modem is on-hook and not receiving valid carrier from a remote modem. In this case, the CXR LED would be controlled by the modem. The DTR LED is the exception as it reflects true serial port status. For the LEDs to indicate true status of other EIA signals on the RS-232 port, turn CXR and DSR to the normal setting.

TXD (Transmit Data)

TXD light goes on when the computer or terminal transmits data to the modem through the serial cable. The modem may be on-hook and processing dialing commands such as *ATDT (telephone number) <ENTER>*, or it may be on-line and transmitting data to the remote modem and computer. At high speeds of more than 38,400 bps, the LED is very faint.

RXD (Receive Data)

The RXD light goes on when the computer or terminal receives data from the modem. For example, if you send an *ATDT<ENTER>* command from your computer keyboard to the modem, the modem echoes the command by displaying it on your computer screen.

CTS (Clear To Send)

The CTS lead indicates to the terminal that it is okay to send data to the modem. The factory default setting specifies that CTS is on. This signal is an output of the modem. RTS/CTS flow control can temporarily override any setting of CTS.

DTR (Data Terminal Ready)

This LED indicates the modem's detection of its DTE's DTR signal. When DTR is on, the modem assumes that the DTE is operating properly. The modem requires DTR to auto-answer and can be optioned to assume that DTR is forced on. The status of the DTR signal at the serial port is indicated by the LED. The DTR LED does not indicate the modem's internal DTR option.

CXR (Carrier Detect)

If the &C0 option forces carrier on (default setting), the CXR LED will remain on at all times. If normal CXR is set, CXR is on when the modem detects a carrier signal from the remote modem, and CXR is off when the modem loses remote carrier.

EC (Error Control)

EC goes on if the modem is on-line using error control and data compression. Also, EC flashes with each retransmission when a self-test is initiated from the front panel.

AA (Auto Answer)

AA goes on when the modem is set to answer incoming calls automatically. If AA is off, the modem will not answer incoming calls. AA flashing indicates an incoming ring. When the modem is on-line, AA indicates originate/answer status, where AA on is answer and AA off is originate.

SYN (Synchronous)

SYN is on if the modem is optioned for synchronous operation and off if the modem is set for asynchronous operation. This LED will flash on-to-off-to-on when the modem is in leased line dial backup mode.

SPD (Speed)

SPD indicates the type and speed of data transmission, as described below.

TABLE 4-1. OPERATION OF SPD LED

STATUS SPD	CONNECTION	ON-LINE SPEED	DTE AUTOBAUD SPEED
Green	V.34	33.6, 31.2, 28.8, 26.4, 24, 21.6, 19.2Kbps	230,400, 115,200, 57,600 or 38,400
	V.32*terbo* V.32*bis*	19.2, 16.8Kbps 14.4 or 12Kbps	
Red	V.32	9,600 or 7,200 or 4,800 bps	19,200 or 9,600 or 4,800 bps
Off	V.22*bis*, 212/V.22, 103/V.21	2,400 - 300 bps	2,400 or 1,200 or 300 bps

While the modem is on-hook (not on-line), SPD LED indicates the speed of the last autobaud. If the autobaud is above 38,400 bps, SPD LED will be green. A 9,600 bps autobaud turns SPD LED red, and a 2400 bps autobaud causes SPD LED to go off.

FAX (Facsimile)

The FAX LED is on when the modem is optioned to or operating in facsimile mode or when the fax Terminate and Stay Resident (TSR) program is active. FAX is off when the modem is in normal data operation.

Manual Operation

Manual Dialing

To dial manually, you must connect a telephone T-adapter in-line with the telco cable in order to have a jack for the telephone. To call a remote modem from the telephone:

1. Pick up the telephone and dial the remote modem's telephone number.

2. Press the <DATA> key while you still hear ringing, then hang up the telephone quickly. The remote modem answers the call and sends a steady, high-pitched answer tone. The modems are connected and ready to communicate data when the CONNECT message is sent to the DTE or when the CXR LED is on (if CXR is set to &C1).

3. When the CXR LED goes on, the modems are on-line. If CXR is set to &C0 (which is the default), then listen for the modems' handshaking tones using the modems speaker. When the tones go off, the modem should be on-line.

Manual Answering

To answer manually, connect a telephone to the telco cable as indicated above and disable the automatic answer (AA) capability. To do this, you may need to option the modem by means of the *ATS0=0 <ENTER>* command. To manually receive a call from another modem:

1. Listen for the attached telephone to ring or look for the AA LED to flash on the modem. Press the DATA key within 8 seconds of the last ring. Note that the link speed will be the speed of the last autobaud up to 33600bps.

2. If you answer the call and have a voice conversation before going to data communication and later want to manually answer the modem, issue an *ATA<ENTER>* command from your terminal.

Manual Disconnect (Go Back On-Hook)

While on-line in data mode or in test mode, press the <DATA> key to drop carrier and disconnect the modem.

Front-Panel Dialing

Store telephone number in memory location 0 using the *&Z0=telephone number<ENTER>* command. After the number is stored, press the DATA key for three (3) or more seconds to cause the modem to dial that telephone number.

Reset Modem to Factory Defaults

To set the modem back to the factory default settings for all options and S-registers and to clear the modem memory, remove the modem from the chassis. Press the <DATA> and <TEST> keys and reinstall the modem. Release the front-panel keys after a few seconds.

Changing Modem Speeds

Review SW3 and SW4 operation in asynchronous and synchronous modes. For software control, review the N command and the settings for register S37.

Setting DIP Switches

The modem has a 10-position DIP switch. The table below indicates various manual options that are available.

TABLE 4-2. DIP SWITCH SETTINGS

OPTION NAME	SWITCH NO.		SETTING			
CONFIGURATION CONTROL	SW1					
	ON		Hardware (switch controlled)			
	OFF		Software (AT command control)			
DATA TYPE	SW2					
	ON		Synchronous (&Q3 version of sync)			
	OFF		Asynchronous (&Q6 version of async)			
			All	Z34	Z32t	Z32b
DTE INTERFACE SPEED	SW3	SW4	ASYNC	SYNC	SYNC	SYNC
	ON	ON	19.2	14.4	9.6	2.4
	OFF	ON	38.4	19.2	14.4	4.8
	ON	OFF	57.6	24.0	16.8	9.6
	OFF	OFF	115.2	28.8	19.2	14.4
ANSWER/ORIGINATE MODE	SW5		DIAL-UP		LEASED LINE	
	ON		Auto Answer On		Answer Mode	
	OFF		S0=0		Originate Mode	
LINE CONNECTION	SW6					
	ON		Leased Line			
	OFF		Dial-up			
LINE TYPE	SW7					
	ON		4-Wire (N/A for SE-Series modems)			
	OFF		2-Wire			

OPTION NAME	SWITCH NO.	SETTING
V.25*bis* DIALING	SW8	
	ON	Enabled
	OFF	Disabled
V.25*bis* DATA FORMAT	SW9	
	ON	Character-oriented (BSC-NRZ)
	OFF	Bit-oriented (HDLC)
DTE TYPE	SW10	
	ON	Dumb Mode (AT autodialer disabled)
	OFF	Smart Mode (AT autodialer and call progress messages enabled)

Hard Strap Options

The following options are enabled or disabled by a pair of push-on headers on the printed circuit board (PCB). Table 4-3 indicates the operation of headers JP1 through JP3. A zero ohm resistor is used on JP4 (JP6 on the Z34-SX/Z34-SE).

TABLE 4-3. HARD STRAP SETTINGS

OPTION NAME	JUMPER NUMBER	STRAP SETTING IN	OUT*
Leased line	JP1-A	Enabled	Disabled*
Caller ID	JP1-B	Enabled	Disabled*
4-wire leased line (SX's only)	JP2	Enabled	Disabled*
MI/MIC control	JP3	Enabled	Disabled*
Frame ground to signal ground (Z32b/t only)	JP4	Enabled	Disabled*
Frame ground to signal ground (Z34 only)	JP6	Enabled	Disabled*

Note: Asterisk (*) denotes default setting.

Automatic Answering

The modem is set to automatically answer, that is, it answers all incoming calls, determines at what speed the remote modem is transmitting, and establishes a data link at the highest possible speed. It also automatically negotiates error control and data compression in asynchronous operation. To enable automatic answer (AA LED must be on), issue an *ATS0=1<ENTER>* command or hold down the DATA and TEST keys for three (3) seconds or longer. If you want the modem to answer after a specified number of rings, set the register S0 to equal that number. When the AA and DTR LEDs are on (&D2 is set), the modem automatically answers all incoming calls. However, if you're sharing a voice line with your data line and expect voice calls, make sure the AA LED is off by entering an *ATS0=0<ENTER>* command.

Communication Software for Your Computer

If you are using a computer with your Zypcom modem, you may need a communications software program. You may purchase one with the modem (see Appendix B). Otherwise, there already exists a great variety of software packages, the simplest of which makes the computer function like a dumb terminal (that is, the device sends information to and receives information from a remote computer, but has little intelligence or computing power of its own).

The more sophisticated communications packages provide more advanced features, allowing you to emulate terminals, perform file transfers, and combine automatic and delayed operations with logon and security procedures through script files. Whatever software package you purchase, make sure it is compatible with the AT command set. Modems such as

the SX-Series and SE-Series that have the AT command set and AT responses will allow you to be compatible with an extensive variety of communications programs (for example, Netscape, Microsoft Explorer or Hyperterminal, Carbon Copy,™ COMit,™ pcANYWHERE,™ PROCOMM,™ QModem,™ and QModem SST™). Follow exactly the installation procedures for your particular software package.

Prestored Modem Profiles

The modem contains a default prestored profiles that address a range of popular applications. The application you select will determine the type of modem profile you will require. AT&F0 loads the factory modem configuration. To view the specific settings for each command and S-register, load the prestored profile desired (for example, AT&F0), then use the *AT&V<ENTER>* command to display the profile on your screen.

Nonvolatile Memory Organization

The active profile stored in the modem's random access memory (RAM) defines the current operating characteristics of the modem. The factory profiles are permanently stored in read-only memory (ROM). This configuration contains options in S-registers used most commonly for asynchronous data communications. To restore and write the modem's default profile to memory, enter an *AT&F0&W<ENTER>* command from your terminal or PC keyboard.

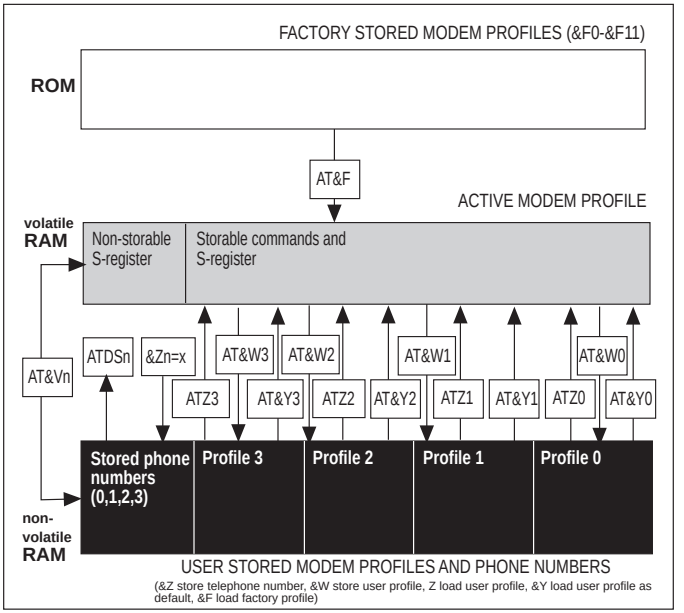

Figure 4.1 Memory Management

Active Profile

The modem's active profile shows the current active settings for AT commands and S-registers. The profile is temporary. Issuing a specific command to change the profile, resetting the modem to its factory options, or cycling power to the modem also changes the active profile.

Stored Profiles

The modem's stored profiles consist of four user-specified profiles. Any one of these can be recalled as the active configuration when you reset the modem. Upon power up, the stored user profiles can be loaded automatically (&Y).

User-Specified Profiles

If you find that the prestored modem profiles are not suitable to your particular application, you can create up to four user-defined profiles. Different combinations of AT command options and S-register settings can be defined in these four profiles.

Determine the communication requirements for your remote system and local DTE. Specify the AT command options and S-register settings that will customize your configuration and allow you to communicate with your remote computer. When you recall this user-specified profile (Z or &Y), its settings will replace the previous active profile.

The commands used to save, recall, view and adjust the four user-specified profiles are described below.

Save User Profile (AT&Wn)

The &W*n* command, where *n* equals 0 through 3, saves AT commands and S-register settings (also known as parameters) of the active profile into the modem's memory. The current settings for stored commands and S-registers are written to a user profile that can be recalled and used later. AT&W0 stores settings to user profile 0, AT&W1 stores settings to user profile 1, and so forth. The speed at which the AT&W command is sent to the modem when storing operational parameters will also govern the modem's operating speed when this configuration is in use.

Recall a Profile (ATZn)

The ATZ*n* command is used to perform a soft reset and recall a stored user-specified profile. ATZ0 recalls user-specified profile 0, ATZ1 recalls user-specified profile 1, and so forth.

View Profile (AT&Vn)

Use AT&V0 to display the active configuration and the parameters stored in user-specified profiles 0 and 1. You can use AT&V1 to display user configurations stored in profiles 2 and 3. Use &V2 to display the four memory locations. Or if S-register 34=0 and the modem has callback security firmware, 10 memory locations will be displayed with &V2.

Select Power-on Profile (AT&Yn)

Any one of the four user-specified profiles can be designated as the power-up configuration. The *AT&Y1<ENTER>* command causes user-specified profile 1 to become the power-up modem configuration, *AT&Y3<ENTER>* causes user-specified profile 3 to become the power-up configuration, and so on.

Factory Profiles (AT&Fn)

AT&F0 recalls the modem's factory profile. AT&F0 replaces all current parameter values in the modem's active profile with the default values.

Creating User-Specified Profiles

The steps below describe how to create an active profile from a prestored profile and how to create a user-specified profile from a prestored factory profile.

Prestored Profile to Active Profile

Issue AT&F*0*<*ENTER*> to recall prestored profile 0 to the active profile. AT&F*0* replaces all active settings with the prestored settings for each option and S-register.

Prestored Profile to User Profile

Set your terminal or communications software data rate to 230,400 bps or any other appropriate speed. The speed specified when you store the user profile settings will be the speed at which the profile will be recalled. Type:

AT&F0&W0<ENTER>

This command causes the prestored factory profile to be written to the active profile. If your application requires AT commands and S-registers to be modified as described below, you would then type:

AT&D2 &C1 &S1 W1 S0=0 &W0<ENTER>

This command string sets DTR normal (&D2), carrier normal (&C1), DSR normal (&S1); turns on 3-line call progress messages ; and disables auto answer (S0=0). &W0 saves these parameters to user profile 0.

The AT&W0 profile will be recalled automatically to the active profile whenever the modem is powered up or reset with the *ATZ<ENTER>* command, assuming AT&Y0 is set.

CHAPTER 5 AT Command Set

A Hayes AT-compatible modem operates with standard commands that enable a computer to configure and control the modem. The modem has a standard set AT commands, in addition to an expanded set of commands to control options not found in Hayes modems.

Capabilities

Many communications software packages use AT commands for autodialing, selecting options, and disconnecting a call. The modem also has an extended set of AT commands to control the following operations:

- Remote modem access and control via side channel
- Leased line operation with autodial backup and auto-restoral
- Simulated half-duplex operation (V.13)
- V.25*bis* autodialing
- Group 3 facsimile operation
- Auto-logon and callback/pass-through security
- RS366 dialer with Bell 801 compatibility (Z34-SX only)

The extended AT command set also provides easy access to eleven prestored factory configurations for common applications, advanced diagnostics, and analog performance measurements. Certain modem options are dependent on or restricted by the modem operation. For example, autodial backup options are available only in leased line operation. Fax options are only available in fax operation.

Functional Modem States

During asynchronous AT operation, the modem functions in one of these three modes:

- ❑ Command mode
- ❑ On-line data mode
- ❑ On-line command mode

Command Mode

When the modem is powered up, it enters command mode and is ready to receive AT commands to dial a telephone number or to have the modem go off-hook to answer an incoming call. The modem does not enter command mode upon power up if it is configured for dumb operation (S49). If you've configured the modem for dumb mode and wish to reset it, set all DIP switches the OFF position, power off the modem and power on the modem while pressing-in the <TEST> and <DATA> keys.

On-line (Data) Mode

When the modem connects to a remote modem, it acquires carrier from the remote modem, then negotiates its error control and data compression features. At this point, the modem goes on-line (data mode) and can transmit data to the remote modem using the telephone line. In on-line (data) mode, the modem can send and receive data, but cannot execute any command instructions. To be able to execute commands while on-line, the modem must be in on-line command mode.

On-line Command Mode

When an on-line modem receives the +++ escape sequence (or as otherwise defined by register S2) from the attached computer, it enters on-line command mode, maintaining the data communications link but suspending data transmission. At this point, commands sent to the modem are executed as they would be in normal command mode. In addition, special commands (^S1, ^R1) can be sent to control the remote Zypcom modem. The modem implements a TIES (time independent escape sequence) escape sequence. To return to on-line data mode, use the *ATO<ENTER>* command or the *ATH<ENTER>* command to disconnect. If you enter an incorrect AT command while in this mode, the modem automatically returns to on-line data mode.

Basics of the AT Command Set

An AT command consists of the AT prefix followed by a string of command characters. These command characters, which can be either upper- or lowercase but not a mixture of both, tell the modem what to do. For example, to dial a telephone number, type:

ATDT1 510 783 2538<ENTER>

ATDT is either all uppercase or all lowercase, AT is the prefix, D is the dialing command, T is the dial modifier that enables tone dialing, and 1 510 783 2538 is the telephone number to be dialed. <ENTER> is the end-of-line flag that tells the modem to process the command entered.

The AT command prefix has a threefold purpose: to get the modem's attention, allow it to detect the speed at which the computer is sending data, and to recognize the character format (parity).

Command Messages

When you issue an AT command and end of line flag (<ENTER>) to the modem, your DTE screen should display an OK message. If the modem does not recognize a command or command parameter, the screen displays ERROR. The screen will also display ERROR if you wait 14 seconds before issuing in your next command. Tables 5-2, 5-3 and 5-4 list all the messages for both words and digits.

The above messages are word response messages. When writing applications programs, programmers sometimes prefer character responses. To select the type of message to be sent by the modem and displayed at the DTE, use the *ATV<ENTER>* command. ATV0 specifies single-character response messages; ATV1 specifies verbose (English) response messages.

AT Command Summary

The modem supports the commands listed in this chapter.

AT commands must always begin with the AT prefix and end with *<ENTER>*, unless you issue an *A/* (Repeat) command or the +++ escape sequence. When using the AT commands to dial, you may add spaces, hyphens or periods to enhance readability. These characters are ignored.

The notion (*n*) in the command description represents a numeric option. For example, in the &F*n* command, *n* is a number from 0 through 11. If you issue a command without a number, the modem assumes 0. For example, if you type ATM, the modem assumes ATM0.

AT Command Buffer

When you send the *AT<ENTER>* command to the modem, it determines the DTE's serial port speed and bits per character. The modem supports these character formats:

- 8,N,1
- 7,E,1
- 7,O,1
- 7,N,2
- 7,MARK,1
- 7,SPACE,1

After receiving a command followed by <ENTER>, the modem returns a response message indicating whether or not the command was accepted. An OK message indicates acceptance of a valid command string. ERROR indicates an invalid command string or command parameter. To clear each command parameter from the command buffer, do one of the following:

1. Type *AT<ENTER>* or lower DTR to reset the command buffer.

2. Use the <BACKSPACE> key to move backward or the <DELETE> key to erase the last character.

Multiple commands can be entered into the 255-character command buffer. You can control EIA signals, set answer mode, change speaker volume, select response messages, and turn off echo all in one command string—as long as you do not exceed the 255-character limit.

Table 5-1 shows a list of valid AT commands and provides a reference for more detailed descriptions of each command.

TABLE 5-1. AT COMMAND SET

COMMAND	GENERAL DESCRIPTION	REFERENCE
+++	Escape sequence	5–9
A	Manual answer	5–9
A/	Re-execute last command	5–9
AT	Attention command	5–9
B	CCITT/Bell compatibility	5–10
D	Dial command	5–10
E	Command character echo	5–12
H	Switch hook control	5–12
I	Memory and firmware status	5–13
L	Speaker volume control	5–13
M	Speaker control	5–14
N	Handshaking	5–14
O	Return to data mode	5–15
Q	Result codes transmission	5–15
V	Result codes type	5–16
W	Connection result codes	5–16
X	Basic result codes	5–20
Y	Long space disconnect	5–21
Z	Recall user-specified profile	5–21
&A	V.42 error control	5–22
&B	Speed conversion	5–22
&C	CXR control	5–23
&D	DTR control	5–24
&E	Automatic modem retrain	5–26
&F	Recall factory profile	5–27
&G	Guard tone control	5–29
&I	Break signal control	5–29

COMMAND	GENERAL DESCRIPTION	REFERENCE
&K	Modem flow control	5–30
&L	Line type select	5–32
&N	Automatic error control abort	5–32
&O	Error control buffer	5–33
&P	Pulse dial make/break ratio	5–33
&Q	Communication protocol select	5–34
&R	CTS control	5–36
&S	DSR control	5–36
&T	Diagnostic tests	5–37
&U	Data compression control	5–38
&V	Display profiles	5–38
&W	Write active configuration	5–39
&X	Synchronous clock control	5–39
&Y	Recall user configuration	5–40
&Z	Store telephone number	5–40
%A	Auto-reliable abort character	5–41
%B	11 bit	5–41
%C	Data compression	5–42
%D	Hang-up buffer delay	5–42
%K	V.42 sliding window size	5–43
%L	DSP measurements	5–43
%P	V.42 negative ADP	5–44
%Q	Dial interrupt control	5–44
%R	V.42 checksum length	5–44
%V	Autodialer select	5–45
%Y	MNP packet format	5–45
%X	Serial port speed	5–46
^E	Read remote EIA signals	5–46
^R	Remote modem access control	5–47

AT Command Descriptions

AT commands normally have a number of possible parameters or values. In instances where a command has multiple parameters, the default is the parameter set at the factory to work with most applications. Default values for each command are marked with an asterisk (*).

+++ (Escape Sequence)

Directs the modem to enter on-line command mode from on-line (data) mode (TIES implementation).

A (Manual Answer)

Selects manual answering and switches from voice to data communication, forcing the modem to go off-hook (connect to the telephone line) and send answer tone. In default mode, the modem will connect at the highest speed supported by the calling modem.

A/ (Re-execute Last Command)

Re-executes the last entered command, which is stored in the modem command buffer, without requiring it to be retyped. Does not require the AT prefix or the <ENTER> end-of-command flag.

AT (Attention)

Prefix that precedes all commands except the +++ escape sequence and the A/ command. Type A*T<ENTER>* to see if the modem is ready to receive commands from your computer or terminal. The modem should respond with an OK message (or 0 if set for character response).

B (CCITT/Bell Compatibility)

Selects the answer tone frequency transmitted by the modem. The CCITT specification for V.22 has an answer tone frequency of 2100 Hz, while the Bell 212A specification calls for a frequency of 2225 Hz. At speeds above 1200 bps, there is no conflict in answer tone frequency. Use the ATB1 command for domestic calls and ATB0 for international calls when communicating below speeds of 2400 bps.

COMMAND	DESCRIPTION
B*n*	CCITT/Bell modulation compatibility
B0	Uses CCITT modulation schemes (V.22 at 1200 bps and V.21 at 300 bps)
B1*	Uses Bell modulation schemes (Bell 212A at 1200 bps and Bell 103 at 300 bps)*

D (Dial)

Instructs the modem to dial a specified telephone number. Pressing <ENTER> at the end of the command string causes the modem to begin dialing. The telephone number, including dial modifiers, punctuation, and any additional commands can be up to 255 characters long. Can also be used in conjunction with a telephone handset to manually dial a telephone number. After dialing the number, simply type *ATD <ENTER>* and quickly hang up the telephone.

MODIFIERS	DESCRIPTION
nn	Specifies a telephone number (up to 68 digits)
T	Selects tone dialing
P	Selects pulse dialing

,	Inserts a pause of two seconds (or the value in seconds of register S8)
R	Forces the modem to dial a call in answer mode
W	Causes the modem to wait for dial tone for a period equal to the value of register S7
!	Switch hook flash = 0.5 seconds duration
@	Waits for 5 seconds of silence before continuing
;	Returns to command mode after dialing
L	Redials the last telephone number
S	Dials one of the four stored telephone numbers (each with a maximum of 68 characters), i.e., DS*n*, where *n* = locations 0 through 3

The modem automatically redials upon call failure if register S41 is set to a value other than 0. If S41 is set to 0, the modem does not automatically redial.

E (Command Character Echo)

Controls whether or not the modem echoes the command characters it receives. At power-on, the default setting for local echo is enabled. If you type AT and your personal computer or terminal screen shows AT, then the option is set correctly. If your screen displays AATT, you need to disable local echo. If your screen shows no characters whatsoever, you may have local echo improperly configured or there may be additional connection problems. If local echo is improperly configured, issue an *ATE1<ENTER>* command to enable it.

COMMAND	DESCRIPTION
E*n*	Command character echo
E0	Disables echo
E1*	Enables echo*

H (Switch Hook Control)

Makes the modem go on- or off-hook, depending on the numerical value that follows H. Typically this command is used to terminate a call.

COMMAND	DESCRIPTION
Hn	Switch hook control
H0	Makes the modem go on-hook (equivalent to disconnecting from the telephone line and placing the modem in command mode)
H1	Makes the modem go off-hook, enabling dial tone transmission

When the modem is in error correction mode, register S38 or the %D command dictates the delay between issuing the on-hook command and actually going on-hook.

I (Memory and Firmware Status)

Requests a three-digit product code stored in the modem. Some software communications programs send ATI0 and read the product code result, setting the speed accordingly. This command has been expanded beyond the product code capabilities to include information about the read-only memory (ROM), the firmware revision level, and the revision levels of the data pump.

COMMAND	DESCRIPTION
I*n*	Memory and firmware status
I0	Requests product code
I1	Requests checksum on EPROM
I2	Compares EPROM checksum value against a stored value
I3	Requests product firmware version
I5	Requests revision of modem data pump
I6	Requests modem serial number

L (Speaker Volume Control)

Sets the speaker volume when the speaker is on. To manually control volume, leave L at its default value of 2 (medium volume) and use the manual volume control on the bottom of the modem.

COMMAND	DESCRIPTION
L*n*	Speaker volume control
L0	Sets low volume
L1	Sets low volume
L2*	Sets medium volume*
L3	Sets high volume

M (Speaker Control)

Controls operation of the speaker.

COMMAND	DESCRIPTION
M*n*	Speaker control
M0	Sets speaker always off
M1*	Sets speaker on until modem detects carrier*
M2	Sets speaker always on
M3	Turns the speaker on until modem detects carrier and then momentarily off during the dialing sequence

N (Handshaking)

Selects whether a connection will be forced to a specific speed or allowed to negotiate the highest speed possible.

COMMAND	DESCRIPTION
N*n*	Handshaking
N0	Forces handshake to line speed selected by register S37, even after a retrain
N1*	Starts handshake at a line speed selected by register S37*

When N1 and S37 = 0, you can autodial at a DTE speed of 19,200 bps and call a remote 33,600 bps modem. The modem connects at 33,600 bps due to automode handshaking even though the serial port is 19,200 bps. To set a line speed at which to begin handshaking and still allow for line speed fall-back use N1 and S37=nn (NOTE: The Z32b-SX/Z32b-SE and Z32t-SX/Z32t-SE do not support the max. line speed handshaking command). To force a line speed use N0 and S37=nn. These speed commands (N1, N0, S37) apply to leased lines, dial-up lines and dial backup mode.

O (Return to Data Mode)

Returns to data mode from on-line command mode. The modem returns to the same mode—either originate or answer—from which +++ was last issued. After returning to on-line data mode, the screen displays a CONNECT message. You can also manually originate if you issue an *ATH1O<ENTER>* command.

COMMAND	DESCRIPTION
O*n*	Return to data mode
O0	Returns the modem to on-line data mode
O1	Returns the modem to on-line data mode and establishes an equalizer retrain for speeds above 2400 bps

Q (Result Codes Transmission)

Defines whether or not the modem will issue result codes to the DTE during normal operation. These codes can cause confusion to some host computer applications and may need to be disabled.

COMMAND	DESCRIPTION
Q*n*	Result codes transmission
Q0*	Enables transmission of result codes to terminal*
Q1	Disables transmission of result codes to terminal
Q2	Enables transmission of result codes to terminal in originate mode only

V (Result Codes Type)

Controls whether the screen displays result codes as words or as single-digit characters (see Tables 5-2, 5-3 and 5-4 for a complete list of result codes). A combination of commands controls result codes from the modem: Q, X, W, or \V (which is the same as W).

COMMAND	DESCRIPTION
V*n*	Result code type
V0	Selects single-digit responses
V1*	Selects verbose (word) responses*

W (Connection Result Codes)

Defines the type of result codes to be returned to the DTE. V.34 modems can have transmit and receive speeds which differ. Zypcom uses the receive speed for DCE speed reporting for W1 and W2. For software compatibility, the modem also supports \V command. \V0 is the same as W0 and \V1 is the same as W2.

COMMAND	DESCRIPTION
W*n*	Connection result codes
W0*	Reports DTE speed as connect speed*
W1	Reports DCE speed in a three-line format
W2	Reports DCE speed in a one-line format
W3	Reports both transmit and receive line speeds in a one-line format

TABLE 5-2. AT RESULT MESSAGE VALUES WHEN ATW0 IS SET

MESSAGES		MESSAGE SELECTION						
WORDS	DIGITS	X0	X1	X2	X3	X4	X5	X6
OK	00	On	On	On	On	On	On	On
CONNECT	01	On	Off	Off	Off	Off	Off	Off
RING(Ans)	02	On	On	On	On	On	On	On
NO CARRIER	03	On	On	On	On	On	On	On
ERROR	04	On	On	On	On	On	On	On
CONNECT 1200	05	On	On	On	On	On	On	On
NO DIALTONE	06	Off	Off	On	Off	On	Off	On
BUSY	07	Off	Off	Off	On	On	On	On
NO ANSWER (see note)	08	On	On	On	On	On	On	On
CONNECT 75TX/ 1200RX	62	Off	On	On	On	On	On	On
CONNECT 1200TX/ 75RX	63	Off	On	On	On	On	On	On
CONNECT 2400	10	Off	On	On	On	On	On	On
CONNECT 4800	11	Off	On	On	On	On	On	On
CONNECT 7200	60	Off	On	On	On	On	On	On
CONNECT 9600	12	Off	On	On	On	On	On	On
CONNECT 12000	61	Off	On	On	On	On	On	On
CONNECT 14400	13	Off	On	On	On	On	On	On
CONNECT 19200	14	Off	On	On	On	On	On	On
CONNECT 38400	15	Off	On	On	On	On	On	On
CONNECT 57600	16	Off	On	On	On	On	On	On
CONNECT 115200	17	Off	On	On	On	On	On	On
CONNECT 230400	19	Off	On	On	On	On	On	On
RINGING(Org)	18	Off	Off	Off	Off	Off	On	On
AUTO LOGON FAILED	90	Off	On	On	On	On	On	On

***NOTE**: The* NO ANSWER *message is sent only when the dial string contains an at sign (@) dial modifier.*

TABLE 5-3. AT RESULT MESSAGE VALUES WHEN ATW2 IS SET

MESSAGES (NOTE 1) WORDS (NOTE 1)	DIGITS	MESSAGE SELECTION X0	X1	X2	X3	X4	X5	X6
CONNECT 300/ (feature negotiation)	20	Off	On	On	On	On	On	On
CONNECT 1200/	22	Off	On	On	On	On	On	On
CONNECT 2400/	23	Off	On	On	On	On	On	On
CONNECT 4800/	31	Off	On	On	On	On	On	On
CONNECT 7200/	32	Off	On	On	On	On	On	On
CONNECT 9600/	33	Off	On	On	On	On	On	On
CONNECT 12000/	34	Off	On	On	On	On	On	On
CONNECT 14400/	35	Off	On	On	On	On	On	On
CONNECT 16800/	36	Off	On	On	On	On	On	On
CONNECT 19200/	37	Off	On	On	On	On	On	On
CONNECT 21600/	38	Off	On	On	On	On	On	On
CONNECT 24000/	39	Off	On	On	On	On	On	On
CONNECT 26400/	40	Off	On	On	On	On	On	On
CONNECT 28800/	41	Off	On	On	On	On	On	On
CONNECT 31200/	88	Off	On	On	On	On	On	On
CONNECT 33600/	89	Off	On	On	On	On	On	On
CONNECT 75TX 1200 RX/	25	Off	On	On	On	On	On	On
CONNECT 1200TX/ 75RX/	26	Off	On	On	On	On	On	On

***NOTE 1**: ATW2<ENTER> enables Microcom-formatted connect messages that include link negotiation levels. These messages replace only the connect messages listed in Table 5-2. (The other messages in Table 5-2 are valid.)*

***NOTE 2**: Feature negotiation messages always follow connect messages if ATW2 is set. For example, you might see* CONNECT 14400/V42BIS*, where /V42BIS indicates that the connection negotiation is a V.42bis handshake. Possible feature negotiation messages are V42BIS, V42, REL 2, REL 3, REL 4 or REL 5. Please note that the digit result messages do not report feature negotiation.*

TABLE 5-4. AT RESULT MESSAGE VALUES WHEN ATW1 IS SET

MESSAGES (NOTE) WORDS	DIGITS	MESSAGE SELECTION X0	X1	X2	X3	X4	X5	X6
CARRIER 300	40	Off	On	On	On	On	On	On
CARRIER 1200	46	Off	On	On	On	On	On	On
CARRIER 75TX/ 1200RX	64	Off	On	On	On	On	On	On
CARRIER 1200TX/ 75RX	65	Off	On	On	On	On	On	On
CARRIER 2400	47	Off	On	On	On	On	On	On
CARRIER 4800	48	Off	On	On	On	On	On	On
CARRIER 7200	49	Off	On	On	On	On	On	On
CARRIER 9600	50	Off	On	On	On	On	On	On
CARRIER 12000	51	Off	On	On	On	On	On	On
CARRIER 14400	52	Off	On	On	On	On	On	On
CARRIER 16800	53	Off	On	On	On	On	On	On
CARRIER 19200	54	Off	On	On	On	On	On	On
CARRIER 21600	24	Off	On	On	On	On	On	On
CARRIER 24000	27	Off	On	On	On	On	On	On
CARRIER 26400	28	Off	On	On	On	On	On	On
CARRIER 28800	29	Off	On	On	On	On	On	On
CONNECT 31200	38	Off	On	On	On	On	On	On
CONNECT 33600	39	Off	On	On	On	On	On	On
PROTOCOL: NONE	70	Off	On	On	On	On	On	On
PROTOCOL: V.42	77	Off	On	On	On	On	On	On
PROTOCOL: REL	79	Off	On	On	On	On	On	On

***NOTE**: ATW1<ENTER> enables Hayes-formatted connect messages. The additional messages detail a call's carrier speed (line speed), error control level, and connect speed (DTE speed). These messages supplement the ones listed in Table 5-2.*

X (Basic Result Codes)

Requests certain messages to be displayed or suppressed. You can choose from seven sets of messages. (Tables 5-2, 5-3 and 5-4 explain the messages for each X*n* command setting and accompanying W*n* command.)

COMMAND	DESCRIPTION
X*n*	Basic result codes control
X0	Disables detection of call progress tones and omits speed connection messages
X1	Enables CONNECT XXXX (speed) messages
X2	Enables detection of dialtone
X3	Enables detection of busy tone but not dialtone
X4*	Enables detection of busy tone, dialtone, and CONNECT XXXX (speed) messages*
X5	Enables all messages except dialtone detection
X6	Enables automatic selection of pulse or tone dialing and all other messages

Y (Long Space Disconnect)

Some computer systems end a data session by sending or receiving a continuous break signal. This capability works only when the modem is on-line with no error control. When the long space disconnect is enabled, the modem detects the incoming break and signals the remote modem to hang up.

COMMAND	DESCRIPTION
Y*n*	Long space disconnect
Y0*	Disables long space disconnect*
Y1	Enables long space disconnect

The modem disconnects when it receives 1.6 or more seconds of a continuous break signal. In addition, when the modem receives a break signal from the DTE, it transmits 4 seconds of break signal to the remote modem before hanging up.

Z (Recall User-Specified Profile)

Recalls one of the four user-specified profiles and loads it into the modem active configuration.

COMMAND	DESCRIPTION
Z*n*	Recall user-specified profile
Z0	Recalls profile 0 to active configuration
Z1	Recalls profile 1 to active configuration
Z2	Recalls profile 2 to active configuration
Z3	Recalls profile 3 to active configuration

&A (V.42 Error Control)

When the modem has been set for auto-reliable operation, this command determines whether or not the modem sends the V.42 handshake (ODP) and whether or not it detects the V.42 handshake (ADP) from the answer modem.

COMMAND	DESCRIPTION
&A*n*	V.42 error control
&A0*	Disables transmission of the V.42 handshake to the remote modem and detection of the V.42 handshake from the remote modem*
&A1	Enables transmission of V.42 handshake

***NOTE**: Use &A only when the standard V.42 link requests are failing.*

&B (Speed Conversion)

Determines the speed at which data is transmitted to the DTE when the line speed is different from the speed of the last autobaud.

COMMAND	DESCRIPTION
&B*n*	Speed conversion
&B0	Sets speed conversion off
&B1*	Sets speed conversion on*

The default speed upon power-up of the modem serial port is 115,200 bps. For communications software compatibility, the modem supports the \J command, where \J0 is the same as &B1 and \J1 is the same as &B0.

&C (CXR Control)

Determines how the modem handles CXR on the DTE interface (pin 8). Most computers operate with CXR set to follow true carrier from the remote modem. Most terminals operate with CXR forced on; some answer-side host computers operate with the CXR port contender option.

COMMAND	DESCRIPTION
&C*n*	CXR control
&C0*	Forces CXR (DCD) always on*
&C1	Sets CXR to follow true carrier (note 1)
&C2	Port contender sets CXR on until the modem goes on-line. CXR then follows the status of true CXR (note 2)
&C3	Sets CXR to follow remote RTS based on the V.13 data pattern. &C3 allows for transmission of the V.13 pattern controlled by RTS and reception of the V.13 pattern that controls CXR
&C4	Enables transmission only of the V.13 pattern controlled by the RTS signal
&C5	Enables reception only of the V.13 pattern to control CXR

***NOTE 1**: When the* modem *is set for non-error control, CXR goes high when true carrier is acquired from the remote modem. When the* modem *is set for error control, CXR goes high after true carrier is acquired and the error control handshake is completed.*

***NOTE 2**: CXR is high while the* modem *is in data mode. When true carrier goes away and the modem hangs up, the* modem *lowers CXR for four seconds, after which CXR goes high again.*

***NOTE 3**: &C3, &C4 and &C5 control operation of the V.13 pattern, referred to as* switched carrier*. See Chapter 9 for a V.13 details.*

&D (DTR Control)

Determines how DTR is interpreted by the modem. &D operates differently in asynchronous and synchronous communication and works in conjunction with register S25 in asynchronous communication.

COMMAND	DESCRIPTION IN ASYNCHRONOUS OPERATION
&D0*	DTR is forced on at all times*
&D1	DTR is forced on at all times; however, an on-to-off transition for a period of time equaling register S25 causes the modem to go from data mode to on-line command mode
&D2	DTR is normal, whereby the modem disconnects and disables auto-answer when DTR goes from on to off (per CCITT 108.2 (see note)
&D3	When DTR transitions from on to off, &D3 causes the modem to disconnect and disable auto-answer, resetting the active profile as specified by the &Y command
&D4	When DTR transitions from off to on, &D4 causes the modem to dial the number stored in memory location 0. An on-to-off DTR transition causes a modem hang up and disables auto-answer. Data mode will depend on the setting of

&Q command. Do not use &Q2 with this option. &Q2 is used for PCs. The &D4 option is used for dial-up routers, servers, multiplexers and other similar applications which cannot halt data transmission while the modem is dialing. (For more information see Chapter 7, "Dial-on-DTR.")

***NOTE**: DTR drops for the period, in 1/100 seconds, set by register S25 while the* modem *is on-line. The call immediately terminates.*

&DN	&QN	DESCRIPTION IN SYNCHRONOUS OPERATION
&D0-4	&Q1	If &D1&Q1 is set, an on-to-off of DTR causes the modem to enter asynchronous on-line command mode (even though it is in synchronous data communication). If &Q1 and &D0 or &D2 or &D3 or &D4 are set, an on-to-off of DTR causes a hang up.
&D0-3	&Q2	&Q2 set ignores all &D settings and acts accordingly DTR off-to-on dials the telephone number stored in memory location 0. DTR on-to-off causes the modem to hang up. No calls are answered if DTR is low. Dial on dial on DTR devices use &Q2&D2; other devices use &D4&Q3.
&D0-4	&Q3	&Q3 set ignores all &D settings. DTR on-to-off causes the modem to hang up (per CCITT 108.1). No calls are answered if DTR is low. Once &Q3 is selected, the modem is in synchronous mode and no longer responds to asynchronous AT commands. The only way to reset the modem after it enters the &Q3 sync mode is with a power reset.

&E (Automatic Modem Retrain)

Enables the modem to monitor line conditions continuously. When those conditions deteriorate, the modem suspends data transmission and initiates a retrain sequence on the line.

COMMAND	DESCRIPTION
&E*n*	Automatic modem retrain
&E0	Disables automatic retrain capability
&E1*	Enables automatic retrain capability*

&F (Recall Factory Profile)

Recalls of the twelve factory-designed profiles stored in ROM and loads it into the active profile. After recalling a factory profile, you may customize the parameters.

Command	Description
&F*n*	Recall factory-designed profile
&F0	Selects asynchronous dial-up communication with speed conversion, autonegotiated error control, and data compression; sets EIA signals for a terminal. (For a PC, you must manually change &C0 default to &C1.)

&G (Guard Tone Control)

Defines how the modem will handle guard tone. Guard tone is a frequency generated by the answer-side modem required in some slow speed international applications.

COMMAND	DESCRIPTION
&Gn	Guard tone control
&G0*	Selects no guard tone*
&G1	Selects 550 Hz guard tone on the answer-side modem
&G2	Selects 1,800 Hz guard tone on the answer-side modem

&I (Break Signal Control)

Defines how the modem handles a break received from the DTE. The break can be processed as it is received (non-expedited) or put ahead of data in the transmit buffer (expedited), and can be destructive or non-destructive.

COMMAND	DESCRIPTION
&I*n*	Break signal control
&I0*	Transmits a break in sequence with the received data (non-expedited and non-destructive)*
&I1	Immediately transmits a break signal without buffering (non-destructive and expedited)
&I2	Immediately handles a break signal and is destructive to data in the buffer (destructive and expedited); causes the modems at both ends to clear the buffers

The modem also supports the \K command. \K1 functions the same as &I2, \K3 the same as &I1, and \K5 the same as &I0.

&K (Modem Flow Control)

Defines how the modem handles flow control on the serial port, as well as between modems for non-error controlled connections. Two types of flow control exist: in-band (XON/XOFF) and hardware (RTS/CTS). With the in-band type, there are three versions: local, pass-through and internal.

In local mode, the local modem will receive and act on the XON/XOFF characters received from the local DTE and will not pass them to the remote modem. In addition, the modem can send flow control to the local DTE.

In pass-through mode, XOFF/XON characters received by the modem from the local DTE are acted upon by the local modem and passed through to the remote modem.

Internal mode (referred to as modem-to-modem) is used between modems for non-error controlled connections with buffered serial ports (&B). In this flow control mode, the modem will accept an XOFF from the remote modem when it fills its transmit buffer and will also send flow control to the remote modem when the local receive buffer fills. Modem-to-modem flow control received from the remote modem is not passed on to the

local DTE. &K20 flow control will protect the DTE-to-DTE communications link, while &K16 protects only the DCE-to-DCE communications link.

When you can choose between in-band and hardware flow control, always select the hardware type for error controlled connections because it will not present any application sensitivity. Note that when the modem flow controls the local DTE, it is called *local send flow control*; when the modem receives flow control from the local DTE, it is called *local receive flow control*. When the modem sends receive flow control to the remote modem, it is called *pass-through flow control*.

COMMAND	DESCRIPTION
&K*n*	Modem flow control
&K0	Sets flow control off
&K3*	Selects hardware (RTS/CTS) flow control for error controlled connections*
&K4	Selects in-band (XON/XOFF) flow control with local send and receive and no pass-through of XON/XOFF for error controlled connections
&K8	Selects in-band (XON/XOFF) flow control with local receive-only and pass-through of XON/XOFF for error controlled connections
&K12	Selects in-band (XON/XOFF) flow control with local send and receive and pass-through for error controlled and non-error controlled connections
&K16	Selects in-band (XON/XOFF) internal flow control for non-error controlled connections
&K20	Selects in-band (XON/XOFF) internal flow control with local send and receive and pass-through for non-error controlled connections

The preferred method of flow control is RTS/CTS. However, if a computer does not have control of these signals and you want to use error control and/or buffered asynchronous protocol, you must use XON/XOFF flow control.

Use &K4 for error controlled communication and &K12 for non-error controlled communication. If the &K12 setting does not work for your application, first try &K20 and then &K16. On error controlled connections, you can mix in-band and hardware flow control for respective local and remote modems.

&L (Line Type Select)

Provides software control of the dial-up or leased line function. (Note that for leased line applications see Chapter 8).

COMMAND	DESCRIPTION
&L*n*	Line type select
&L0*	Selects software control for dial-up lines*
&L1	Selects 2-wire leased line operation
&L2	Selects 4-wire leased line operation (SX-Series modems only)

Jumpers must be set accordingly, as described in Chapter 4. To select answer side in 2-wire leased line operation, use the &L1S0=1 setting. To select originate side in 2-wire leased line operation, use the &L1S0=0 setting. Refer to Chapter 8 for more information on leased line dial backup (S42) and restoral (S17 and S20).

&N (Automatic Error Control Abort)

Selects whether or not automatic error control aborts if the character specified in register S46 is received during error control negotiations.

COMMAND	DESCRIPTION
&N*n*	Automatic error control abort
&N0*	Disables automatic abort of error control*
&N1	Enables automatic abort of error control

&O (Error Control Buffer)

Selects the type of buffering to be performed during an error control handshake. Normally data received from the remote modem during the error control handshake is discarded. With this command, the data can be buffered and sent to the local DTE after negotiation is successful or after the timeout occurs.

COMMAND	DESCRIPTION
&O*n*	Error control buffer
&O0	Discards data received from remote modem during error control negotiations
&O1*	Buffers data received from the remote modem during error control negotiations; aborts data sent to the DTE after successful error control negotiations or a timeout*

&P (Pulse Dial Make/Break Ratio)

Sets the make/break ratio to be used when pulse dialing.

COMMAND	DESCRIPTION
&P*n*	Pulse dial make/break ratio
&P0*	Selects 39%/61% ratio used for U.S. and Canada*
&P1	Selects 33%/67% ratio used for United Kingdom

&Q (Communication Protocol Select)

Selects the modem communication mode. There are four buffered asynchronous (&Q6, &Q7, &Q5 and &Q0) settings, one non-buffered (&Q4) setting and three synchronous (&Q1, &Q2 and &Q3) settings. In addition, in the asynchronous modes the process of error control negotiations can be controlled with register S36.

COMMAND	DESCRIPTION
&Q*n*	Communication protocol select
&Q0	Selects normal buffered asynchronous communication
&Q1	Selects synchronous communication whereby asynchronous command mode switches to synchronous data mode after carrier is acquired. After a disconnect, the modem returns to asynchronous command mode. Modem sends call progress messages and will echo commands with &Q1
&Q2	Selects synchronous communication whereby an off-to-on transition of DTR causes the modem to dial the telephone

	number stored in memory location 0. When the modem detects an on-to-off transition of DTR, it hangs up and returns to asynchronous command mode. Modem sends call progress messages and will echo commands with &Q2
&Q3	Selects normal synchronous communication. DTR on-to-off causes the modem to hang up. DTR must be present to answer an incoming ring. &Q3 is also used for synchronous leased line operation. Call progress messages and command echo should be disabled with &Q3. V.13 switched carrier operation is used exclusively with &Q3. Power reset is required to return modem to default
&Q4	Selects non-buffered asynchronous communication. &Q4 is used only for special 8, 9 and 11-bit applications when modem buffers can not be used
&Q5	Selects MNP error control, whereby the automatic feature negotiation attempts an MNP handshake first and, if unsuccessful, falls back to buffered asynchronous communication.
&Q6*	Selects V.42 error control, whereby the automatic feature negotiation attempts a V.42 handshake and, if unsuccessful, attempts MNP. If unsuccessful again, falls back to buffered asynchronous communication*
&Q7	Selects V.42 error control, whereby the automatic feature negotiation attempts a V.42 handshake first and, if unsuccessful, falls back to buffered asynchronous communication

Register S36 can be used to modify the &Q command. For example, if you want to force an error-controlled link, use &Q6 S36=0 for either V.42 or MNP, use &Q7 S36=0 for V.42 only, and use &Q5 S36=0 for MNP only.

> ***&Q4 NOTE**: Call progress messages (Q1) should be off when &Q4 is used and the line speed (N0S37=nn) must set to equal the DTE speed (%X=nn.n)*

&R (CTS Control)

Controls the Clear to Send (CTS) signal in synchronous communication.

COMMAND	DESCRIPTION
&R*n*	CTS control
&R0	Sets CTS to follow RTS after a delay defined by register S26
&R1*	Forces CTS on at all times*
&R2	Sets CTS to follow true carrier (CXR)

&S (DSR Control)

Defines how the modem handles the DSR signal.

COMMAND	DESCRIPTION
&S*n*	DSR control
&S0*	Forces DSR on at all times*
&S1	Sets DSR for compatibility with CCITT recommendations (DSR normal)
&S2	Sets port contender DSR option, whereby DSR is on until the modem hangs up. Upon a disconnection, DSR goes off for 4 seconds and then goes on again

&T (Diagnostic Tests)

Refer to Chapter 10, "Troubleshooting and Testing," for a complete description of all modem tests.

COMMAND	DESCRIPTION
&T*n*	Diagnostic tests
&T0	Terminates test in progress. Run test, enter the +++ escape sequence, wait for the OK message to be displayed on your screen, then issue *AT&T0<ENTER>*
&T1	Initiates analog loopback test (per CCITT V.54)
&T3	Initiates local digital loopback test
&T4	Allows the modem to respond to a remote digital loopback test (RTRT)
&T5	Disables RTRT
&T6	Initiates remote digital loopback test (IRT per CCITT V.54)
&T7	Initiates remote digital loopback test with self-test data pattern (IRT/ST)
&T8	Initiates analog loopback test with self-test data pattern (per CCITT V.54)

&U (Data Compression Control)

Controls modem data compression. A V.42 link operates with V.42*bis* data compression, which allows a 4:1 compression ratio. An MNP error control link operates with MNP level 5 data compression, which allows for a compression ratio of 2:1. This command functions only when &Q5, &Q6 and &Q7 or the equivalent \N command parameters are set.

COMMAND	DESCRIPTION
&U*n*	Data compression control
&U0	Disables data compression
&U1*	Enables data compression*

The %C command can also be used to enable or disable data compression: %C0=disabled and %C1=enabled.

&V (Display Profiles)

Causes the modem to display its current configuration. When displaying remote modem options, use the &V0. The modem also supports the \S command: \S0 is the same as &V0 and \S1 is the same as &V1.

COMMAND	DESCRIPTION
&V*n*	Displays active configuration and user-stored profiles
&V0	Displays active profile and user-stored profiles 0 and 1
&V1	Displays user-stored profiles 2, 3, and the four telephone numbers stored in memory
&V2	Displays all ten memory locations for security

&W (Write Active Configuration)

Enables the modem active configuration to be written to a user-stored profile in nonvolatile memory.

COMMAND	DESCRIPTION
&W*n*	Writes active configuration to user-specified profile
&W0	Writes active configuration to user profile 0
&W1	Writes active configuration to user profile 1
&W2	Writes active configuration to user profile 2
&W3	Writes active configuration to user profile 3

&X (Synchronous Clock Control)

Defines the source of the transmit clock used in synchronous communication.

COMMAND	DESCRIPTION
&X*n*	Synchronous clock control
&X0*	Selects internal clock*
&X1	Selects external clock
&X2	Selects slave (receive) clock, whereby the modem uses the receiver-derived clock to synchronize the transmitter clock

&Y (Recall User Configuration)

Recall a user-stored profile into the active configuration upon power up.

COMMAND	DESCRIPTION
&Y*n*	Recall user configuration upon power up
&Y0*	Designates user profile 0 as the active configuration upon power up*
&Y1	Designates user profile 1 as the active configuration upon power up
&Y2	Designates user profile 2 as the active configuration upon power up
&Y3	Designates user profile 3 as the active configuration upon power up

&Zn=x (Store Telephone Number)

Stores telephone number *x* in location *n*, where *n* = 0 through 3. The maximum length of each stored telephone number is 68 characters (including the automatic logon sequence). Storing telephone numbers with this command retains them in the modem memory even during power loss.

COMMAND	DESCRIPTION
&Z*n*=*x*	Stores telephone number x to nonvolatile memory location *n* (where *n* = 0 through 3)
&Z*n*?	Displays the telephone number stored in memory location *n*

For example, to store a telephone number in location 3, issue this command:

AT&Z3=T9,783 2538<ENTER>

%A (Auto-Reliable Abort Character)

Sets the ASCII character (from 0 to 127) that, if sent during an error control negotiation, aborts error control negotiation and causes the modem to return to standard (buffered) asynchronous communication.

COMMAND	DESCRIPTION
%A*n*	Defines auto-reliable abort character, where *n* = ASCII character 0 through 127 (has the same effect as changing register S46). *Default = 13*.

%B (11 Bit)

Sets the number of bits per byte. The %B2 (10 bit) setting is mandatory if error controlled or AT auto-dialing is required. Non-buffered asynchronous data (&Q4) with no error controlled data links must be used when selecting commands %B0, %B1 and %B3.

COMMAND	DESCRIPTION
%B0	8 bits
%B1	9 bits
%B2	10 bits
%B3	11 bits

%C (Data Compression)

Controls modem data compression. A V.42 link operates with V.42*bis* data compression, which allows a 4:1 compression ratio. An MNP error control link operates with MNP level 5 data compression, which allows a compression ratio of 2:1. This command functions only when &Q5, &Q6 or &Q7 are set (and when equivalent \N commands are set).

COMMAND	DESCRIPTION
%C*n*	Data compression control
%C0	Disables data compression
%C1*	Enables data compression*

The &U command can also be used to enable or disable data compression: &U0=disabled and &U1=enabled. Users with software designed around the &U command may be able to maintain compatibility using the modem.

%D (Hang-up Buffer Delay)

Determines how long the modem will wait after receiving a hang-up command to clear data in its receive buffer.

COMMAND	DESCRIPTION
%D*n*	Hang-up buffer delay
%D0	Hangs up without clearing receive buffer
%D=*n**	Attempts to clear receive buffers within *n* seconds, where *n* can be from 001 to 255. *Default = 020 (seconds)**

%K (V.42 Sliding Window Size)

Sets the number of V.42 error control packets that can be outstanding without acknowledgment, where *n* can equal from 1 to 15 possible windows. The maximum of 15 should be set for most applications to allow for maximum throughput. (&V does not display this command.) *Default = 15*.

%L (DSP Measurements)

Measures multiple analog parameters: the receive level in decibels (dBm) and the data pump line status, i.e., signal quality, near- and far-end echo, and round trip delay. This command must be issued while the modem is in on-line command mode.

COMMAND	DESCRIPTION
%L*n*	Reports analog DSP performance measurements
%L0	Measures signal level of the received carrier in dBm
%L1	Reports data pump's line status and receive level

%L1 reports receiver level, signal quality, near-end echo, far-end echo, round trip delay, and modulation statistics for the local modem. To report statistics for the remote modem, you must first enable secondary channel operation (^S1), set remote modem access (^R1), then enter %L1 to download the remote DSP's statistics. Enter ^R0 to disable the secondary channel.

%P (V.42 Negative ADP)

Controls the issuance of a negative ADP packet for V.42 error control.

COMMAND	DESCRIPTION
%P*n*	V.42 negative ADP
%P0*	Disables V.42 negative ADP*
%P1	Enables V.42 negative ADP

%Q (Dial Interrupt Control)

Controls whether or not the modem can be interrupted (by RXD data) once it has begun answering an incoming call. Applications such as dial-on-DTR and leased line dial back-up, and other applications that cannot stop data traffic while the modem is answering incoming ring, require this command to be disabled.

COMMAND	DESCRIPTION
%Q*n*	Dial interrupt control
%Q0*	Enables dial interrupt control*
%Q1	Disables dial interrupt control

%R (V.42 Checksum Length)

Controls the length of the checksum on V.42 error-controlled data packets. Normally, the longer the checksum, the more precise the error checking.

COMMAND	DESCRIPTION
%R*n*	32-bit checksum
%R0*	Selects 16-bit checksum*
%R1	Selects 32-bit checksum

%V (Autodialer Select)

Selects between the AT command set and various forms of the V.25*bis* autodialer. To enable any synchronous form of V.25*bis*, the &Q2 or &Q3 option must also be enabled.

COMMAND	DESCRIPTION
%V*n*	Autodialer select
%V0*	Selects asynchronous AT commands*
%V1	Selects asynchronous V.25*bis* commands
%V2	Selects synchronous V.25*bis* (character-oriented-BSC)
%V3	Selects synchronous V.25*bis* NRZ (bit-oriented-HDLC)
%V4	Selects synchronous V.25*bis* NRZI (bit-oriented-HDLC)

%Y (MNP Packet Format)

Selects the data format used in MNP error control packets. MNP error control packets which are synchronous (default setting) are more efficient and result in higher throughput.

COMMAND	DESCRIPTION
%Y*n*	Async MNP packets
%Y0*	Disables asynchronous MNP packets*
%Y1	Enables asynchronous MNP packets

This command should not be used unless you are sure of your application requirements, as throughput will degrade.

%X= (Serial Port Speed)

Selects the modem's serial port speed. Used to set modem port speed for answer-only (dial-in) applications. This command automatically updates bitmapped S-registers S23 and S39. This command is commonly used in conjunction with serial port speed lock command (#L1) to fix the modem's serial port speed to match that of the connected DTE. Also it is used durng a remote modem control session when the modem port speed is diifferent than that of the connected DTE.

COMMAND	DESCRIPTION
%X=*n*	Serial port speed select
%X=	Port speed decimal value .3 - 230.4 (Ex. 57.6, 9.6, 2.4)

***NOTE**: An autobaud (AT<ENTER>) will also update the %X= command. For example, AT%X=115.2<ENTER> sets the serial port of your modem to 115,200 bps. A subsequent autobaud (AT<ENTER>) to the modem at a terminal speed of 9600 bps will override the %X=115.2 and change it to %X=9.6 unless the modem has the speed lock command set (#L1).*

^E (Read Remote EIA Signals)

Reports the status of the remote EIA signals for RXD, TXD, RTS, CTS, DSR, DTR and CXR, where signal = 1 indicates on status and signal = 0 indicates off status.

COMMAND	DESCRIPTION
^E0	Reports remote EIA signals to the local DTE

To read remote EIA signals, you must first enable secondary channel operation (if it is not already enabled) by using the ^*S1* and ^*R1* commands in on-line command mode.

^R (Remote Modem Access Control)

Selects the modem to be accessed using the secondary channel control option (see Chapter 9).

COMMAND	DESCRIPTION
^R*n*	Remote access control
^R0*	Sets local modem access*
^R1	Sets remote modem access

^S (Secondary Channel Control)

Controls the secondary channel used in remote modem access. The ^S*n* command must be issued when the modem is in on-line command mode, which can be entered from data mode using the +++ escape sequence.

COMMAND	DESCRIPTION
^S*n*	Secondary channel control
^S0*	Disables secondary channel operation*
^S1	Enables secondary channel operation

#B (Busyout Control)

Selects the method used to busyout the modem. This command is only supported in the Z34-SX and Z34-SE.

COMMAND	DESCRIPTION
#B*n*	Modem busyout control
#B0*	Disables busyout operation*
#B1	Push test switch to busyout modem
#B2	DTR off will busyout modem
#B3	Push test switch while modem is on-line and modem will busyout after current call terminates

#C (Caller ID Control)

Selects the type of caller ID message sent to the DTE. The caller ID jumper (JP1-B) must be enabled for this option to work properly.

COMMAND	DESCRIPTION
#C*n*	Caller ID control option
#C0*	Caller ID disabled*
#C1	Formatted caller ID message which includes DATE= , TIME= , and CID=
#C2	Unformatted (single line) caller ID message

#L (Serial Port Speed Lock)

Locks the modem's port speed (in both AT command mode and data mode) to the setting of the %X command. Once the #L1 command is given, the modem will function properly only when data is sent at the locked rate (i.e., at the setting of %X). This option prevents the modem from inadvertently changing serial port speeds and causing a speed mismatch between the computer and the modem. The command #L0 (the default setting) will unlock the serial port and allow for full autobaud from 300 bps to 230,400 bps. This command is only supported in the Z34-SX and Z34-SE.

COMMAND	DESCRIPTION
#L0*	Port unlocked allows for AT & data at any speed*
#L1	Port locked allows for AT & data at one speed (%X)

To change the serial port speed once #L1 is set, issue a #L0 then a new port speed command (%X=xxx.x) and re-lock the port (#L1). Remember to write these commands to memory (&W0) so the are not lost on a power cycle.

*H (Hardware Reset)

Initiates hardware reset to check watchdog reset circuit. Once the command is used, the modem will flash the FAX LED, which is the positive indication that the reset circuit is operational. If the modem cannot reset, it should be returned to the factory for repair. This command is only supported in the Z34-SX and Z34-SE.

\A (V.42 Block Size)

Selects the transmit block size for error-controlled connections. On cellular connections a smaller block size increases overall throughput.

COMMAND	DESCRIPTION
\A*n*	Select block size for error control packets
\A0	Sets error control packet to 64 characters
\A1	Sets error control packet to 128 characters
\A2	Sets error control packet to 192 characters
\A3*	Sets error control packet to 256 characters*

\B (Break Length Control)

Instructs the modem to transmit a break signal to the remote end. The break signal (a constant space condition) can vary in length, from 100 to 900 ms. From data mode, issue the +++ escape sequence, wait for the OK message, and issue an AT\B*n* command, where n represents from 1 to 9—with each increment representing 100 ms of break signal. (&V does not display this command.)

COMMAND	DESCRIPTION
\B	Break length control
\B0*	Transmits a break signal of 300 ms*
\B*n*	Transmits a break signal of *n*, where *n* can equal 1 through 9

\C (Auto-Reliable Buffer)

Determines whether or not the modem buffer receives data while it attempts to negotiate error-controlled communication with an originating modem without error control. Use this command when the modem is set for error control and is expected to answer a call from a non-error control modem.

COMMAND	DESCRIPTION
\C*n*	Auto-reliable buffer
\C0	Does not buffer data during error control negotiation and will not recognize abort character (as specified by %A or S46)
\C1*	Buffers up to 128 characters received and does not recognize abort character*
\C2	Buffers up to 128 characters and detects error control abort character

\C0 is the same as &N0 and &O0. \C1 is the same as &N0 and &O1. \C2 is the same as &N1 and &O1.

\G (Modem-to-Modem Flow Control)

Controls modem-to-modem flow control on a non-error controlled link when using buffered asynchronous communications (&Q0) with Zypcom modems only. When this command is enabled, the local modem will flow control the remote modem once the local receive buffer fills; this in turn causes the remote modem to buffer data in its transmit buffer until it is full. When the remote transmit buffer is full, data will be lost. This command is used only for special applications.

COMMAND	DESCRIPTION
\Gn	Modem-to-modem flow control
\G0*	Disables modem-to-modem flow control*
\G1	Enables modem-to-modem (software XON/XOFF) flow control

\G1 is the same as &K16.

\K (Break Signal Control)

Defines how the modem handles a break received from the DTE. The break can be processed as it is received, put ahead of data in the transmit buffer, and be destructive or non-destructive.

COMMAND	DESCRIPTION
\K*n*	Break signal control
\K1	Immediately handles a break signal and is destructive to data in the buffer. Causes the modems at both ends to clear the buffers, and immediately passes the break (destructive and non-expedited)
\K3	Immediately transmits a break signal without buffering (non-destructive and expedited)
\K5*	Transmits a break in sequence with the received data (non-expedited and non-destructive)*

The modem also supports the &I command to maintain compatibility with existing communications software packages. &I2 functions the same as \K1, &I1 the same as \K3, and &I0 the same as \K5.

\N (On-line Data Mode Operation)

Selects how the modem operates when it enters on-line data mode. The \N*n* command is similar to the &Q command and is incorporated in the modem to maintain communications software compatibility.

COMMAND	DESCRIPTION
\N*n*	On-line data mode operation
\N0	Selects normal asynchronous communication (no error control) where data is buffered
\N1	Selects direct operation (no error control) where data is not buffered
\N2	Forces MNP error control and, if unsuccessful, causes modem to hang up
\N3	Selects automatic MNP and, if unsuccessful, causes the modem to fall back to buffered asynchronous communication
\N4	Forces V.42 (lapm) operation
\N5	Selects automatic V.42 (lapm) operation and, if unsuccessful, falls back to buffered asynchronous communication
\N6	Forces reliable V.42 (lapm) or MNP operation and, if unsuccessful, hangs up (S36=0)
\N7*	Selects automatic V.42 or MNP operation and, if unsuccessful, causes the modem to fall back to buffered asynchronous communication*

When forced, the modem must enter the mode selected. If unable to enter that mode, the modem hangs up rather than falls back. When set to automatic operation, the modem first attempts the mode selected and, if unsuccessful, falls back to a secondary mode of operation. If unsuccessful again, it attempts a third mode of operation.

Note that \N0 is the same as &Q0, \N1 as &Q4, \N2 as &Q5 and S36=0, \N3 as &Q5 and S36=1, \N4 as &Q7 and S36=0, \N5 as &Q7 and S36=1, \N6 as &Q6 and S36=0, and \N7 as &Q6 and S36=1.

\P (Modem Security Password Control)

Controls the password for modem security for local and remote access. When this option is enabled, you must issue the proper password before using the AT commands to dial, option, or view memory locations. The option can be enabled remotely, but can be disabled only locally.

COMMAND	DESCRIPTION
\P*n*	Modem security password control
\P0*	Disables local security password. Remote access security remains on*
\P1	Enables local security password. (When ^R1 is issued before \P1, \P1 refers to the remote modem's security password.)
\P2	\P2? displays the password. \P2=*xxxxxxx* is used to set the password, where *xxxxxxx* can be up to 7 alpha-numeric, case-independent characters

\S (Display Active Profiles)

Causes the modem to display its current profile as well as other stored profiles and telephone numbers. To maintain communications software compatibility, the modem also supports the &V command. &V0 is the same as \S0 and &V1 is the same as \S1. (&V does not display this command.)

COMMAND	DESCRIPTION
\S*n*	Displays active configuration and stored profiles
\S0	Displays active configuration and stored profiles 0 and 1
\S1	Displays stored profiles 2 and 3, as well as the four telephone numbers stored in memory

\V (Extended Result Messages)

Controls whether extended result messages (reporting error control and data compression status) are returned to the DTE. For software compatibility, the modem also supports the W*n* command. \V0 is the same as W0 and \V1 is the same as W2.

COMMAND	DESCRIPTION
\V*n*	Extended result messages
\V0*	Does not report extended (error control) result messages*
\V1	Reports one-line (Microcom-type) codes

\Y (Error Control Link Request)

Causes the modem to attempt to establish error-controlled communication, even though the modem has already made a normal (&Q0) or direct (&Q4) connection.

\Z (MNP Abort Error Control Link)

Forces the modem to attempt to switch to normal operation, even though MNP error-controlled communication has already been established. Also causes the remote modem to attempt to switch, and any data in the buffer at this time is lost.

Zscript Command Language

Modem instructions added at the end of a stored telephone number can enable the modem to automatically log into a remote computer system or provide security features such as pass-through or callback.

The set of instructions that makes up the script command language called Zscript can be used to cause the modem to verify a password, callback a telephone number, send an ASCII string, receive an ASCII string, or execute an AT command. The modem is able to store a Zscript sequence in nonvolatile memory and will execute any Zscript instruction that follows the stored telephone number when originating a call. When automatically answering a call, the modem will execute the Zscript sequence selected by register S34. If S34=255 then no Zscripts are processed, S34=0 for pass-through and callback security, and S34=1 through S34=10 for auto logon in memory location 0 through location 9.

The Zscript capability of the modem consists of a security command, programmed transmit and receive fields as well as one command field. The transmit fields tell the modem what to send to the remote end, and the receive fields tell the modem what to receive from the remote end. In addition, the command field—always the last field—specifies what the modem should do if the last transmit or receive command successfully executes. A security command (^W) and command field (^C) can not be in the same memory location.

Zscript Commands

These commands are used by the modem for automatic modem operation.

COMMAND	MODEM RESPONSE	DESCRIPTION
<CONTROL>W	(Security Pswd):	Enter the password
<CONTROL>T	(Transmit):	Enter data to be transmitted
<CONTROL>R	(Receive):	Enter data to be received
<CONTROL>C	(Command):	Enter the command field (always last in the Zscript sequence and can not be used in same location with ^W)
<CONTROL>A	(Return)	Equivalent to <ENTER>
<CONTROL>P	(Pause)	Causes the modem to pause for 2 seconds before continuing to process Zscript commands
<ENTER>	OK	Completes the Zscript sequence

After receiving a <CONTROL>T, <CONTROL>R, or <CONTROL>C command, the modem echoes to the screen a carriage return and line feed (<ENTER><LF>) before the (Transmit):, (Receive):, or (Command): prompts. To clear all memory locations use AT&ZC<ENTER>. To clear one location AT&Z0=<ENTER>. Zscript commands only operate in asynchronous buffered modes (&Q0, &Q5, &Q6 and &Q7).

Storing Zscript Commands for Automatic Logon

The modem can automatically log onto a remote computer by programming the modem with Zscript command language. The logon sequence below, for example, instructs the modem to dial a stored telephone number, wait for a connection, and receive a Logon prompt. If LOGON: is successfully received, the modem transmits the logon information (ZYPCOM<CR>). The modem waits to receive the PASSWORD: prompt and then transmits the password (SCOTT<CR>).

The Zscript command sequence that follows illustrates commands and modem responses as they would appear on your terminal screen, except for the <CONTROL> characters (^P,^R, and ^T) which are typed but not seen.

AT&Z0=T783 2538^R

(Receive): **LOGON:^T**

(Transmit): **ZYPCOM^A** (Return)**^R**

(Receive): **PASSWORD:^T**

(Transmit): **SCOTT^A** (Return) **<ENTER>**

The AT&Z0 command stores the telephone number and Zscript sequence to memory location 0. To interrogate this location, issue the *AT&Z0?<ENTER>* command to view the contents of memory location 0. If you enter an AT&V1 or &V2 command, the modem does not display the Zscript commands and shows the memory locations as blank.

Zscript Commands for Callback or Pass-through Security

To store a Zscript sequence for callback security or pass-through, enable auto-answer (S0=1) and set register S34=0 to enable all ten memory locations for security. The examaple below is callback. To have pass-through security delete the telephone number.

STEP	TYPED BY USER	ECHOED TO THE SCREEN
1.	**ATS0=1<ENTER>**	ATS0=1
2.	**ATS34=0<ENTER>**	ATS34=0
3.	**AT&Z0=783 2580^W**	AT&Z0= 783 2580 (Security Pswd):
4.	**Blue**	(Security Pswd):Blue
5.	**<ENTER>**	OK

Step 1 sets the modem to answer on the first ring. Step 2 instructs the modem to use all 10 memory locations for valid passwords and or callback numbers. Step 3 begins the Zscript sequence for storage in memory location 0 of the callback number and security password command. Step 4 adds the password. Step 5 instructs the modem to store these Zscript commands. The modem then goes off-hook and answers the call, it then waits for a <ENTER> from the remote user. After receiving <ENTER> the modem sends PASSWORD? Upon receipt of a valid (Blue) password from the caller the modem hangs up in 20 seconds and calls back within 20 seconds of hang-up. If the line is busy or no-answer occurs the modem will not retry.

Not all versions of the modems firmware will contain the callback security feature. Before setting up security, verify your modem has this feature. Set ATS34=0 and then send the AT&V2 command. If 10 memory locations are displayed then the modem has security. If, stored user profiles are displayed then visit the www.zypcom.com to obtain the security firmware and reflash your modem.

Helpful Hints for Callback

If you make a mistake in a transmit or receive field, use the <Backspace> key to erase and retype it again. To return to a field to correct it, you must first type <ENTER>, then the AT&Z*n* command to start from the beginning of the script again.

The Zypcom web site (www.zypcom.com) has a detailed application note on the security feature. It contains many examples and is easy to follow. It is recommended that if you are using mixed pass-through and callback security you read it. Also, this guide's Appendix F contains additional information on callback security setup.

Helpful Hints for Auto-Logon

If the first Zscript field is a transmit field, it is transmitted and the modem looks for a response corresponding to the first receive field. When the response is received, the next transmit field (if any) is transmitted. The procedure can be repeated. If the first Zscript field is a receive field, the modem waits for a message to be received before transmitting the first transmit field.

If you make a mistake in a transmit or receive field, use the <Backspace> key to erase and retype it again. To return to a field to correct it, you must first type <ENTER>, then the AT&Z*n* command to start from the beginning of the script again.

In originate mode, the Zscript sequence can be executed using only the ATDS*n* command, where *n* is the desired stored sequence. When the telephone number has been dialed and the call is connected, the modem will enter the Zscript sequence. To cause the modem to use the Zscript sequence when answering a call, register S34 must be set to the required stored sequence (ATS34*n*, where *n* = 1 to 10). Typing ATS34=0 disables any Zscript sequence for answer operation and enables security password. Therefore, there are only ten Zscript sequences available in answer mode, as well as in originate mode—each with a maximum length of 68 characters. In answer mode, the modem ignores the stored telephone number associated with a chosen memory location.

The modem does not wait indefinitely to receive a required message. If the expected message is not received within 30 seconds, the modem sends an AUTOLOGON FAILED message to the local terminal and disconnects the call.

Host computers sometimes miss the first few characters transmitted. If you have trouble with your remote computer, try inserting a pause in the first transmit instruction.

Sending your logon ID and your password in one string will expose your password to others, as your password is echoed by the host. (This applies to many, but not all, computers.) To prevent a password from being echoed back to the terminal by a host system, program the Zscript instruction to transmit the password response after receiving the PASSWORD? prompt from the host computer.

CHAPTER 6 Status Registers

Description

The modem has over 30 status registers—commonly referred to as S-registers—that can be used to control specific modem functions in AT and V.25*bis* autodialing modes. S-registers are memory locations that hold values for various parameters, for example, for counters, timers, and specific ASCII characters used to configure and operate the modem. S-registers impact the way a variety of modem settings operate. S-registers control options that determine the manner in which the modem dials, what features and speeds the modem will negotiate with remote modems, and how and when the call will disconnect.

There are three different types of S-registers:

- Storable
- Nonstorable
- Bit-mapped

A storable S-register is one whose value can be permanently saved with the &W<*ENTER*> command (see Table 6-1).

TABLE 6-1. STORABLE S REGISTERS

S REGISTER	DESCRIPTION
S0	Auto-answer
S2	Escape character
S6	Dial tone delay
S7	Wait time for carrier/silence
S8	Comma delay
S9	Valid carrier detect
S10	Lost carrier disconnect
S11	Touch tone timer
S13	Rate adaption bias (Z34-SX/Z34-SE only)
S17	Leased line auto-restoral
S18	Test duration
S20	Leased line lookback timer
S23	Serial port speed 300 to 57,600 bps (bit-mapped)
S25	DTR detect timer
S26	RTS/CTS delay
S32	Side channel timer
S34	Callback security and auto-logon
S35	Leased line transmit level
S36	Error control negotiation fall-back (bit-mapped)
S37	DCE line speed
S38	Hang-up delay
S39	Serial port speed 230,400 bps (Z34-SX/Z34-SE only)
S40	Inactivity timer
S42	Dial backup and fall-back/fall-forward (bit-mapped)

S46	Error control abort character
S47	XON character
S48	XOFF character
S49	Dumb modem
S53	Dial retry interval
S99	Bell 801 RS366 (S34-SX only)

A nonstorable S-register resets to its factory setting upon receipt of an ATZ<ENTER> command or whenever power is cycled (see Table 6-2).

TABLE 6-2. NONSTORABLE S REGISTERS

S REGISTER	DESCRIPTION
S1	Ring count
S3	Carriage return character
S4	Line feed character
S5	Backspace character
S41	Dial retry
S44	Error control mode
S45	Disconnect reason

Bit-mapped registers are complicated S-registers that hold multiple option settings. These registers are normally used for advanced programming purposes only, and therefore are not completely identified in this manual. Should you require information on all the bit-mapped registers, please contact Zypcom Customer Service and ask for the bit-map register specification. Bit-mapped registers S23, S36, S39, S42 and S49 are listed in this manual. Appendix F has a decimal-to-binary conversion chart for those unfamiliar with bit-map registers.

Operation

Displaying Values

To display a list of the S-registers, as well as all current register settings, type:

AT&V<ENTER>

To display the value of a single S-register, type:

ATSn?<ENTER>

where *n* is the number of the register you wish to have displayed. For example, if you wish to know the current setting of S0, type:

ATS0?

If auto-answer is disabled, the modem returns this message:

```
000
OK
```

To display multiple S-register values with one command, type:

ATS0?S2?S7?<ENTER>

You would see a message like this on your screen:

```
000
043
030
OK
```

Setting Values

You can assign new values to S-registers with the ATSn=*x*<*ENTER*> command (where *n* is the number of the register and *x* is the value you want assigned). For example, if you want the modem to hang up if there is no activity for one minute, type:

ATS40=1<ENTER>

The modem responds with this message after it executes this command:

OK

Storing Values

Values for the storable registers listed in Table 6-1 can be saved in nonvolatile memory using this command:

AT&W <ENTER>

The modem responds with the OK message. Once saved, these values are protected—even if the modem loses power or is reset by means of the *ATZ*<*ENTER*> command.

Resetting Values

To reset all S-registers to their factory values, type:

AT&F<ENTER>

To save the factory settings in nonvolatile memory, type:

AT&F&W<ENTER>

S-registers that can't be written to nonvolatile memory return to their factory settings whenever the A*TZ*<*ENTER*> command is issued.

Reading Last Register Changed

To review the contents of the last S-register accessed, type:

AT?<ENTER>

If the modem has no record of the last register, then this command reads the contents of register S0.

Escaping to Command Mode

You can use the +++ escape sequence to go from data mode to on-line command mode without dropping your connection with the remote modem. Once the modem successfully processes the escape code sequence, it remains in on-line command mode. If you enter *ATO<ENTER>*, the modem reenters data mode. If you enter *ATH<ENTER>*, the modem hangs up. If neither command is issued, the modem will hang up whenever it loses remote carrier or when the local DTE lowers the DTR signal (if &D2 is set). *Note that the escape character can be redefined by setting register S2 to another value.*

If the first AT command issued after an escape sequence is an unrecognizable AT command, the modem returns to data mode and does not send an error message to the DTE.

Register Settings

Auto Answer (S0=0-255)

Register S0 controls the auto-answer option. S0=0 disables auto answering. S0=n (where *n* can be a value from 1 through 255) specifies the number of rings before the modem automatically answers an incoming call. (DTR must be on.) When S0 is not set to 0, the AA LED is ON, on the modem's front panel. *Default = 1*.

Ring Count (S1)*

Register S1 counts the number of rings the modem receives during an incoming call. When S1 matches the value set for S0, the modem answers the call. S1 resets to 0 if no ring occurs for 8 seconds. *Default = 0*.

> ***CAUTION:*** *An asterisk (*) next to the S-registers in this section indicates that it is nonstorable.*

Escape Character (S2=0-128)

Register S2 defines an ASCII character as the escape character. Setting this register to a value higher than 127 disables the escape character entirely. It also disables the ATH<*ENTER*> command normally used to terminate a connection. In this case, you'll have to turn off DTR locally or press the <DATA> key on the front panel to hang up. *Default = 43 (+).*

Return Character (S3=0-127)*

Register S3 defines the end-of-line character. Upon receiving this character, the modem executes a command line. The end-of-line character is also appended to response messages. *Default = 13 (<ENTER>).*

Line Feed Character (S4=0-127)*

Register S4 defines the ASCII character that follows the carriage return when the modem is set to give verbose (word) responses (V1). *Default = 10 (ASCII LF).*

Backspace Character (S5=0-255)*

Register S5 defines the ASCII character used as the backspace character. The backspace character causes the cursor to move backwards in a line, deleting the characters. If the backspace character is set to a value between ASCII 33 and 127 or a value greater than 127, the modem does not recognize it. *Default = 8 (ASCII backspace).*

Dial Tone Delay (S6=2-255)

Register S6 determines how long the modem will wait after going off-hook before dialing the telephone number. The S6 register is in effect when the *X* command is set to 0, 1 or 3. When the *X* command is equal to 2 or 4, this register is ignored. Also, since the W modifier overrides S6, the modem will wait the length of the failed call timer (S7) for dial tone when the W modifier is part of the dial command string. *Default = 2 (seconds)*

Wait Time for Carrier/Silence (S7=1-255)

Register S7 controls the wait time for carrier. If the at sign (@) is used in the dialing command string, register S7 also controls the wait time for silence. After dialing or answering the call, the modem must receive a valid carrier signal within the specified wait time. If carrier is not received within that specified wait time, the modem sends a NO CARRIER message to the DTE. This register should be set to at least 60 for international calls. *Default = 60 (seconds).*

Comma Delay (S8=0-255)

Register S8 determines the length of the delay inserted with the pause command (,). For every comma in the dialing command string, the modem looks at the S8 register and pauses for that value in seconds. *Default = 2 (seconds).*

Valid Carrier Detect (S9=1-255)

Register S9 sets the amount of time that carrier must be received before it is determined to be a valid signal. Each number between 1 and 255 represents the number of tenths of a second that the modem must see carrier before responding to it. If the setting is high, a false carrier signal will probably not be mistaken for a true carrier signal. *Default = 6 (0.6 seconds).*

Lost Carrier Disconnect (S10=1-255)

Register S10 determines the amount of time the modem must wait to disconnect after losing carrier from the remote modem. If carrier remains absent for the time specified by the S10 register, the modem disconnects the call and responds with a NO CARRIER message to the DTE. Each number between 1 and 255 represents the number of tenths of a second the modem must wait before beginning the disconnect sequence. Cellular connections normally require register S10 to be set to at least 50. *Default = 14 (1.4 seconds).*

Touch Tone Timer (S11=50-255)

Register S11 controls the length of time that tones are transmitted by the modem. The default value is set to the telephone company's standard. Each number between 50 and 255 represents the number of milliseconds in which the tone will be sent. *Default = 95 (0.095 seconds).*

Rate Adaption Bias (S13=0-8)

This S-register's current setting is only displayed by using the command ATS13? Register S13 affects V.34, V32*terbo*, V.32*bis*, and V.32 operation in the Z34-SX and Z34-SE modems only. S13 determines how aggressive or conservative the modem will be when determining the maximum line rate a PSTN or leased line circuit can support. At least one modem needs to have the S13 register set for it to control the line speed of a link. Zero bias is S13=4, maximum positive bias is S13=0, and maximum negative bias is S13=8. S13 range is 0 to 8. S13=4 is the default.

S13 VALUE	DESCRIPTION
0-8	Rate adaptation bias S-register
4*	Default setting for maximum sustainable line rate. Zero bias setting.*
0	Line rate is usually 2400bps higher than when S13=4. Positive bias, aggressive setting.
8	Line rate is usually 2400bps lower than when S13=4. Negative bias, conservative setting.

Leased Line Auto-Restoral (S17=0-1)

This S-register's current setting is only displayed by using the command ATS17? Register S17 controls automatic restoral to the leased line from dial backup mode. S-register 17 causes the modem to lookback to the leased line to see if the modem can return to leased line operation. The modem will lookback at intervals controlled by S20. The lookback process take about 30 seconds during which time no data will be transmitted. *Default = 0 (disabled).*

S17 VALUE	DESCRIPTION
0*	Auto restoral disabled
1	Auto restoral enabled

Test Duration (S18=0-255)

Register S18 sets the duration of the modem diagnostic tests. When S18 is set to 0, the test continues indefinitely until stopped by the operator. To manually stop a test, you would enter the +++ escape sequence and from on-line command mode issue an *AT&T0<ENTER>* command. *Default = 0 (indefinite).*

Leased Line Lookback Timer (S20=0-255)

This S-register's current setting is only displayed by using the command ATS20? Register S20 controls the interval in minutes between leased line lookback operations. This register is functional only if S17=1. The lookback process takes about 30 seconds during which time no data will be transmitted. Normally, a lookback at the leased line every 120 to 180 minutes is satisfactory. A manual lookback will occur if the DATA key is pressed. *Default = 0 (disabled).*

Serial Port Speed to 57.6 Kbps (S23=bit-map)

Register S23 sets, among other things, the serial port speed of the modem. The *%X* command also sets serial port speed and is easier to use than bit-mapped registers for most users. The last autobaud speed is contained in this register or in register S39, depending on the autobaud speed. The last autobaud speed can be overridden by changing the value of S23 and S39. See Appendix F for more information on setting bit-map registers.

Bit 0 Detect RDLB (&T4 and &T5 command)

0 = Deny RDLB request (&T5)

1 = Accept RDLB (&T4)*

Bit 3,2,1 Serial port speed of the modem

0 = 300 bps
1 = 57,600 bps
2 = 1200 bps
3 = 2400 bps
4 = 4800 bps
5 = 9600 bps
6 = 19,200 bps*
7 = 38,400 bps

Note: bits 3,2,1 are valid only if S39 bit 3=0.

Bit 5,4 Parity

0 = Even

1 = Space*

2 = Odd

3 = Mark/none

Bit 7, 6 Not used

DTR Detect Time (S25=0-255)

Register S25 determines the amount of time the modem will wait before detecting a change in the DTR signal. When the modem is configured for synchronous operation (&Q) in command mode, the value between 0 and 255 is measured in seconds. Once the modem is on-line—whether in synchronous or asynchronous autodialing—the value is measured in 1/100 seconds. *Default = 5 (0.05 or 5 seconds).*

RTS/CTS Delay (S26=0-255)

Register S26 determines the delay from the time RTS is raised to when CTS is raised in the modem. The value is measured in 1/100 seconds. *Default = 1 (0.01 seconds).*

Side Channel Timer (S32=0-255)

Register S32 determines the amount of time (in seconds) to wait, after remote carrier is received, until the modem will send or receive the side channel enable pattern (^S1). S32=0 sends side channel request immediately, S32=255 disables side channel operation. *Default = 0.*

Callback Security and Auto Logon (S34=0-10, 255)

Register S34 controls callback security as well as automatic logon sequences in answer mode. When S34=255, no memory locations with Zscript is active in answer mode. If S34=0, callback security (^W) is active and auto logon sequences are disabled. When S34=0, all ten memory locations are scanned for a valid password in answer mode. To enable a single auto logon sequence, set S34=1, 2, 3, . . . 10. To enable logon sequence in memory location 1, set S34=2. To enable memory location 9, set S34=10. Security and auto logon sequences are developed using the Zscript command language in Chapter 5. *Default = 255.*

Transmit Level (S35=0-20)

Register S35 controls the transmit level for leased line operation. Z34-SX and Z34-SE models maximum output is -6dBm but -10dBm runs fewer errors because the local echo will be less with a slightly lower transmit signal. *Default = 9 (decibels).*

Error Control Negotiation Fall-back (S36=bit-mapped)

Register S36 is a bit-mapped S-register. S36 clarifies what the modem should do when it is unsuccessful in establishing error control link negotiations as determined by &Q or \N. When S36, bit 0 is set to 0, the modem will disconnect and hang up. When S36, bit 0 = 1, the modem will connect in buffered asynchronous mode. Also, data byte length and serial port lock options are controlled by this S-register. *Default = 5 (bit0 = 1 and bit1 = 0/bit2=1).*

Bit 0 Failure to negotiate error control
- 0 = Disconnect line, hang-up modem
- 1 = Fall-back to buffered asynchronous mode (non-E.C. mode)*

Bit 2,1 Character length in bits (use %Bn command to set)
- 0 = 8 bits
- 1 = 9 bits
- 2 = 10 bits*
- 3 = 11 bits

Bit 6,5,4,3 Not used

Bit 7 Lock modem serial speed at %X setting (use #Ln command to set)
- 0 = Serial port unlocked (#L0)*
- 1 = Locked at %X=nn setting (#L1)

DCE Line Speed (S37=0-36)

Register S37 controls the maximum line speed at which the modem will attempt to connect to the remote modem. S37 works in conjunction with the N*n* command. To force a specific line speed, set the S37 register to the desired value and the N command to N0. To set the maximum connect speed, set the S37 register to the desired value and the N command to N1. S37 in conjunction with N1 sets the initial maximum connect rate and allows fall-back if line conditions warrant. *Default = 0.*

COMMAND	S37 SETTING	DESCRIPTION
N1*	0*	This setting lets the modem determine maximum line rate and allows for a lower line rate if conditions warrant (default setting). Line rate can be higher or lower than DTE speed.
N1	1-36	This setting lets register S37 determine maximum line rate and allows for a lower line rate if conditions warrant. Line speeds variables 1 to 36 are listed below. The Z32t-SX, Z32t-SE, Z32b-SX and Z32b-SE do not support this maximum kine rate command (N1).
N0	1-36	Connection line rate is forced by register S37. Modem cannot lower line speed if conditions warrant, but will retrain at speed set by register S37.
N0	0	This setting forces the line speed to equal the current DTE speed. Modem cannot lower line speed if conditions warrant, but will retrain at DTE speed.

1	300 (Bell 103)
2	300 (Bell 103)
3	300 (Bell 103)
5	1200 (Bell 212)
6	2400 (CCITT V.22*bis*)
7	4800 (CCITT V.32)
9	9600 (TCM V.32)
10	9600 (non-TCM V.32)
11	300 (V.21)
12	1200 (V.23)
15	4800 (V.32*bis*)
16	7200 (V.32*bis*)
17	9600 (V.32*bis*)
18	12000 (V.32*bis*)
19	14400 (V.32*bis*)
20	16800 (V.32*terbo* for Z34 and Z32t)
21	19200 (V.32*terbo* for Z34 and Z32t)
22	21600 (V.34 for Z34 only)
23	24000 (V.34 for Z34 only)
24	26400 (V.34 for Z34 only)
25	28800 (V.34 for Z34 only)
26	Setting reserved
27	2400 (V.34 for Z34 only)
28	4800 (V.34 for Z34 only)
29	7200 (V.34 for Z34 only)
30	9600 (V.34 for Z34 only)
31	12000 (V.34 for Z34 only)
32	14400 (V.34 for Z34 only)
33	16800 (V.34 for Z34 only)
34	19200 (V.34 for Z34 only)
35	31200 (V.34+ for Z34 only)
36	33600 (V.34+ for Z34 only)
37-254	Settings reserved

Delay Before Hang Up (S38=0-254)

Register S38 controls the amount of time the modem will wait in asynchronous mode before going back on-hook after it has received a hang-up command (same as %Dn). The S38 register allows the modem to empty its receive buffers before going back on-hook when it is in error controlled communication or in buffered asynchronous communication (same as %D command). *Default = 20 (seconds).*

Serial Port 115.2 Kbps (S39=bit-map)

Register S39 sets, among other things, the serial port speed of the modem to 115,200 bps. The *%X* command also sets serial port speed and is easier to use than bit-mapped registers for most users. The last autobaud speed is contained in this register or in register S23, depending on the autobaud speed. The last autobaud speed can be overridden by changing the value of S39 and S23 or by using the *%X* command. See Appendix F for more information on setting bit-map registers.

Bit 1,0 Stored profile recalled upon power-up (&Y command)

- 0 = Stored profile 0*
- 1 = Stored profile 1
- 2 = Stored profile 2
- 3 = Stored profile 3

Bit 2 Not used

Bit 3 Serial port speed of the modem

- 0 = Speed according to register S23*
- 1 = Speed set to 115,200 bps

Bit 5,4 Break handling (&I command)
- 0 = Non-destructive and non-expedited*
- 1 = Non-destructive and expedited
- 2 = Destructive and expedited

Bit 6 Not used

Bit 7 Automatic retrain (&E command)
- 0 = Disable
- 1 = Enable*

Inactivity Timer (S40=0-255)

Register S40 controls the amount of time the modem will wait for activity before automatically hanging up. S40=0 disables the inactivity timer. The number between 1 and 255 represents a value in minutes. Inactivity must occur on both the transmit and receive data pins. *Default = 0 (minutes).*

*Dial Retry (S41=0-10)**

Register S41 defines the number of times the modem will attempt to redial a telephone number after a NO ANSWER, BUSY, NO CARRIER or NO DIALTONE condition. Register 53 defines the interval between retries. To abort the redial process, press any key. When S41=0, no retry occurs. *Default = 0*.

Dial Backup Enable and Fall-back/ Forward (S42 = bit-map)

Register S42 is a bit-mapped register that changes value depending on various settings. To enable dial backup for your configuration, determine the current value of register S42, add 2 to the result, and store the new number. To enable fall-back and fall-forward for your configuration, determine the current value of register S42, add 4 to the result, and store the new number. Caution is advised in using fall-back/forward in synchronous applications as this feature can cause new problems due to changing modem clocks as new speeds occur.

For example, on dial backup, interrogate register S42:

ATS42?<ENTER>

If the value returned is 0, type:

ATS42=2&W<ENTER>

to enable dial backup (see Chapter 8 and Appendix F for more information.)

Note that in the sample command string above, &Wn writes the command setting to memory. If you don't specify memory location *n* (where *n* can be 0, 1, 2 or 3), the modem assumes 0.

*Error Control Mode (S44=0-7)**

Register S44 indicates the type of error control used on the modem link. To determine what error control, if any, is in effect for an incoming call, send the +++ escape sequence, then interrogate the register with *ATS44?<ENTER>*. To return to online data mode, issue an *ATO<ENTER>* command. *Default = none*.

S44 VALUE	DESCRIPTION
0	No error control
2	MNP Class 2
3	MNP Class 3
4	MNP Class 4
5	MNP Class 5
6	V.42
7	V.42b*is*

*Disconnect Reason (S45=0-6)**

Register S45 stores code that indicates the reason for the last modem disconnect. You can interrogate the modem after a disconnected call with the A*TS45?<ENTER>* command. Note that register S45 is disabled if *AT&V0<ENTER>* has been issued. *Default = none*.

S45 VALUE	DESCRIPTION
0	Loss of carrier
1	User interrupted
2	Modem training failure
3	Modem retrain failure
4	Inactivity timed out register S40
5	Long space disconnect
6	Error control negotiation failure

Error Control Abort Character (S46=0-127)

Register S46 stores the selected ASCII value of the error control abort character. This feature is used when an originating modem does not have error control and calls a modem. If the modem has been configured to auto-negotiate error control, it will attempt to do so for 6 seconds before timing out. If the error control abort character is sent by the originating DTE during this waiting period, the modem will enter buffered asynchronous communication immediately. *Default = 13 (ASCII <RETURN>).*

XON Character (S47=0-127)

Register S47 defines the ASCII character sent by the modem as the XON character. *Default = 17 (DC1).*

XOFF Character (S48=0-127)

Register S48 defines the ASCII character sent by the modem as the XOFF character. *Default = 19 (DC3).*

Dumb mode (S49 = bit-map)

This S-register's current setting is only displayed by using the command ATS49? Register S49 is a bit-mapped register that changes value depending on various settings. To enable dumb mode add 64 to current value. To enable AT mode, perform a power reset again. For example, on dial backup, interrogate register S49:

ATS49?<ENTER>

If the value returned is 3, type:

ATS49=67&W<ENTER>

NOTE: Once dumb mode is enabled the modem can not be interrogated to determine the value of S-register settings.

Redial Interval (S53=0-15)*

This S-register's current setting is only displayed by using the command ATS53? Register S53 defines the interval in minutes between redialing a telephone number (number of times the modem will redial is define by S41). When S53=1 the modem will redial every minute until the S41 counter is reached. *Default = 1.*

Bell 801 Control (S99 = bit-map)

This S-register's current setting is only displayed by using the command ATS99? Register S99 is a bit-mapped register that changes value depending on various settings. For your configuration, determine the current value of register S99, add 8 to the result, and store the new value. For example, interrogate register S99:

ATS99?<ENTER>

If the value returned is 0, type:

ATS99=8&W<ENTER>

to enable the internal Bell 801 compatible autodialer (RS366). After enabling the 801 autodialer you will need a "Y" cable (connects the modem port to the computers RS232 and RS366 ports), part number 91009-094 which can be purchased from you reseller or from the Zypcom parts department. Moreover, you may find the following command string useful in optioning your modem for Bell 801 dialing.

To enable a Bell 801 dialer for a IBM 3745, type:

AT&C1&D2&S1&Q3S0=1S99=8&R2&W<ENTER>

To enable a Bell 801 dialer for a 9600bps Wang, type:

AT&C1&D2&S1&Q3S0=1S99=8&R2N0S37=17&W<ENTER>

CHAPTER 7 V.25*bis* Autodialing and Synchronous Dial-Up Operation

General

V.25*bis* is an international standard set by the Consultative Committee for International Telephone and Telegraph (CCITT) that defines how to automatically initiate serial communication synchronously or asynchronously over the public switched telephone network.

The modem supports three V.25*bis* data formats:

- 7 or 8 bits with odd, even or no parity for asynchronous devices
- 7-bit odd parity for character-oriented bisynchronous (BSC) protocol
- HDLC (SDLC-ASCII) bit-oriented synchronous protocol (NRZI or NRZ)

V.25*bis* autodialing is commonly used in international markets. Domestically, synchronous minicomputers (for example, IBM AS/400s), bridges and routers, and some PCs also use V.25*bis* autodialing. The modem implementation of V.25*bis* supports all standard V.25*bis* commands, as well as several extensions for enhanced operation.

Once the modem has been set for synchronous or asynchronous V.25*bis* autodialing, you can automatically dial numbers directly from your DTE or dial a telephone number previously stored in nonvolatile memory.

The modem can be configured for synchronous communication with or without V.25*bis* using hardware switches or AT commands. Four different methods for enabling V.25*bis* and/or synchronous operation are listed in this chapter. They are:

- ❑ Software (AT commands) setup of V.25*bis*
- ❑ Hardware setup of V.25*bis*
- ❑ Software (AT commands) setup of synchronous operation
- ❑ Hardware setup of synchronous operation

V.25bis Autodialing

V.25*bis* autodialing can be set up in one of two ways. If you'll be using V.25*bis* exclusively, it is recommended that you follow the procedure outlined later in this chapter for hardware setup. If you'll be switching between synchronous V.25*bis* and asynchronous AT autodialing, you'll probably want to use the software setup procedures.

V.25bis Hardware Setup Introduction

The modem has a 10-position DIP switch on it that can be used to select asynchronous, bisynchronous, or HLDC-NRZ V.25*bis* autodialing (refer to Figure 7-1 and Table 4-2). Once configured, the modem can be returned to its factory default configuration by performing a power reset.

V.25bis Software Setup Introduction

The modem can also be configured for V.25*bis* autodialing by using AT commands. However, once you select V.25*bis* with a particular data type, you must use that data type to issue the commands that will change options. To return the modem to its default settings, use the data type selected and send a CNL&F0 command or power reset.

Synchronous Communication Setup Introduction

If you won't be using V.25*bis* autodialing in your synchronous application, skip "Software Setup of the V.25*bis* Autodialer" and refer directly to the "Software Setup of Synchronous Operation" section later in this chapter. If you will not be using AT commands to set up the modem for synchronous communication, refer to "Hardware Setup of Synchronous Operation" at the end of this chapter.

V.25*bis* Autodialing

General

In asynchronous V.25*bis* applications, autodialer commands can be issued directly from an asynchronous DTE keyboard or with communications software. For synchronous V.25*bis* applications, commands can also be issued from a synchronous DTE by using the selected synchronous data format.

Dashes, parentheses, periods and spaces may be used within a V.25*bis* dial command string for clarity, but they are ignored by the modem. If a left angle bracket (<)—the equivalent of a comma in AT autodialing—is inserted into the dial string, the modem pauses for two seconds or for the value in seconds of register S8. Inserting an equal sign (=) into the dial string causes the modem to pause twice as long as the value in seconds of register S8.

The modem issues response messages for each entered command. If the command executes successfully, the modem sends a VAL (valid) message to your screen. If a command string has errors—such as an unsupported command character, parity error, or out-of-range command parameter—the modem sends an INV (invalid) message.

Execute V.25bis Command

The <ENTER> key is an end-of-line delimiter that tells the modem to execute the command in V.25*bis* asynchronous format. The hexadecimal ETX character tells the modem to execute the command in V.25*bis* bisynchronous format. The flag following the FCS field specifies V.25*bis* HDLC format.

V.25*bis* Commands

Below is a list of V.25*bis* commands and response messages supported by the modem. Several extensions to the V.25*bis* standard have also been added to enhance the modem's capabilities. These command set additions are thoroughly discussed in the "Command Set Extensions" section of this chapter.

Connect Incoming Calls (CIC)

Causes the modem to go off-hook in answer mode, overriding any previously issued *DIC* command.

Dial Command (CRN)

Directs the modem to dial a telephone number. Upon receiving the command, the modem goes off-hook, dials the specified number, and attempts to establish a remote connection.

MODIFIER	COMMENTS
0-9	Causes the modem to dial digits in either DTMF or pulse mode, depending on what is indicated in the command string
*	Selects DTMF dialing of the star character
#	Selects DTMF dialing of the gate character
T	Specifies tone dialing of digits that follow in the dial string
P	Selects pulse dialing of digits that follow in the dial string
<	Causes the modem to pause for the

	period specified by register S8 (same as the comma in the AT command set)
=	Causes the modem to pause for twice the value (in seconds) of register S8
:	Causes the modem to wait for dial tone before dialing the digits that follow
!	Causes the modem to go on-hook for 0.5 seconds and then off-hook for 0.5 seconds before dialing the next digit

MODIFIER	COMMENTS
@	Causes the modem to wait for 5 seconds of silence before dialing the digits that follow
space, dash, period, parentheses	Space, dash, period, and parentheses are ignored, but may be used in the command string for clarity

Dial Stored Number (CRS)

Directs the modem to dial a telephone number stored in one of four memory locations.

COMMAND	DESCRIPTION
CRSn	Dial stored telephone number
CRS0	Dial telephone number stored in memory location 0
CRS1	Dial telephone number stored in memory location 1
CRS2	Dial telephone number stored in memory location 2
CRS3	Dial telephone number stored in memory location 3

Disregard Incoming Call (DIC)

Causes the modem to disregard an incoming call, even if the modem has been configured for auto-answer. If DIC is issued when the modem is not set for auto-answer, an INV (invalid) message is returned to the DTE. *This command must be entered for each incoming call you wish to disregard.*

Program Number (PRN)

Causes the modem to store a dial string into a specified memory location.

COMMAND	DESCRIPTION
PRNn	Program number
0-3	Identifies the memory location in which the dial string is to be stored, where 0 is memory location 0, 1 is memory location 1, and so forth
;	Serves as a separator between the memory address referenced and the dial string to be stored. For example, *PRN 1;1-510-783-2538* stores 1-510-783-2538 into memory location 1
space	Clears the memory location that follows it in the command string. For example, PRN 0 clears memory location 0

List Stored Numbers (RLN)

Lists the contents of one specified memory location or the contents of all four memory locations.

COMMAND	DESCRIPTION
RLNn	List stored numbers
0-3	Identifies the memory location whose contents are to be returned to the DTE, where 0 is memory location 0, 1 is memory location 1, and so forth
space	Causes the modem to return the contents of all four memory locations to the DTE

Standard V.25*bis* Command Responses

For each command entered during V.25*bis* autodialing, the modem returns one of the following responses. Response messages are sent in asynchronous, bisynchronous or HDLC format, depending on the data format selected. You can disable the messages using the *CNLQ1* command.

Call Failure Indication (CFI)

Sent after a call fails to establish a successful connection.

RESPONSE	DESCRIPTION
CFInn	Call failure indication
AB	Indicates dial tone not detected, expiration of failed call timer, or detection of answer tone but no carrier acquired
ET	Indicates detection of busy tone

NT	Indicates answer tone not detected, ring-back detected, or call aborted
RT	Indicates expiration of failed call timer during ringback detection
NS	Indicates missing telephone number in specified memory location

Call Connections (CNX)

Sent to the DTE with a line rate indication. For example, after receiving a CRN command and successfully establishing a connection, the modem issues to the DTE a CNX XXXXX message, where XXXXX reflects the connect speed, ranging from 1200 to 33600 bps for synchronous mode and 300 to 230,400 bps for asynchronous communication.

Incoming Call (INC)

Sent by the modem each time it detects an incoming ring signal.

Invalid (INV)

Sent in response to a syntactical error in the command string or in response to other incompatibilities that make it impossible for the modem to execute the command. For example, if you issue a CRS9 command to dial the telephone number stored in memory location 9, but there isn't a memory location 9, an INV message is returned. In general, INV indicates an unknown command, an error in command or parameter syntax, or a parameter value error.

List Stored Number (LSN)

Sent in response to an RLN command requesting the contents of a specific memory location or the contents of all memory locations.

RESPONSE	DESCRIPTION
LSNn	List telephone number stored in memory
LSN 1;	Issued in response to RLN1; displays the contents of memory location 1
LSN 2:	Issued in response to RLN2; displays the contents of memory location 2
LSN 3:	Issued in response to RLN3; displays the contents of memory location 3
LSN 4;	Issued in response to RLN4; displays the contents of memory location 4

When RLN (space) is issued, the contents of all four memory locations are returned to the DTE and these messages precede the reading for each location.

Valid (VAL)

Sent to the DTE whenever the modem successfully executes a command.

V.25*bis* Command Set Extensions

Zypcom has extended the V.25*bis* autodialing command set to provide the ability to configure the modem in asynchronous or synchronous communication. Modem configuration is not defined by the V.25*bis* specification, but Zypcom has extended its command set to provide this capability. Additionally, Zypcom has further enhanced the modem by designing it to recognize the +++ escape sequence in asynchronous V.25*bis* autodialing.

Configuration Local (CNL)

CNL is a prefix that functions the same as AT and precedes the same command parameters available in the AT command set. For example, if you want to set your DTR and auto-answer options in asynchronous V.25*bis* autodialing, type:

```
CNL&D2S0=2<ENTER>
```

The modem responds with a VAL message. Command strings not successfully executed cause the modem to return an INV message to the DTE.

V.25bis Escape Sequence

After receiving the +++ escape sequence, the modem enters on-line command mode. If you issue a *CNLH* command, the modem goes back on-hook (hangs up). If you issue a *CNLZ* command, the modem resets before going back on-hook.

DTE Adaptation

The default speed of the modem's serial port is 230,400 bps in asynchronous communication and 33,600 bps in synchronous communication. Upon receipt of the *CRN* command in asynchronous V.25*bis* communication, the modem automatically autobauds to match the speed of the DTE. In synchronous communication, the modem clocks commands at 33,600 bps and changes its clock rate to match the speed on the line after carrier is acquired. When asynchronously optioning the modem for synchronous operation, set the DTE speed to 33,600 bps before typing AT commands.

V.25*bis* Framing Rules

All V.25*bis* commands must have the correct syntax and framing for the modem to be able to properly interpret them. The V.25*bis* autodialer supports asynchronous, bisynchronous (BSC) and HDLC character formats. The framing of each is different and must be followed exactly.

Asynchronous Framing

The framing for asynchronous V.25*bis* autodialing is straightforward. Type the command string and end it with the <ENTER> end-of-line delimiter. The data rate at which commands can be issued to the modem range from 230,400 to 300 bps.

An asynchronous V.25*bis* command field can have between 3 and 60 characters organized in one of the following ways:

- 7 data bits, odd parity, one start and one stop bit
- 7 data bits, even parity, one start and one stop bit
- 8 data bits, no parity, one start and one stop bit

Each field must contain only one command, but may be followed by as many parameters as will fill the 60-character limit. For example, a CNL command string can have a maximum of 57 additional characters, but may not contain CNL and CRN commands together. Commands with fewer than 3 characters or more than 60 are invalid.

HDLC Framing

An HDLC frame must consist of these elements:

- Flag character (HEX '7E')
- Address character (HEX 'FF')
- Control character (HEX '13')
- Message (command)
- FCS (two characters that make up a 16-bit cyclical redundancy check)
- End-of-frame flag (HEX '7E')

Message data must be organized in an 8-bit format between 3 and 60 characters long. The FCS characters will be a CRC calculated on the message data.

HDLC frames may be preceded and followed by additional HDLC flags. Frames with incorrect addresses, control characters, or FCS fields, as well as frames with more than 60 characters or fewer than 3 in the message field, are invalid. When the modem receives a valid command frame, it ignores any subsequent command frame until it has completed sending its indication of successful or unsuccessful completion back to the DTE.

Bisynchronous (BSC) Framing

A BSC frame must consist of these elements:

- SYN (HEX '16')
- SYN (HEX '16')
- STX (HEX '02')
- Message (command)
- ETX (HEX '83')

Message data must be in 8-bit character format and may be between 3 and 60 characters long.

Frames can be followed or preceded by additional SYN characters. Frames with a parity error or with more than 60 characters or fewer than 3 in the message field are invalid. Once the modem accepts a valid command frame, it ignores any subsequent command frame until the command is successfully processed and an indication is sent back to the DTE.

Software Setup of V.25*bis*

In synchronous V.25*bis* autodialing, you can configure the modem for BSC (%V2), HDLC-NRZ (%V3) and HDLC-NRZI (%V4) formats, but &Q2 must also be enabled.

To select V.25*bis*-BSC autodialing, first asynchronously configure your modem options as necessary (terminal speed at 38,400 bps). Use AT commands to set the line speed and any other capabilities you may need. Once the modem has been configured properly, you can then enable the V.25*bis* autodialer. For example, if you want to select V.25*bis*-BSC, use an asynchronous terminal and type:

AT&Q2%V2&W<ENTER>

To return to asynchronous AT autodialing from V.25*bis*-BSC autodialing, you must first send the modem a bisynchronous-formatted *CNL&Q6%V0* or *CNL&F0* command or power reset the modem.

Disabling the V.25bis Autodialer

You can issue *CNL %V0<ENTER>* to disable the V.25*bis* autodialer as long as the command is in the proper data format. The CNL&Q6 command returns the modem to asynchronous (auto error control) communication. A power reset will also return the modem to default, disabling the V.25*bis* dialer. To perform the reset, turn the modem off, depress both Data and Test keys and power on the modem. After a few seconds, release the keys.

V.25bis Autodialing

V.25*bis* autodialing lets you dial through a serial port by using a selected communication protocol. A typical asynchronous dial command would look like this:

CRN(space)telephone number<ENTER>

The modem goes off-hook and dials that number. In addition, telephone numbers can be stored in the modem's memory locations, then dialed from those locations.

While the modem is configured for V.25*bis* autodialing, you can still pick up the telephone handset attached to the modem, dial a telephone number manually, and press the <DATA> key to establish a data connection. In addition, pressing the <DATA> key for three or more seconds causes the modem to redial the telephone number stored in memory location 0.

V.25bis Auto-Answering

Assuming the modem's AA and DTR LEDs are on, the modem will automatically answer an incoming call. Should AA be out, configure the modem by using the appropriate synchronous framed message with the *CNLS0=1* command. If your synchronous DTE cannot send commands to a modem and you have already configured the modem for synchronous V.25*bis* autodialing, perform a power reset. Asynchronously set auto-answer on (S0=1), then re-enable V.25*bis* (&Q2%V*n*&W) again.

V.25*bis* Autodialing Procedures

Originating a Call

The following is an example of the commands and responses issued on a successful call. If you send this command to the modem from your DTE,

CRN 1 510 783 2538

the modem can send this response to the DTE:

VAL
CNX 33600

The message indicates that the modem has successfully dialed the specified telephone and established a successful connection with a line speed of 33,600 bps.

Storing a Telephone Number in Memory

To store a telephone number in memory location number 1, issue a PRN command followed by the selected telephone number. For example, send:

PRN 1;1 510 783 2538

The modem stores the number and responds:

VAL

Dialing a Stored Telephone Number

If you send

CRS 1

the modem dials the telephone number stored in memory location 1 and returns a CNX (speed) message to the DTE:

VAL
CNX 33600

Auto-Answering

The modem is normally preset to automatically answer. If auto-answer is disabled, it can be enabled by using the *CNLS0=1* command. This command causes the modem to automatically answer on the first ring if DTR is present. If the DTE is unable to provide DTR, then you can also send a *CNL&D0* command that causes the modem to assume that DTR is present.

Changing the Modem Configuration

To send several options to the modem in one command string, use the CNL command. For example, issuing CN*LS0=1&D0 <ENTER>* causes the modem to assume DTR is present and to auto-answer on the first ring.

To change the modem options, follow this example. Send:

CNL&C1&S1&D2S0=1&W

This particular field sets CXR, DSR and DTR normal, activates auto-answer upon detection of the first ring, and saves the configuration to memory.

The modem returns this message:

VAL

Hardware Setup of V.25*bis*

You can also use the hardware DIP switches to set the modem for V.25*bis* autodialing. Follow the step-by-step instructions below.

1. Set SW1 ON to enable switches SW2 through SW10.

2. SW2 controls communication. Select ON for synchronous or OFF for asynchronous communication.

3. Select the line rate speed for synchronous data types and the DTE speed for asynchronous data format by setting switches 3 and 4 in combination. For the maximum speed, set SW3 and SW4 OFF. Refer to Table 4-2 for other speed options.

4. Set SW8 ON to enable V.25*bis* autodialing. When SW8 is ON options change, &C1, &D2, &R0, and &S1 are set.

5. SW9 controls data format and is applicable only if SW2 is ON. Select ON for character-oriented bisynchronous data format or OFF for bit-oriented HDLC data format. The bit-oriented HDLC protocol has two variations: NRZI and NRZ. SW9 OFF assumes NRZ.

6. Reinstall the modem to activate the settings.

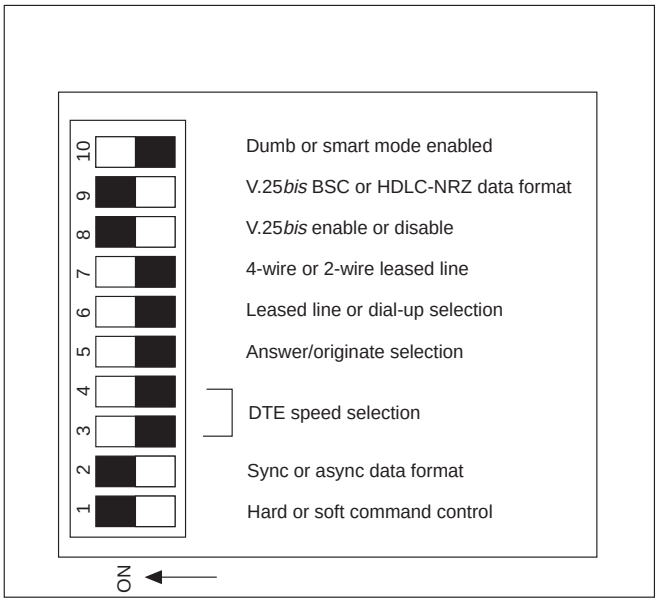

Figure 7-1. Using the DIP Switches to Select V.25bis

In some cases, other modem options will need to be changed. If synchronous V.25*bis* autodialing has been enabled and you can't send synchronous-formatted CNL commands but want to set an option:

1. Return SW1 to the OFF position and reinstall modem.
2. Connect an asynchronous terminal set to 38,400 bps to the modem.
3. Issue the required AT commands and write them to memory (&W).
4. Return SW1 to its ON position.

Hardware Disabling of the V.25bis Autodialer

Return all DIP switches to their OFF position and reinstall the modem.

Dialing

Once you've manually configured the modem for V.25*bis* autodialing and selected your required data format, send:

CRN (space) telephone number<command delimiter>

The modem executes the command by going off-hook and dialing the specified telephone number.

With manual V.25*bis* dialing enabled, you can also pick up the telephone handset attached to the modem and dial the telephone number yourself. Press the <DATA> key immediately after dialing to establish a connection. To dial the telephone number stored in memory location 0, press the <DATA> key for 3 seconds, then release.

Auto-Answering

To auto-answer once the modem has been manually configured for V.25*bis* autodialing, set DIP SW1 and SW5 to the ON position. With SW5 on and DTR present, the modem will automatically answer an incoming ring signal and put out CNX call progress messages on the answer side.

Synchronous Operation

The modem can operate synchronously in full or simulated half duplex at 28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9,600, 7,200, 4,800, 2,400 or 1,200 bps, in which case the SYN LED on the modem's front panel will be on. There are two ways to enable synchronous operation:

- ❑ Software (AT commands) setup of synchronous operation
- ❑ Hardware setup of synchronous operation

For an AT enabled synchronous dial-on-DTR example, refer to the end of this chapter.

Software Setup of Synchronous Dial-up Operation

The modem can be asynchronously configured for synchronous dial-up communication (without V.25*bis* enabled) by using the &Q command from the AT command set. There are several variations of &Q (see command descriptions in Chapter 5). For leased line synchronous setup on a leased line see Chapter 8.

- &Q1 allows you to dial a telephone number asynchronously, then go on-line in synchronous communication
- &Q2 allows you to dial a telephone number stored in memory location 0 by raising DTR and going on-line in synchronous communication. (Use only &Q2 if you can stop all data coming from the DTE while the modem is dialing; otherwise, use &D4&Q3. See example at end of this chapter.)
- &Q3 provides normal synchronous operation used for manual originate and leased line operation

In the &Q1 and &Q2 cases, when you lower DTR, the modem hangs up and returns to asynchronous command mode. From there, you can configure the modem asynchronously or return it to its factory settings. In the &Q3 case, the modem stays in a dumb synchronous mode and reconfiguration can occur only after a power reset.

Set the modem for the speed and EIA options you require. The value in register S37 determines speed. The EIA settings for CTS, DSR, DTR, CXR and auto-answer should be reviewed for your application. Select the type of synchronous communication that will best suit your application and enable it with the AT&Qn <*ENTER*> command.

Software Disabling Synchronous Operation

When the modem is on-hook in command mode (even if it has been configured for synchronous communication with the &Q1 or &Q2 command), you can send an asynchronous *AT&F0<ENTER>* command and return the modem to its factory settings. If you use the &Q3 command, you must perform a power reset to disable synchronous operation.

Dialing

There are several ways to dial a telephone number.

1. &Q1 allows you to dial asynchronously (ATDT) and go to synchronous communication when remote carrier is present.

2. &Q2 allows you to dial the number stored in memory location 0 (&Z0) after an off-to-on transition of DTR.

3. &Q3 allows you to go off-hook in originate mode by pressing the <DATA> key. Pick up the telephone attached to the modem and dial a telephone number. Press <DATA> when you hear ringing and immediately return the handset to the cradle to establish a synchronous (&Q3) data connection.

Answering

In all cases, and as long as ATS0=1 or more than 1, the modem will answer in one or more rings as long as DTR is present.

Hardware Setup of Synchronous Operation

You can set the modem for synchronous communication by using the 10 DIP switches on the modem. Hardware setup is preferred if you are manually originating calls or using synchronous leased line operation.

Enabling Synchronous Communication

Use the 10-position DIP switch to enable synchronous communication. The normal position for these switches is in the OFF position. SW1 must be in the ON position to enable the other switches (SW2 through SW10).

Turn SW1 and SW2 ON, then set your speed selection by using switches 3 and 4 (see Table 4-2). After selecting a speed so that the modem will read the switches and activate the settings.

Disabling Synchronous Communication

Set SW1, SW2, SW3 and SW4 to the OFF position, then reinstall the modem.

Originating a Call in Synchronous Communication

A common way to originate a call in dumb (no autodialer) synchronous communication is to pick up a

telephone attached to the modem, dial the number, and press the <DATA> key. When you hear ringing, immediately return the handset to its cradle. This ensures that no modem handshaking is missed and that your connection will occur at the highest speed. The modem goes off-hook at this point and establishes a connection with the remote modem. You may also press the <DATA> key for three or more seconds; the modem then redials the telephone number stored in memory location 0. Once on-line, pressing the <DATA> key again causes the modem to disconnect the call.

Answering a Call in Synchronous Communication

The modem automatically answers an incoming call on the first ring when SW5 is ON and DTR is high. When configured properly, the AA (auto-answer) LED on the modem front panel will be on.

Example: Synchronous Dial-on-DTR for 7400 Multiplexer

The example below configures the modem for dial-on-DTR applications that cannot control data flow to the modem while the modem is dialing a stored telephone number. For multiplexers and digital service units (DSUs), it is normally impossible to stop data flow while the modem is dialing and handshaking. However, this sample setup will work for all devices that cannot control data flow before a communications link can be established.

1. Set up the answer side modem with the following AT command string:

AT&C1&S1&R0&Q1S0=1%Q1E1Q0&W<*ENTER*>

2. Set up the originate side modem with the following AT commands. First, store the telephone number:

AT&Z0=telephone number

then configure the modem with the following command string:

AT&C1&S1&R0&D4&Q3S0=0E1Q0&W<ENTER>

3. Connect the modem to their respective devices and turn on the power to the DTEs. As the DTR lead goes high on the originating modem, the modem will go off-hook and dial the telephone number stored in memory location 0.

4. To hang-up the call, lower DTR on the originating modem. (Turn the power off to the DTE device.)

5. To return the modem to its factory configuration, you must perform a power reset.

CHAPTER 8 Leased Line Operation

General

A leased line is a permanent connection between local and remote modems that provides full-time access for a fixed fee. Leased lines are also sometimes referred to as *dedicated*, *private*, or *3002* lines.

Zypcom modems normally do not require the various classes of special conditioning that is available for leased lines. However, in some cases to achieve maximum speed some conditioning of the line may be necessary. These modems can operate in full duplex in a point-to-point configuration on a two-wire and or four-wire leased line. The SX-Series can operate in full duplex in a point-to-point configuration on a two-wire or a four-wire leased line. The SE-Series can operate in full duplex in a point-to-point configuration on a two-wire leased line. The SX-Series and the SE-Series modems can perform automatic dial backup if the leased line degrades or goes down. In addition, these modems can also automatically return (auto-restoral) to the leased line once the leased line is operational again.

Considerations

When ordering a leased line from the telephone company, you need to decide what type of line to order. In most cases, you will not need to order any special line conditioning such as D4, D5, or D6.

Before choosing your line, consider these issues:

- ❑ Whether your application would be better served by a two- or four-wire leased line (SX-Series modem is required for 4-wire leased line and SE-Series will operate on 2-wire leased lines).
- ❑ How the telephone company terminates the line—terminal block (spade lugs connectors) or modular connector (RJ45 type connector receptacle).
- ❑ Which modem will be used for answering and which for originating (S0=1, S0=0).
- ❑ Modem line speed required (S37, Nn).
- ❑ For asynchronous communication, data bits, parity, and serial port speed (%Xn).
- ❑ For synchronous communication, internal or external clock source, V.13 switched carrier requirements (&Xn, &Cn).
- ❑ Automatic dial backup if the leased line goes down (S42).
- ❑ Automatic return to the leased line once it is repaired (S17, S20).

There are two types of domestic line termination provided by the telephone company. A 42A terminal block requires a telco cable with spade lugs; a modular JM8 block requires a modular connector (RJ45).

Overview Setup Procedures

All leased line setups involve:

- ❑ Running an optional leased line cable from the modem to the leased line terminated wall jack
- ❑ Opening the modem's case to properly set the jumpers inside

- ❑ Setting the modem for leased line operation using the AT commands (software setup) or the appropriate DIP switches on the underside of the modem (hardware setup)

Mandatory Setup Procedures

Whether you'll be using AT commands or the DIP switches to put the modem in leased line communication, you must first properly install several jumpers on the PCB.

1. Remove the four rubber feet on the underside of the modem.

2. Remove the four Phillips head screws that secure the top cover. Remove the top cover.

3. Refer to figures 8-1 and 8-2 and ENABLE the JP1 jumper for 2-wire and JP-1 and JP-2 for four wire.

4. SE-Series: Install optional 2-wire leased line cable (P/N 91009-202) cable into modem jack labeled "Phone" on the back of the SE-Series modem. Be sure the cable end labeled "Modem" (pin5 and pin 6) is inserted into the modem jack labeled "Phone". The cable end labeled "Leased line" with pin 3 and pin 4 inserts into the leased line termination point.

   SX-Series: Install optional 4-wire leased line adapter (P/N 15080-001) cable into modem jack labeled "Phone" on the back of the SX-Series modem. Be sure the short (6 inches) cable end inserts into the modem jack labeled "Phone". Select the correct leased line cable (91009-105 for RJ11 to spade lugs or 15080-002 for RJ11 to RJ45) and connect the RJ11 side of the cable to the leased line adapter and then the other cable end to the leased line termination point.

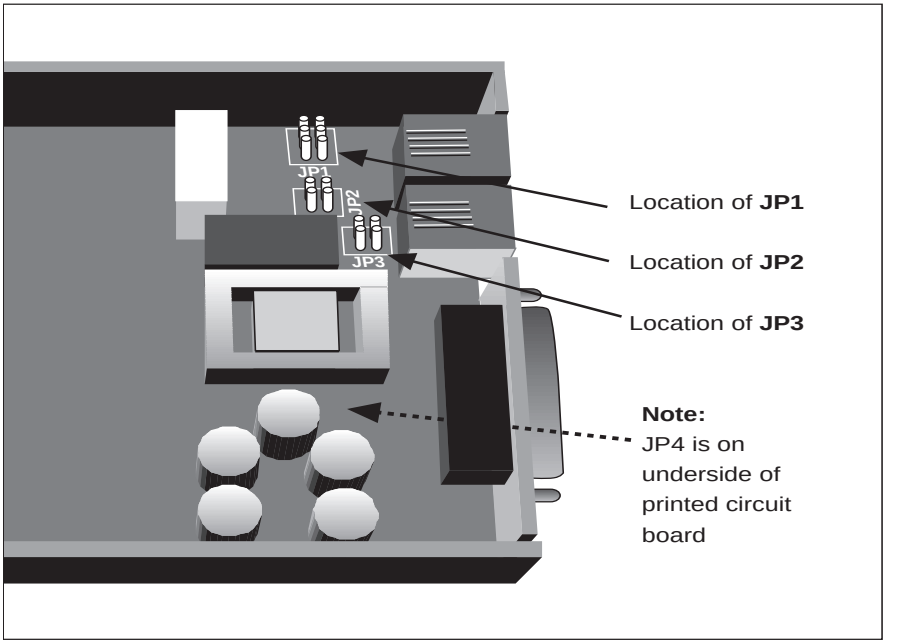

Figure 8-1. Printed Circuit Board Layout

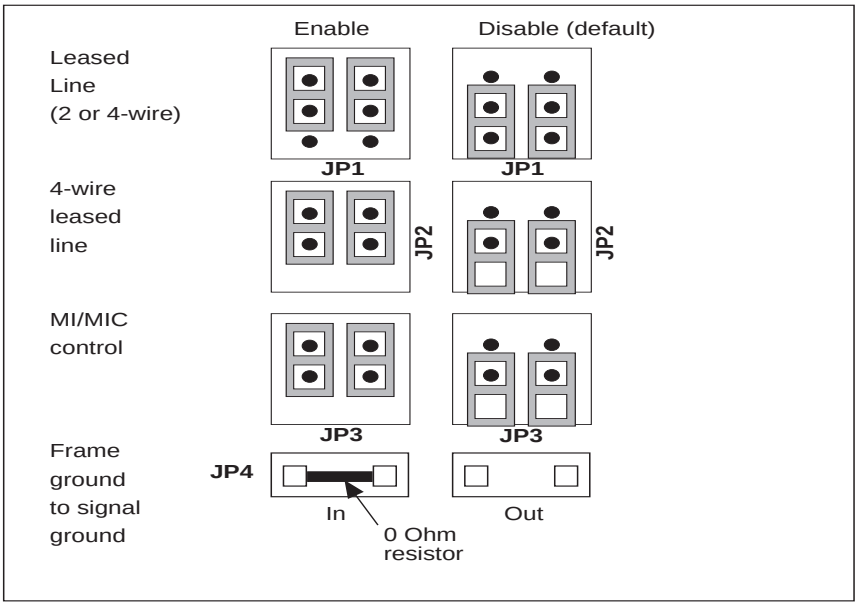

Figure 8-2. Hard Strap Settings

Note: On the modem's printed circuit board (PCB) the jumper blocks are labelled (white lettering JP-1, JP-2, etc.). The Z32b-SX, Z32b-SE, Z32t-SX and Z32t-SE are labelled per Figure 8-2. The Z34-SX and Z34-SE have the JP-2 label at the bottom (not the side as in Figure 8-2) of the JP-2 jumper block.

Once the jumpers has been set (only JP1 for 2-wire and JP1/JP2 for 4-wire), replace the top cover and re-install the screws and rubber feet. Make sure that the speaker cable is still properly attached to the modem assembly

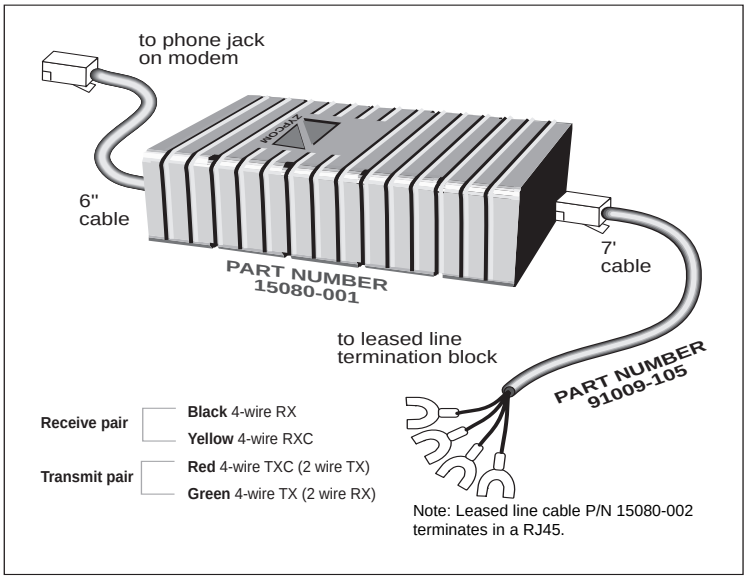

Figure 8-3. SX-Series 4-wire Leased line Cable

At this juncture, you have two options for configuring the modem: hardware setup using the DIP switches or software setup using AT commands.

Hardware Setup Procedures

Before setting the DIP switches, you should first set the EIA options to whatever is required for your application. Normally, leased line communication requires CXR to be

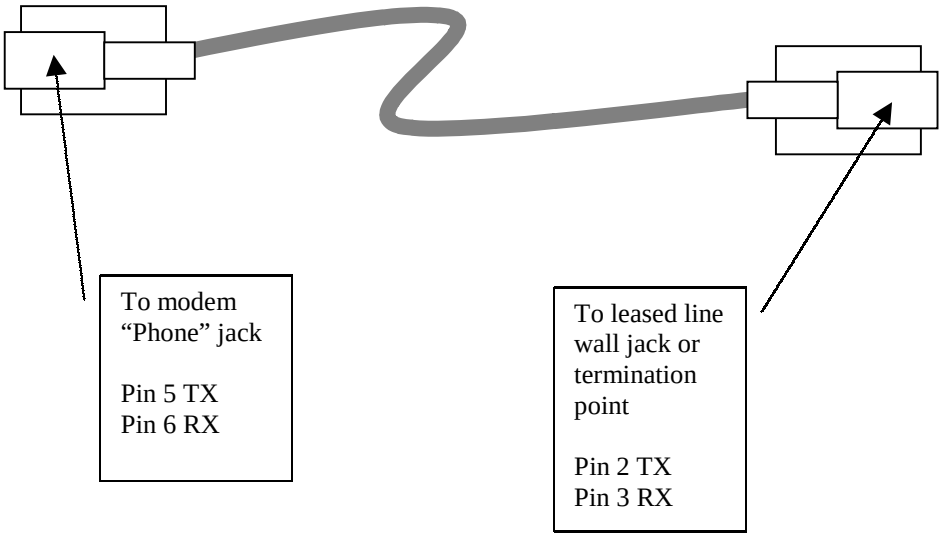

Figure 8-4. SX-Series or SE-Series 2-wire Leased Line Cable

set to a normal condition (&C1). Other applications may require CTS to follow CXR (&R2) and DTR to be set to normal (&D2). Check your DTE to learn what requirements it may have and set those options accordingly. Once you have set all options not controlled by the DIP switches, write those options to stored profile 0 using the *AT&W0<ENTER>* command.

Disconnect power to the modem, remove the DTE serial cable from the back of the modem, and begin setting the DIP switches according to the following step-by-step procedure.

1. Set SW1 to the ON position to enable the rest of the switches.

2. Select synchronous or asynchronous communication and set SW2 to match the data type of your DTE.

3. Set the serial port speed using switches SW3 and SW4. Synchronous port speed is different from asynchronous port speed and depends on the setting of SW3 and SW4 (see Chapter 4).

4. Use SW5 to select which modem will originate and which modem will answer. Set SW5 to the OFF position on the originating modem and SW5 ON on the answering modem.

5. Set switch SW6 to the ON position to enable leased line operation.

6. Set switch SW7 to the OFF for two-wire leased line communication.

Once the switches have been set, reconnect the DTE's serial cable, leased line telco cable and return power to the modem.

When the leased line configured modem is powered up, it will automatically go off-hook in 5 seconds. The handshaking tones that are heard through the modems speaker depends on the modem model. The Z34-SX and Z34-SE have the transmit pair connected to the speaker. The Z32t-SX, Z32t-SE, Z32b-SX and Z32b-SE have the receive pair connected to the speaker. Therefore, when the Z32t-SX, Z32t-SE, Z32b-SX and Z32b-SE answer side modem puts out handshaking tones through the speaker it is actually the remote modems tones that are heard.

After going off-hook and putting out answer tone for about 30-40 seconds, it then goes on-hook waits 4 or 5 seconds and repeats the process. The originate-side modem goes off-hook in originate mode, waiting to detect answer tone. If the leased line is installed properly, the modems will handshake and return a call progress message indicating the speed of the connection and the type of error control, if any, being used for asynchronous communication.

If call progress messages are not needed in your application, then set AT commands for echo (En) off and response messages (Qn) off.

Software Setup Procedures

The modem can be configured for leased line operation using AT commands, however the terminal being used to configure the modem should be set for 38,400 bps or higher.

Note: All DIP switches must be in the off position when configuring the modem for leased line operation using AT commands (software setup).

As is the case with hardware setup procedures, first configure the EIA (CXR, DSR, DTR, RTS/CTS) options and any other options required for your application. In asynchronous applications error control (&Qn) and flow control (&Kn) must be considered. Synchronous applications must consider clock source (&Xn) and line speed (maximum line speed setup is S37=xxN1 or a forced line speed setup is S37=xxN0), automatic dial backup/restoral (S42, S17, S20) and fall-back/fall-forward (S42). Once those have been set and written to a specified memory location with the AT&Wn<ENTER> command, issue an &L1 command to select the leased line operation. Register S0 controls whether the modem is used for originating (S0=0) or answering (S0=1).

Leased Line Setup of the Answer Modem

The following is a step-by-step procedure for setting the answer-side modem.

1. Set the EIA options and any other options required for your application. For example, often CXR and DSR need to be set to normal conditions (&C1, &S1). Synchronous applications need line speed set (forced line rate setup is S37=xxN0 and a max speed setup is S37=nn N1). Issue the &Ln command and register S0 setting and write it to memory. For example, a synchronous two-wire answer modem, type:

   AT&Q3&C1&D0&S1&L1S0=1S37=17N0&W0<ENTER>

   For example, a synchronous four-wire answer modem, type:

   AT&Q3&C1&D0&S1&L2S0=1S37=17N0&W0<ENTER>

2. For asynchronous two-wire leased line communication &Q6S36=0 replaces &Q3 above and add &R2 E0 Q1 to have CTS follow true carrier (CXR), disable echo and call progress messages with this command:

   AT&Q6S36=0&C1&D0&S1&R2&L1S0=1S37=17N0E0Q1&W0<ENTER>

   For example, an asynchronous four-wire answer modem, type:

   AT&Q6S36=0&C1&D0&S1&R2&L2S0=1S37=17N0E0Q1&W0<ENTER>

3. Turn power off and then on. After about five

seconds the commands take effect and the modem goes off-hook and begins sending answer tone. NOTE: For bench testing ONLY add S35=20 after the leased line command (&Ln) to reduce the transmit level.

Leased Line Setup of the Originate Modem

The following is a step-by-step procedure for setting the originate-side modem.

1. Set the EIA options and any other options required for your application. For example, set &Q3 for synchronous communication or &Q6 for asynchronous communication. Often CXR and DSR need to be set to normal conditions. Synchronous applications need line speed set (forced line rate setup is S37=xxN0 and a max speed setup is S37=nn N1)). Issue the &Ln command and register S0 setting. For example, a synchronous two-wire originate modem, type:

   AT&Q3&C1&D0&S1&L1S0=0S37=17N0&W0<ENTER>

For example, a synchronous four-wire originate modem, type:

AT&Q3&C1&D0&S1&L2S0=0S37=17N0&W0<ENTER>

2. For asynchronous two-wire leased line communication &Q6 S36=0 replaces &Q3 above and add &R2 E0 Q1 to have CTS follow true carrier (CXR), disable echo and call progress messages with this command:

   AT&Q6S36=0&C1&D0&S1&R2&L1S0=0S37=17N0E0Q1&W0<ENTER>

For example, an asynchronous four-wire originate modem, type:

AT&Q6S36=0&C1&D0&S1&R2&L2S0=0S37=17N0E0Q1&W0<ENTER>

3. Turn power on and then off. After about five seconds, the commands take effect and the modem goes off-hook in originate mode, waiting to detect answer tone from the answer-side modem.

When the modems have been properly connected to the leased line, they will handshake and go online—as evidenced by the CXR LED going on for synchronous and the CXR and EC LEDs for asynchronous mode.

Leased Line with Dial Backup & Auto-Restoral Setup

The modem can be configured to restore the communication link upon failure of the leased line. This requires that each modem have working PSTN lines installed in the jacks marked “WALL” on the back of each modem. The originating modem (register S0=0) needs to have a telephone number for the remote modem stored in memory location 3 (AT&Z3=). In addition, both modems must have dial backup enabled via register S42. The modem can also restore the communication on the leased line automatically once returned to service (S17=1 S20=180). The following are step-by-step procedures for enabling leased line operation with dial backup and auto restoral. If auto restoral is not required then remove the S17 and S20 commands from the examples below. Auto restoral requires that the originate modem (S7=54) have its S7 register set to six (6) seconds less than that of the answer modem (S7=60 the default value). The examples below for asynchronous applications assumes RTS/CTS flow control is supported in the device connecting to the modem.

Leased Line with Dial Backup and Auto Restoral Answer-Side Modem

The following procedure explains how to setup leased line operation with dial backup/auto restoral for an answer-side modem.

1. Set the EIA and speed options and any other options required for your application. For example, it is recommend that asynchronous applications use forced error controlled mode (S36=0). Often CXR (&C1) and DSR (&S1) need to be set to normal. Also, CTS should follow true carrier (&R2) for most applications but some may require CTS ON (&R1). Also, it is important to force the line speed (forced line rate setup is S37=xxN0 and a max speed setup is S37=nn N1) your application requires and for asynchronous applications set the serial port speed and lock it (%X=9.6 #L1) so the modem ignores data at any speed except the desired modem serial port speed.

Async. Setup: 9.6Kbps serial port and force 9.6Kbps line speed

ATS36=0&C1&S1&R2S7=60N0S37=17%X=9.6#L1&W

Synchronous Setup: Force 14.4Kbps line speed with internal clock

AT &X0 &C1 &S1 S7=60 N0 S37=19 &W

2. Enable dial backup (S42=2), leased line look back (S17=1) for automatic leased line restoral and set the look back timer (S20=1 to 255) on the answer-side modem. To do this, increment register S42 by two. First, interrogate the S42 register:

ATS42?<ENTER>

The modem should respond:

000
OK

Issue the enable dial backup command (increment S42 by 2, see Chapter 6). Enable leased line look back for automatic restoral of the leased line when it is restored to operation with S17=1 and set the interval for checking (S20= 1 to 255 minutes). Normally, 2 to 3 hours (120 to 180 minutes) would be a good interval for checking to see if the leased line has been restored. The leased line look back process takes 20 seconds and will interrupt data flow during look back.

AT S42=2 S17=1 S20=180 &W<ENTER>

3. Issue the data type command, leased line (&Ln) command, register S0 setting, turn off echo and messages and set transmit level (on most leased lines set S35=0 but back-to-back bench testing set S35=20) then write it to memory.

   For an asynchronous two-wire answer modem, type:

   AT &Q6 &L1 S0=1 %Q1 E0 Q1 S35=n &W<ENTER>

   For a synchronous two-wire answer modem, type:

   AT &Q3 &L1 S0=1 E0 Q1 S35=n &W<ENTER>

NOTE: The OK message is not sent after the command in step 3 due to Q1 command.

NOTE: To return the modem to its factory default after &Q3 has been sent to the modem perform a power reset (Chapter 4).

4. Turn power off and then on. After about five seconds the commands take effect and the modem goes off-hook and begins sending answer tone.

5. In synchronous mode the modem' serial port speed will match the line rate and adjust automatically. In asynchronous communication, the modem's serial port speed must be set to match the speed of the device connected to the modem. Therefore, set the terminal that you will use to configure the modem to the same speed as the device that will ultimately be connected to the modem. To verify terminal speed, type AT<ENTER> and then AT&V<ENTER>. Look at the value of %X command in the Active Profile, this is the speed your terminal is set to currently.

Leased Line with Dial Backup and Auto Restoral Originate Side Modem

The following procedure explains how to set leased line operation with dial backup and automatic restoral for the originate-side modem.

1. Set the EIA and speed options and any other options required for your application. For example, for forced error controlled asynchronous communication (S36=0). Often CXR (&C1) and DSR (&S1) need to be set to normal. Also, CTS should follow true carrier (&R2) for most applications but some may require CTS ON (&R1). Also, it is important to force the line speed (forced line rate setup is S37=xxN0 and a max speed setup is S37=nn N1) your application requires and for asynchronous applications set the serial port speed

and lock it (%X=9.6 #L1) so the modem ignores data at any speed except the desired modem serial port speed. Also, the originate modem must have register S7 set to 6 seconds less than the answer modem (S7=54).

Async. Setup: 9.6Kbps serial port and force 9.6Kbps line speed

ATS36=0&C1&S1&R2S7=54N0S37=17%X=9.6#L1&W

Sync. Setup: Force 14.4Kbps line speed with internal clock

AT &X0 &C1 &S1 S7=54 N0 S37=19 &W

2. Enable dial backup (S42=2), leased line look back (S17=1) for automatic leased line restoral and set the look back timer (S20=1 to 255) on the answer-side modem. To do this, increment register S42 by two. First, interrogate the S42 register:

   ATS42?<ENTER>

   The modem should respond:

   000
   OK

   Issue the enable dial backup command (increment S42 by 2, see Chapter 6). Enable leased line look back for automatic restoral of the leased line when it is restored to operation with S17=1 and set the interval for checking (S20= 1 to 255 minutes). Normally, 2 to 3 hours (120 to 180 minutes) would be a good interval for checking to see if the leased line has been restored. The leased line look back process takes 20 seconds and will interrupt data flow during look back.

AT S42=2 S17=1 S20=180 &W<ENTER>

3. Store the dial backup telephone number in memory location 3. For example, type:

   AT&Z3=T9,7832535<ENTER>

4. Issue the data type command, leased line (&Ln) command, register S0 setting (S0=0 for originate side modems) , turn off echo/ messages and set transmit level (on most leased lines set S35=0 but back-to-back bench testing set S35=20) then write it to memory.

   For an asynchronous two-wire answer modem, type:

   AT &Q6 &L1 S0=0 %Q1 E0 Q1 S35=n &W<ENTER>

   For a synchronous two-wire answer modem, type:

   AT &Q3 &L1 S0=0 E0 Q1 S35=n &W<ENTER>

NOTE: The OK message is not sent after the command in step 4 due to Q1 command.

NOTE: To return the modem to its factory default after &Q3 has been sent to the modem perform a power reset (Chapter 4).

5. Cycle power by turning it on and off. After about 3 to 5 seconds, the modem goes off-hook, waits for answer tone and completes the modem handshake (If &D2 had been set, the modem would require DTR to perform this function, DTR is not needed for the DTR default &D0.) The modem' serial port speed

will match the line rate and adjust automatically in synchronous communication. In asynchronous communication, the serial port speed matches the speed of the %X command.

Upon leased line failure, the originating modem goes off-hook and dials the telephone stored in memory location 3. If the answering modem has been properly configured, it answers the call, initiating the handshaking sequence to restore communication.

When a leased line connection is broken or is bad (fails two modem retrains) and modem can not retrain successfully, the CXR LED goes out. After about 90 to 120 seconds, the originate-side modem goes off-hook to connect to the PSTN line and dials memory location 3, attempting to re-establish the communication link. If the originate modem does not connect to the answer modem, the originate modem attempts a call every 90 to 120 seconds, until successful or until the leased line is repaired.

Once the modem is in dial backup operation as indicated by the flashing SYN LED, the modem can automatically look back to the leased line connection to see if it is back in operation. S-registers S17 and S20 control this feature. Register S17 enables (S17=1) or disables (S17=0) the leased line look back feature. S-register S20 controls the intervals of look back in minutes (S20=1 to 255 minutes, with 0 disabling the interval feature). During look back the data flow is interrupted and lost. The look back process takes 20 seconds and if it is determined that the leased line is operational the it will take another 30 to 45 seconds to re-handshake on the leased line.

Caution: *Dial backup (SYN LED flashing) should only be used in environments where personnel can monitor the line. This will ensure that the modem does not go off-hook after a leased line failure on a Friday night, for example, and remain on the backup line throughout the weekend—when no one is actually using the connection.*

If you do not want to use the auto restoral feature then when the telephone company reports that the leased line is restored, you can switch from dial backup communication to leased line communication by pressing the <DATA>. The modem goes on-hook temporarily and then off-hook to reconnect to the leased line.

Transmit and Receive Levels

When the modem is configured with AT commands or the DIP switches for leased line communication, the receive levels are set for a range of 0 dBm to -43 dBm (-6dBm to -43dBm for the Z34-SX and Z34-SE). The transmit level can vary and depends on the setting of register S35. Typically, a transmit level of 0 dBm should be selected (S35=0) for leased line operation unless the modem is the Z34-SX and Z34-SE then use a maximum transmit level of -6dBm (S35=6). The register S35 must come after the &L command in the setup command string.

Modem Speed and Retraining

In the case of leased line operation when the modem encounters a low quality line and the modem will retrain, the SPD LED will indicate the link speed, per table 4-1. Normally, retrains will cause the modem to operate at a lower speed whether DIP switches or AT commands have been used to setup leased line operation. To force a line speed (even after a retrain) option the modem with the appropriate AT (N0 and S37=nn) commands. To set a maximum line speed and let the modem fall-back if it needs to use N1S37=nn (only available on the Z34-SX and Z34-SE) and enable fall-back/fall-forward with S42 for leased line applications.

CHAPTER 9 Special Features

Zypcom modems incorporate advanced features that can be used in specialized applications:

- ❑ V.13 (switched carrier) operation
- ❑ Remote modem control
- ❑ Z34-SX Bell 801 auto call unit (RS366)

Remote modem control is used in both asynchronous and synchronous environments and V.13 and Bell 801ACU features are used exclusively in synchronous environments.

V.13 Operation

CCITT V.13 operation (&Cn command) allows for a full-duplex modem to operate in half-duplex or multi-drop environments. V.34, V.32*terbo* and V.322*bis* modems can be used only in point-to-point applications.

V.32*bis*, V.32*terbo*, and V.34 modems are full duplex; however, these full-duplex modems can operate with network environments that require half-duplex transmission (where local RTS controls remote CXR) or multi-drop transmission (where a host modem's CXR is controlled by remote RTS and the remote modem's CXR is on constantly). In V.13 operation, a special pattern is sent to the remote modem. Upon reception of this pattern, the remote modem raises CXR. When the remote modem receives a V.13 idle pattern, it lowers CXR.

On the transmitting side, when the local modem detects an RTS off-to-on transition, it transmits a V.13 “carrier on” signal and raises CTS. When RTS goes low from the DTE, the modem transmits a “CXR off” idle pattern and lowers CTS.

Multi-drop Environments

The modem can be used as a leased line segment of a multi-drop network or as dial backup of a DDS multi-drop segment. In both cases, have the modem closest to the host computer set for V.13 RXD transmission and the modem closest to the remote drop set for V.13 TXD transmission.

These settings will enable the modem closest to the host to have CXR turned on and off, based on the RTS signal from the remote location. CXR on the modem closest to the remote location will have CXR on all the time. This approximates how a multi-drop modem network would function. In this network, the master at the host location continues to broadcast carrier. This results in CXR being high at all the drops and having carrier low at the host location until one of the drops transmits a response, creating a CXR on at the host modem.

V.13 works only in synchronous communication (&Q3) from 33,600 bps to 2400 bps. It can only be configured by using the AT commands and will work in conjunction with dial-up or leased line operation.

When enabling V.13 operation with the &C command, you also have to enable several additional commands listed under the V.13 Setup section in this chapter.

V.13 Operation Setup

The following is a specific example of how to option the modem for V.13 operation on a dial-up communications link. If you are using a leased line, you would have to set additional parameters (&L and S0). Also, the example below does not give consideration to operation of DSR and DTR. You must understand the requirements of your application regarding these signals and configure the modem before issuing this command:

AT&Q3&R0S26=3&C3&X2S37=17N0&W<ENTER>

The command string can be issued to both the answer- and the originate-side modems.

- &Q3 selects synchronous communication
- &R0 sets CTS to follow RTS by the value specified in register S26
- &C3 sets RXD/TXD V.13 operation
- &X2 sets slave clock and is required for one modem; &X0 sets internal clock and is required for the other end modem
- S37=17 sets the line rate to 9600bps and N0 forces it to stay there even after a retrain.
- &W writes the configuration to a user-stored profile. (If you don't define a location, the modem assumes 0.)

Upon loss of power, the modem will recall user-stored profile 0 into the active configuration (providing AT&Y0 is selected).

Should you need to re-option the modem, issue a power reset and reoption the modem. (Depress the <DATA> and <TEST> keys on the modem front panel while reinstalling the modem into the chassis.)

When issuing the command string above to configure V.13 operation, calls should be initiated by using the front-panel <DATA> key. Pressing <DATA> for three or more seconds causes the modem to dial the telephone number stored in memory location 0. Subsequently pressing <DATA> for a moment or so while the modem is online causes the modem to drop the connection and go back on-hook.

Calls can also be initiated manually by dialing the telephone number from an attached telephone and pressing the <DATA> key for a moment after ringing is detected. Remember to immediately return the handset to the phone cradle.

If the modems are retraining when RTS is raised, the modem raises CTS, but the V.13 on pattern is not sent. The modem that has V.13 enabled turns off CXR when it detects the V.13 idle pattern, loses carrier from the remote modem, is retraining, or is reset.

Remote Modem Access

Remote modem access lets the local DTE and modem view and change the configuration, as well as set security on the remote modem. This feature is extremely useful for troubleshooting modem problems and is always protected by password security (\P0).

The modem provides remote modem access at any speed—from 1200 bps to 230,400 bps—with or without error control on the communications link. When you troubleshoot modem modems set up for synchronous communication, you may take an asynchronous terminal and asynchronously option the modem, and you may call into the synchronously optioned modem to interrogate its configuration.

Commands

Several commands are used exclusively to enable and disable remote modem access. You must enable the secondary channel, then enable remote modem access to control the remote modem memory. You have to enable the ^S1 and ^R1 commands only once for each modem connection.

^S (Secondary Channel Control)

Starts the remote modem access session. The ^S1 command must be issued when the modem is in online command mode, which can be entered from data mode by using the +++ escape sequence.

COMMAND	DESCRIPTION
^Sn	Secondary channel control
^S0*	Disables secondary channel operation*
^S1	Enables secondary channel operation

^R (Remote Modem Access Control)

Selects the modem to be accessed during the secondary channel operation.

COMMAND	DESCRIPTION
^Rn	Remote access control
^R0*	Sets local modem access*
^R1	Sets remote modem access

\P (Modem Security Password Control)

Controls the password for modem security. When enabled (\P1), the command prevents the modem from being used by the local DTE without a password. The modem will answer incoming calls when this option is

enabled (\P1). When this option is enabled, you must issue the proper password before using the AT commands to dial, option, or view memory locations. The option (\P1 or \P2) can be enabled remotely, but can only be disabled (\P0) locally.

COMMAND	DESCRIPTION
\P*n*	Modem security password control
\P0*	Disables local security password. Remote modem access security remains enabled*
\P1	Enables local security password. Remote modem access security is enabled
\P2	\P2? displays the password and \P2=*xxxxxxx* is used to set the password, where *xxxxxxx* can be up to 7 alpha-numeric, case-independent characters

\^E (Read Remote EIA Signals)

Reports the status of the remote EIA signals for RXD, TXD, RTS, CTS, DSR, DTR and CXR, where signal = 1 indicates on status and signal = 0 indicates off status.

COMMAND	DESCRIPTION
^E0	Reports remote EIA signals to the local DTE

To read remote EIA signals, you must first enable secondary channel operation (if it is not already enabled) by using the ^S1 and ^*R1* commands in online command mode.

%L (Read Analog DSP Performance Measurements)

Measures multiple analog parameters: the receive level in decibels (dBm) and the data pump line status, i.e., signal quality, near- and far-end echo, and round trip delay. This command must be issued while the modem is in online command mode.

COMMAND	DESCRIPTION
%Ln	Reports analog DSP performance measurements
%L0	Measures signal level of the received carrier in dBm
%L1	Reports data pump's line status and receive level

%L1 reports receive level, signal quality, near-end echo, far-end echo, round trip delay, and modulation statistics for the local modem. To report statistics for the remote modem, you must first enable secondary channel operation (^S1 command), set remote modem access (^R1), then enter %L1 to download the remote DSP's statistics. Enter ^R0 to disable the secondary channel.

Enabling Remote Modem Access

The modem comes from the factory with remote modem access disabled. To enable the option:

1. Connect to the remote modem.

2. After the CONNECT message appears on your screen, send the +++ escape sequence. Wait for the OK message.

3. Enable the modem's secondary channel:

AT^S1<ENTER>

Wait for the OK message.

4. Enable remote modem access:

   AT^R1<ENTER>

   In about 10 to 20 seconds, the remote modem returns this message:

   REMOTE PASSWORD?

5. Type your password. The default is:

   ZYPCOM<ENTER>

   If you make a mistake in typing the password, the modem issues this message:

   PASSWORD REJECTED
   ERROR MESSAGE

   If the password is accepted, the modem issues an OK message.

You are now interacting with the remote modem's memory. You may interrogate the remote modem's DSP status (%L1) or EIA signals (^E0), change the remote modem access password (\P2=), or display the remote modem's configuration and contents of its stored memory locations (&Vn).

***NOTE**: AT&V0 or AT&V1 displays only the active configuration and the contents of the four memory locations of the remote modem.*

Note that modem action commands, for example, ATA and ATD, cannot function in remote modem access.

The only two action commands that function in remote modem access are the &Fn and &W*n* commands. You can use the &Z*n* to store telephone numbers in the remote modem, as well as to change any option or S-register and save it to any memory location.

Disabling Remote Modem Access

To disable remote modem control:

1. After you have completed interrogating the remote modem, setting options, and storing telephone numbers and autologon sequences, type:

   AT^R0<ENTER>

   Wait for the OK message.

2. Type *ATH<ENTER>* to hang up or *ATO<ENTER>* to go back online.

Remote Access Examples

The following are several examples of how to use the remote modem control capability of the modem to support your network.

Remote User is Having Problems Trying to Dial a Remote Location

If a user you support is having a modem dialing problem, you can call his modem to determine what the problem might be. (It does not matter if the remote modem is configured for asynchronous or synchronous operation.)

1. From the terminal attached to your local modem, establish a connection with the modem experiencing problems.

2. Go online and issue the +++ escape sequence.

3. Type:

   AT^S1<ENTER>

   Wait for the OK message.

4. Type:

   AT^R1<ENTER>

   The remote modem responds with:

   REMOTE PASSWORD?

5. Type the password of the remote modem, followed by <ENTER>. For example:

   ZYPCOM<ENTER>

Wait for the OK message. At this point you are communicating with the remote modem.

6. Type:

   AT^E0<ENTER>

   The remote modem responds with the status of its EIA signals.

7. Type:

   AT&V<ENTER>

   The remote modem displays the active configuration. In reviewing the option settings, you may see that &C1 (carrier normal) is set. However, the remote modem is connected to a terminal that requires CXR to be high before the terminal can be interactive with the modem.

8. Type:

   AT&C0&W<ENTER>

   Wait for the OK message.

9. Type:

   AT^R0<ENTER>

   Wait for the OK, then hang up:

   ATH<ENTER>

   At this point, have the remote operator type AT from the keyboard. AT should be echoed back to the screen.

Interrogating the Remote Modem's Serial Number

Security is often an important element when planning to install modems in a computer network. Unauthorized access is something that can be avoided with some intelligent planning and the modem. The modem remote modem control capability can be used to ensure that only authorized users gain access to your network.

For example, a host computer can have a small application running in front of an end-user application that would interrogate the remote modem to ensure that it is in fact an authorized modem. All modems are programmed at the factory with a unique serial number in ROM that cannot be altered.

When a remote operator originates a call to your answer side, this particular security application would start up after the CONNECT message is sent by the answer-side modem. If call progress messages are disabled, the application starts up when the CXR lead goes high. The application would then send a +++ escape sequence.

Wait for the OK message and send this command to turn on the secondary channel:

AT^S1<ENTER>

Wait for the OK message and type:

AT^R1<ENTER>

Wait for the REMOTE PASSWORD? message. Send the correct password, wait for the OK message, then type:

ATI6<ENTER>

The modem will respond with:

REMOTE SERIAL NUMBER: XXXXX

When the computer receives the serial number of the remote modem, it can check that serial number against the database of known modem serial numbers. If it accepts the serial number, it passes the connection on to the end-user application. If the serial number does not pass, it types:

AT^R0<ENTER>

then drops DTR to disconnect the link.

If the serial number does pass, the application sends:

AT^R0<ENTER>

Wait for the OK message and send:

ATO<ENTER>

Wait for the CONNECT message before passing off to the end-user application.

Many creative applications can be designed by using the remote modem control feature of your modem, thereby simplifying user support, increasing security, and automating your data communications.

Bell 801 ACU Dialer *(Z34-SX only)*

The Z34-SX is compatible with RS366 dialing ports found on mainframes and front-end processors (3705, 3725, 3745, etc.). The Z34-SX requires the optional "Y" cable (P/P 91009-094). One end of the "Y" cable is for the data port and the other one is for the dialer port. The Z34-SX must be configured for the Bell 801 ACU operation using a plain terminal or Windows PC.

Enable 801 ACU

To enable the Bell 801 ACU dialer s-register 99 must be increased by 8. S-register S99 is a bit-mapped register that changes value depending on various settings. For your configuration, determine the current value of register S99, add 8 to the result, and store the new value. For example, interrogate register S99:

ATS99?<ENTER>

If the value returned is 0, type:

ATS99=8&W<ENTER>

to enable the internal Bell 801 compatible autodialer (RS366). After enabling the 801 autodialer, connect the "Y" cable (connects the modem port to the mainframes RS232 and RS366 ports). This cable can be purchased (P/N 91009-094) from you reseller or from the Zypcom parts department. Moreover, you may find the following command string useful in optioning your modem for Bell 801 dialing.

To enable a Bell 801 dialer for a IBM 3745, type:

AT&C1&D2&S1&Q3S0=1S99=8&R2&W<ENTER>

To enable a Bell 801 dialer for a 9600bps Wang, type:

AT&C1&D2&S1&Q3S0=1S99=8N0S37=17&R2&W<ENTER>

Disable 801 ACU

To disable the 801 autodialer perform a power reset as outlined in Chapter 4 of this manual. The power reset will return the modem back to the default state.

CHAPTER 10 Troubleshooting and Testing

General

Although the modem default option settings are suitable for most terminals, a default option setting can cause problems if it is incorrect for your application. You can resolve many problems by first checking the following settings on your DTE, making sure that the modem is set to match the DTE:

- ❑ Parity (odd, even, or none)
- ❑ Character length (10 bits)
- ❑ Terminal speed
- ❑ COM port selection
- ❑ Synchronous or asynchronous transmission protocol
- ❑ Local echo on terminal (should be off)

If you encounter communication problems, run through the troubleshooting procedures and built-in data and self-tests to attempt to isolate the source of your trouble. In addition, refer to the quick checkout procedure in Chapter 2 for first-time modem installations.

Communication Problems

Type *AT<ENTER>*. The AT should be echoed back to the DTE, followed by OK from the modem. If these characters don't appear on your screen, follow the procedures described below to determine the problem.

Cable Connections

1. Check that the modem and computer or terminal are plugged in and turned on. When the modem has power, the DTR LED should be on (DTR is provided by most DTEs).

2. Check the modem cable. Make sure it is specifically wired for your DTE. Normally any modem cable would require pins 1 through 8, 15, 17, 20, and 22, and would be a straight-through cable (where pin 1 goes to pin 1 on each end).

3. Check the connectors at both ends of the cable. Make sure they are firmly attached and the screws are tightened.

4. Verify that the modem is connected to the serial port on your terminal or computer with your communications software. Normally terminals and PCs for a selected port will have DTR on. This will also show on the modem. For example, if you set your modem software for COM1 and the modem DTR LED is not on, your modem is probably attached to COM2.

Terminal or Computer Settings

These are the most common problems involving terminal or computer settings.

1. Check that your computer or terminal operates at a speed the modem can handle: 230,400 (Z34-SX/Z34-SE only), 115,200, 57,600, 38,400, 19,200, 9,600, 4,800, 2,400, 1,200 and 300 bps.

2. Make sure that your terminal or communications software is set for 10 bits per character. The total of the data bits, parity bit, and the start and stop bits

must equal 10. The modem automatically determines speed and parity for 10-bit characters. The most common settings are:

- ❑ 8N1 (8 data bits, no parity, 1 start bit, and 1 stop bit)
- ❑ 7E1 (7 data bits, even parity, 1 start bit, and 1 stop bit)
- ❑ 7O1 (7 data bits, odd parity, 1 start bit, and 1 stop bit)

3. Type *AT<ENTER>*. The SPD LED should reflect the speed of the attached DTE (as described in Chapter 4).

Win95 HyperTerminal Settings

If you are using HyperTerminal to configure your modem, follow the directions below.

1. Start | Program | Accessories | Hyperterminal | Hypertrm.exe
2. Provide session name (for example, Direct COM2), then OK
3. Change "Connect using" to the COM port your using (1,2,3,4), then OK
4. Select your speed (115,200), etc., then click OK
5. Now wake up the modem AT<enter>, it should respond OK
6. If it doesn't type AT&F<enter>, if that doesn't wake the modem up verify that the DTR LED is on. If it isn't then switch COM port setting in HyperTerminal
7. Option the modem, if your unsure on the setup string see Chapter 2, quick setup.

Windows COMit Software Settings

If the computer screen does not display AT when you type it, check your communications software. If using Windows COMit software:

1. Start the program and then select SETTINGS.
2. Select MODEM
3. Select your particular Zypcom modem.
4. Select OK.
5. Select PORT.
6. Set the speed to 19,200 or 38,400 or 57,600 (maximum speed for COMit).
7. Select the communications port to match the one to which the modem is connected.
8. Select lock baud rate, carrier detect, and hardware flow control.
9. Select OK.
10. Type *AT<ENTER>* and the modem should return an OK message.

Note: If 38,400 bps or 57,600 bps is not shown in the port setup window, you can use your Windows SYS.INI file to set the port's maximum speed.

If you are using a different communications software package, verify that the modem's software settings match those of the communications software or terminal.

1. In the modem's default setting, CXR is forced on. Some software packages need CXR to follow true carrier. In AT autodialing, you can control this option using the AT&C*n* command.

2. Check the setting for DSR. The default setting is forced on, but it can be changed using the AT&S*n* command in AT autodialing.

3. Check the CTS setting. The default setting is forced on, but it can be changed using the &R*n* command in AT autodialing.

Other Common Problems

DTE Doesn't Display What You Type

When your modem and computer or terminal are properly connected, the screen should display what you type. If it doesn't, enable local echo:

ATE1<ENTER>

using another terminal to option the modem. If ATE1 was already set, then check to see if the CXR and DSR LEDs are on. If not, set them on:

AT&C0&S0&Wn<ENTER>

Also check to make sure the modem cable you have contains, RTS (pin 4).

DTE Displays Double Characters

If the DTE screen doubles every character you type, then the terminal and modem are both echoing characters. Try to disable your terminal's local echo option. If that's not possible, then disable local echo using the *ATE0<ENTER>* command.

Communications Program Thinks the Modem is On-line

If you receive an ONLINE message somewhere on your DTE screen but the modem is not online, set CXR to normal conditions using the *AT&C1&Wn<ENTER>* command (and then store this command into the communications software's initialization string).

DTE Screen Displays Unusual Characters

If your DTE screen displays unusual characters, check the speed setting of your communications software or terminal and the character length and parity, match to the system you are calling.

Another common problem involves error control. If your modem is set for error control and the remote modem is not set for error control, you can see a lot of unusual characters on your screen. Disable error control using the *AT&Q0<ENTER>* command and then redial the telephone number.

If your communications software program does not have the Zypcom modem listed in its modem setup menu, and it is possible to define a custom modem, then type the following initialization string:

AT&F0&C1&D2&S1K3&Q6S7=90S0=0<ENTER>

If you will be communicating with a non-error controlled modem, replace &Q6 with &Q0 in the initialization string.

Delays During V.42/ MNP Error-Controlled Communication

A small amount of character delay is normal for error-controlled communication links. Large file transfers normally call for a communications software file transfer protocol to be used. Zypcom recommends that a protocol with large data packets be used like Ymodem-G or Zmodem for the best data throughput rates.

Modem Does Not Answer Incoming Calls

If the modem does not answer incoming calls:

1. Verify that your terminal or computer supplies DTR (the modem's DTR LED should be on). If not, force DTR on. Type:

   AT&D0&Wn<ENTER>

2. Verify that the AA LED (automatic answer) is on. If not, while the modem is in command mode, type:

   ATS0=1&Wn<ENTER>

Note that &W*n* in the command string writes the command settings to memory. If you don't specify memory location *n* (where *n* can be 0, 1, 2 or 3), the modem assumes 0.

If the modem does not automatically answer when connected to a minicomputer or mainframe and the DTR and AA LEDs are on, turn off the echo and response message options:

ATE0Q1&Wn<ENTER>

Modem Does Not Dial

If your DTE displays the NO DIALTONE message, the modem is not receiving dial tone.

1. Connect a telephone to the back of the modem, plugging the modular jack into the connector labeled "PHONE."

2. Lift the telephone handset. If dial tone is not present, you probably have a faulty line. Call the telephone company.

3. If you hear dial tone but the modem does not dial, change the X command setting from X4 to X1 as you probably have a nonstandard dial tone.

Modem Dials But Cannot Connect

If the modem dials a telephone number but does not establish a communication link, something may be wrong with the remote modem. Try calling another system.

If unusual characters appear on your screen, check the settings for character length and parity. Consult your system manager for proper settings. If you still have problems, turn off error control and force a low line speed (9600). From command mode, type:

AT&Q0N1S37=9<ENTER>

Retry the call. If this works then raise the line speed in increments until you know the speed you telephone line and remote modem can accommodate.

Modem Dials, Connects but No Data

If the modem connects in dial-up mode but you can not get data from either modem or perhaps only one modem it is probably because the modem has RTS/CTS flow control (&K3) set but the modem cable you are using does not have it installed. Get another modem cable or use Xon/Xoff flow control.

Modem Dials, Connects but Streams Garbage Characters

If the modem dials, connects to the remote modem then streams lots of garbage charters on to your screen then possibly hangs up, enable forced error control (S36=0). When the modem has error control and data compression ON, the EC LED will be on.

Built-In Data and Self-Tests

The modem has several built in tests to help you isolate modem and line problems.

- A power-on self-test checks the modem
- Analog loopback (ALB) data and self-tests check the link between your DTE and the modem
- A digital loopback test, remote digital loopback test, and remote digital loopback self-test check the telephone line and the remote modem (on non-error controlled links).

Optional Test Timer

The test timer ends each test after a preset time, controlled by register S18. Before you start a local test, type:

ATS18=x<ENTER>

where *x* is a number from 1 to 255. For example, ATS18=30 sets the test timer for 30 seconds.

Normally, the preset test time is indefinite (S18=000) and the timer is inactive.

1. To end tests that you have initiated with the <TEST> key, press the <TEST> key a second time.

2. For tests initiated using AT commands, issue the +++ escape sequence. Wait for the OK message and then issue *AT&TO<ENTER>*.

Power-on Self-Test

To execute an automatic self-test, turn the modem's power off and then on. One or several LEDs might flash. If the flashing persists after power up, call Zypcom Customer Service.

Analog Loopback Self-Test

An analog loopback self-test (ALB) checks the modem's transmitter and receiver and counts the number of errors (figure 10-1), as follows:

- The modem's built-in test pattern generator sends a signal to the transmitter
- The transmitter modulates the signal, converting it to an analog and sends it to the receiver

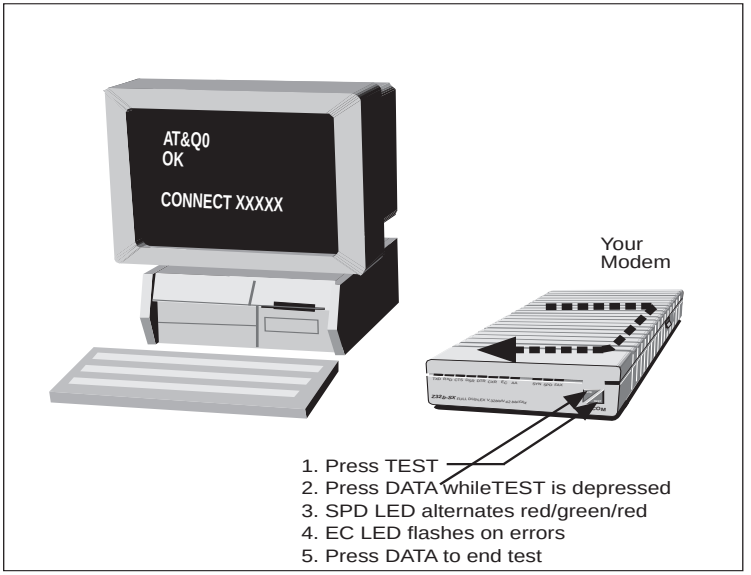

Figure 10-1. Analog Loopback Self-Test

- ❑ The receiver demodulates the signal, converting it back into a digital test pattern
- ❑ The logic circuit compares the original test pattern to the demodulated signal
- ❑ If an error exists, the screen displays the number of errors when the test completes

Note that the modem does not answer calls during this test and the modem should be set to &Q0 mode. To execute an analog loopback self-test, from command mode, type:

ATS18=60&T8<ENTER>

CONNECT 115200

The modem tests itself until the preset timer expires, as indicated by the alternating of the SPD LED (red/green/red). If register S18 is set to 0, the test runs indefinitely—until *AT&T0<ENTER>* which ends the test.

After the test completes, the DTE screen displays a 3-digit count of errors and the OK message. For example, you might see:

000
OK

If errors persist, call Zypcom Customer Service at the number listed in the front of this manual.

Analog Loopback Data Test

This test checks the modem's transmitter, receiver, and interface to the terminal or computer (figure 10-2). During an analog loopback data test:

- ❑ Characters you type at the terminal keyboard are sent to the modem transmitter
- ❑ The transmitter modulates the digital signal, converting it into an analog signal
- ❑ The analog signal loops back to the receiver
- ❑ The receiver demodulates the analog signal, converting it back into a digital signal

Mismatches between the characters sent and the ones received indicate a problem with the link between the modem and DTE or with the modem itself. Check the serial cable. If it is connected properly, make sure that you have set your DTE to the proper settings. To execute an analog loopback data test:

1. Turn on power to the modem and your DTE.

2. Load the communications software, if necessary, and go to terminal emulation mode using a personal computer.

3. Invoke the test:

   AT&T1<ENTER>

   CONNECT 115200

   Wait for the alternating red/green/red SPD LED to indicate that the modem is in test mode.

4. Type characters from the keyboard. Compare the characters sent to the ones received. Mismatches indicate errors.

5. Issue the +++ escape sequence wait for OK. To end the test, followed by

   AT&T0<ENTER>.

If errors persist, call Zypcom Customer Service at the number listed in the front of this manual.

After checking the link between your DTE and modem using the ALB tests, have the remote operator perform the same tests on the remote modem. If the remote system is functional, check the telephone line with one of the three online tests.

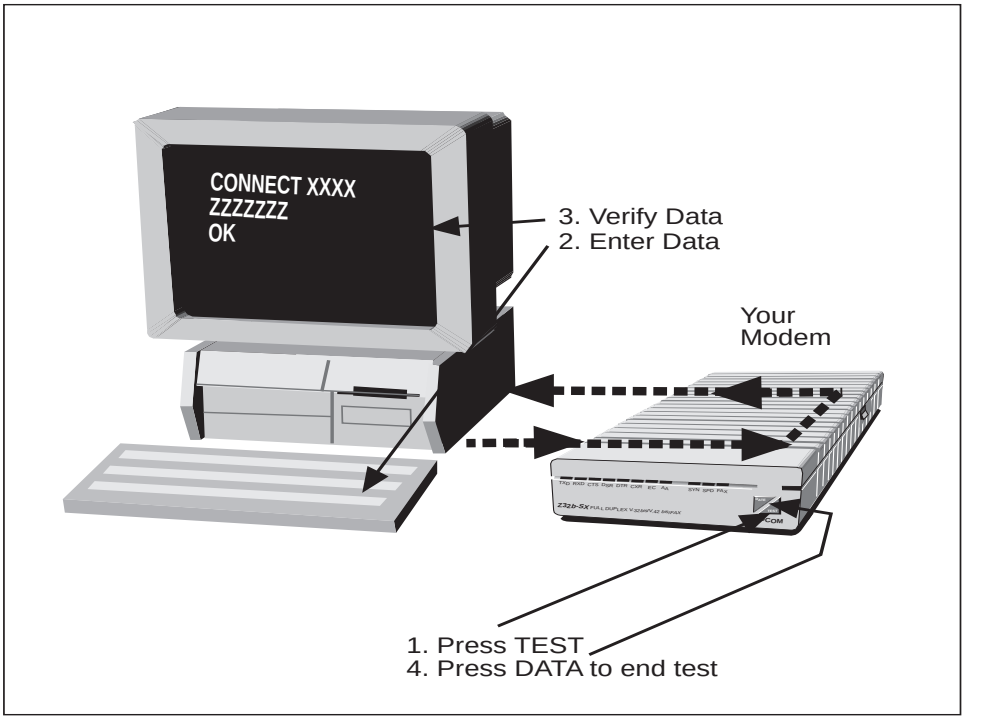

Figure 10-2. Analog Loopback Data Test

Online Tests

Online tests are performed on communications links with no error control. However, speed conversion is allowed. When the modem enters test mode, its SPD LED will alternate red/green/red. An occasional error in an online test—an incorrect character or burst of characters on the screen—does not necessarily indicate a serious problem. Hang up and redial to get a different connection. If errors persist, call Zypcom Customer Service.

Local Digital Loopback Data Test

In a local digital loopback data test, the remote operator enters and monitors data to test the telephone line, both modems, and the link to the remote DTE (figure 10-3).

1. Establish a non-error controlled (&Q0) data link with the remote modem.

2. From your modem, type the +++ escape sequence and wait for the OK message.

3. Set the test timer value on your modem, and

4. Invoke the test:

   ATS18=60&T3<ENTER>

5. Have the remote operator type characters at the keyboard for 60 seconds.

6. Have the remote operator compare the characters returned to the ones typed. If both modems worked properly in the previously performed analog loopback tests, then a mismatch here normally indicates a problem with the telephone line.

7. On your DTE Type

   AT&T0<ENTER>

OK

   ATH<ENTER>

OK

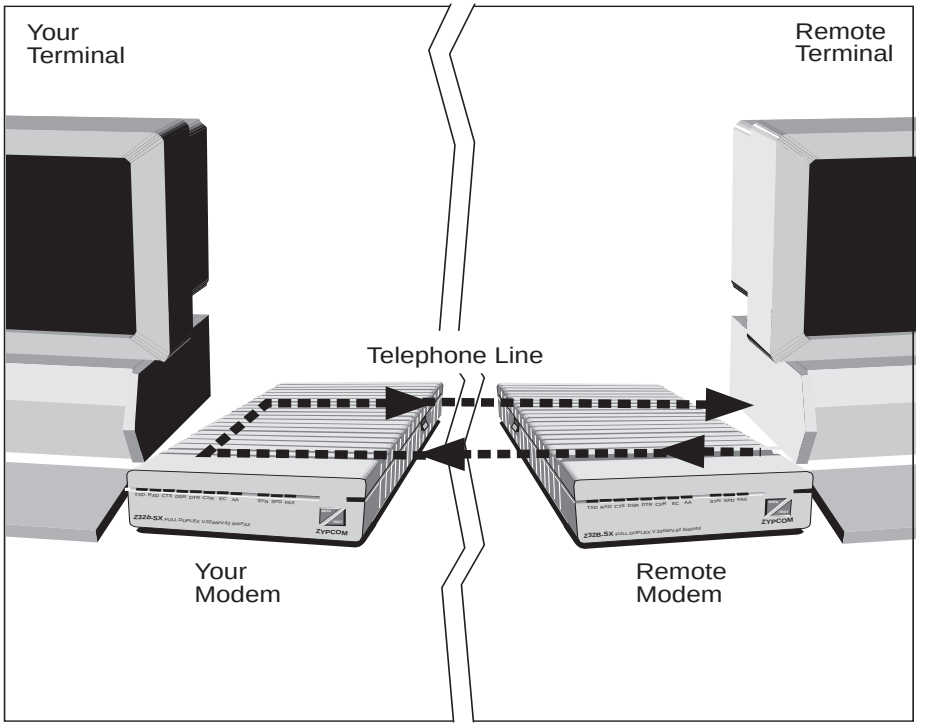

Figure 10-3. Local Digital Loopback Data Test

Remote Digital Loopback Data Test

In a remote digital loopback data test, data entered from the local DTE is used to test the telephone line, both modems, and the link to the local DTE (figure 10-4).

1. Have the remote operator type *AT&T4<ENTER>*.

2. Establish a non-error controlled (&Q0) data link with the remote modem.

3. From the local modem, type the +++ escape sequence and wait for the OK message.

4. Invoke the test:

   AT&T6<ENTER>

5. Type characters at the keyboard.

6. Compare the characters returned to the ones typed. If both modems worked properly in the previously performed analog loopback tests and the local digital loopback data test, then a mismatch here normally indicates a problem with the telephone line.

7. Issue the +++ escape sequence. Wait for the OK message and then type *AT&T0<ENTER>* wait for OK and hang up using the *ATH<ENTER>* command.

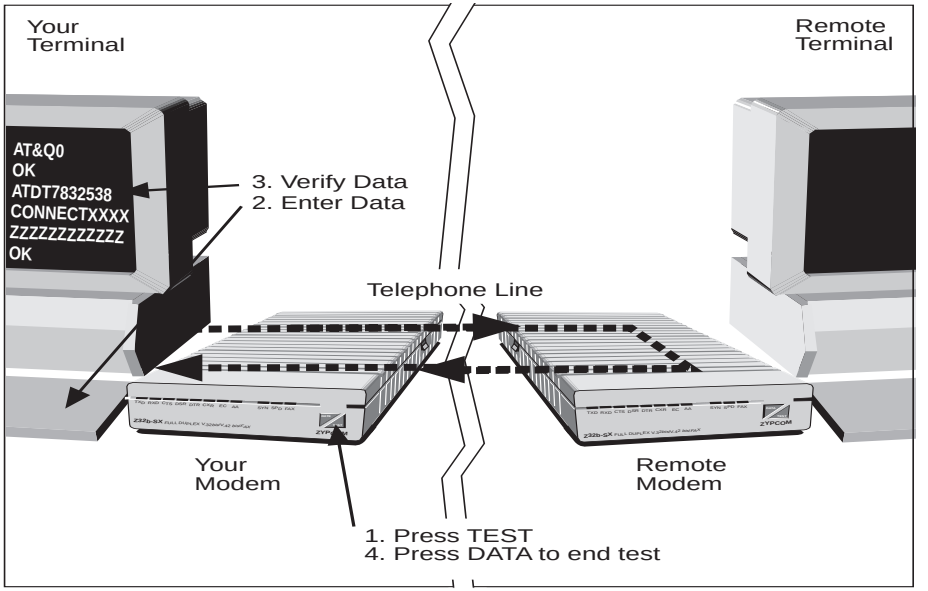

Figure 10-4. Remote Digital Loopback Data Test

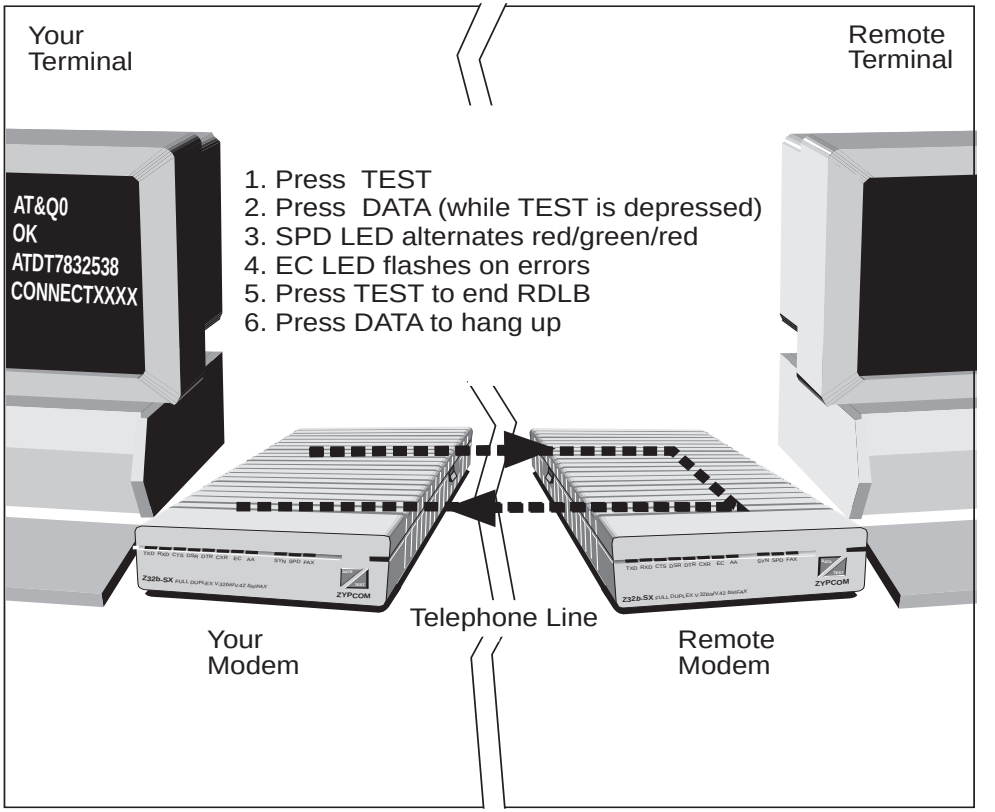

Figure 10-5. Remote Digital Loopback Self-Test

Remote Digital Loopback Self-Test

In a remote digital loopback self-test, the modem tests the data link with a self-generated signal (figure 10-5).

1. Have the remote operator type *AT&T4<ENTER>*.

2. Establish a non-error controlled (&Q0) data link with the remote modem.

3. From the local modem, type the +++ escape sequence and wait for the OK message.

4. Set the test timer value on the local modem and invoke the test:

   ATS18=60&T7<ENTER>

5. After the test timer expires, the DTE screen displays a 3-digit count of errors and the OK message. For example:
   000
   OK

6. If the error count is low the modems are working properly. If the error count is high, the test indicates a potential problem with the telephone line (assuming that the ALB tests were successful).

7. Type *AT&T0<ENTER>* wait for OK, type *ATH<ENTER>*.

APPENDIX A Specifications

FEATURE	DESCRIPTION
Compatibility	CCITT V.32*bis* at 14K, 12K, and 9600, 7200 and 4800 bps AT&T V.32*terbo* at 19.2K and 16.8K CCITT V.34 at 33.6K, 31.2K, 28.8K, 26.4K, 24K, 21.6K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, 9600, 7200, 4800 bps CCITT V.32 at 9600 and 4800 bps CCITT V.23 at 1200/75 bps CCITT V.22*bis* at 2400 bps CCITT V.22/Bell 212A at 1200 bps CCITT V.21/Bell 103 at 300 bps ***NOTE:*** V.34 only in Z34-SX/Z34-SE and V.32terbo only in Z34-SX/Z34-SE and Z32t-SX/Z32t-SE
DTE Rates (asynchronous)	230.4K (Z34-SX/Z34-SE only), 115K, 57.6K, 38.4K, 19.2K, and 9600, 4800, 2400, 1200 and 300 bps; fixed speed or autobaud
Line Rates (synchronous DTE rates)	33.6K, 31.2K, 28.8K, 26.4K, 24K, 21.6K, 19.2K, 16.8K, 14.4K, 12K, and 9600, 7200, 4800, 2400, and 1200 bps, asynchronous or synchronous 300 and 1200/75 bps, asynchronous only ***NOTE***: Z32t-SX/Z32t-SE and Z32b-SX/Z32b-SE excludes 33.6K, 31.2K, 28.8K, 26.4K, 24.0K, 21.6K bps speeds. The Z32b-SX/Z32b-SE also excludes 19.2K and 16.8K bps speeds.

Data Format	Asynchronous: 8, 9, 10 or 11 bits serial, binary Synchronous: serial, binary
Operation	Full-duplex over 2-wire dial-up lines or 2-wire/4-wire leased lines ***NOTE:*** V.13 option for switched carrier applications; Automatic dial backup on leased line failure and automatic restoral to leased line. ***NOTE:*** 4-wire leased line only in Z34-SX, Z32t-SX and Z32b-SX
Modes	QAM at 33,600 to 4800 bps; echo canceling, full-duplex (Trellis coded or noncoded at 9600 bps) QAM at 2400 bps; bandsplit, full-duplex DPSK at 1200 bps; bandsplit, full-duplex FSK at 300 bps; bandsplit, full-duplex FSK at 1200/75 bps; bandsplit, half-duplex with reverse channel
Interface	Serial: RS-232D, CCITT V.24/V.28 Telco: RJ11C Telset: RJ11C
Line Requirements	Unconditioned 2-wire or 4-wire leased line or dial-up
Transmit Timing	Internal, external, or slaved
Transmit Level	Leased line: selectable from 0 to -20 dBm Dial line: -10 dBm fixed
Carrier Detect Threshold	Leased line: -3 to -43 dBm Dial line: -10 to -43 dBm
Test Capabilities	Power on self-test, ALB, DLB, RDLB, V.54
AC Power	90-130 VAC @ max. .5A or 180-250VAC at max. .25A, 47-63Hz
Autodialer Protocols	Hayes AT, Dial on DTR, RS366 (Bell 801 ACU) and V.25*bis* ***NOTE:*** RS366 dialer only in Z34-SX

Autodialer Type & Data	Type: tone, pulse, and automatic Data: asynchronous = AT and V.25*bis* 10 bit; synchronous = V.25*bis* HDLC or BSC
Answer Modes	Automatic and manual answer
Environmental	Operating temp: 32 to 122 degrees F Storage temp: –4 to 158 degrees F Humidity: 5% to 95% NC
Dimensions	Height: 1.5", Width: 4.5", Length: 7.5"
Weight	1.5 lbs
Configuration	External modem
Error Control/Data Compression	V.42, V.42*bis*, MNP Classes 2-5
Facsimile Compatibility	CCITT Group 3 fax machines and fax modems CCITT V.17, V.29, V.27*ter*, V.21 Channel 2, T.30, T.4 EIA-578 Class 1 and EIA-592 Class 2 compatibility for fax software
Facsimile Operating Speeds	Send/receive: 14,400 bps to 2400 bps

APPENDIX B Software Compatibility

Modem Software

The modem is compatible with all data communications software packages and devices that use the AT command set to dial and option the modem. Specifically, Windows 95, Windows NT, Remote Access Services (RAS) servers, 3Com Access Builder 2000/4000/5000, Livingston Portmaster, Cisco 2500, and personal computer applications like WinFax Pro, ProComm, etc.

If your software or hardware does not have a Zypcom SE-Series modem driver then use a Zypcom SX-Series or RX-Series driver.

If your software does not support any Zypcom modem, call your software/hardware customer support to see if a new modem entry has been developed for your Zypcom modem. If not, and you can store a custom modem initialization string in your software or hardware device, try the following:

AT&F&C1&D2&S1&K3&Q6S7=90S0=0<ENTER>

If you can't find an existing Zypcom modem initialization string and your software does not have the capability to define a custom modem, try some of the other modem selections. Attempt to choose profiles that can operate at 33,600 bps (V.34) or 19,200 bps (V.32*terbo*), have V.42*bis* error control and data compression, and

include the parameter settings incorporated in the command string above.

If you receive an ERROR message after selecting a modem entry and initialization string, try other modem entries until a successful initialization occurs. Then try dialing the telephone number of a remote modem. If this is unsuccessful call Zypcom technical Support.

Facsimile Software

The modem is compatible with EIA specification 578 Class 1 fax modem devices and specification 592, which defines Class 2 devices. To operate the modem's facsimile functions, your software must be compatible with these specifications. Zypcom is compatible with Delrina WinFax, Microsoft's fax manager, etc. Fax commands supported by the Zypcom are listed in Appendix C.

APPENDIX C Facsimile Commands

SERVICE CLASS IDENTIFICATION	
+FCLASS=*n*	Identity *n* = service class (where *n* = 0, 1, or 2 and 0 = data modem, 1 = class 1 fax, 2 = class 2 fax)
CLASS 1 COMMANDS	
+FTS	Stop transmission and wait
+FRS	Receive silence
+FTM	Transmit facsimile data
+FRM	Receive facsimile data
+FTH	Transmit HDLC facsimile data
+FRH	Receive HDLC facsimile data
CLASS 2 COMMANDS	
D	Originate a call
A	Answer a call
+FDT	Transmit data
+FET=n	Transmit page punctuation
+FDR	Begin or continue phase C receive data
+FK	Terminate session
+FAA	Data/fax auto-answer and detection
+FBUG	Debug HDLC frame
+FCQ	Copy quality
+FHPS	Handshake protocol
+FMINSP	Minimum phase C speed

CLASS 2 DCE RESPONSES

+FCON	Facsimile connection response
+FDIS	Report remote identification
+FTSI	Report the transmit data identification
+FCSI	Report the called station identification
+FET	Post page message response
+FHR	Report HDLC frame
+FHT	Report transmitted HDLC frame

CLASS 2 SESSION PARAMETERS

+FMFR?	Identify manufacturer
+FDCC=	DCE capabilities parameters
+FDCS=	Current session results
+FLID=	Local identification string
+FCR=	Capabilities to receive
+FPTS=	Page transfer status
+FCHPTO	Phase C timeout
+FAXERR	Fax error value
+FBOR	Phase C data bit order

APPENDIX D Factory-Stored Profiles

Factory Default: AT&F0

AT COMMANDS

AT COMMAND	&F0
B	1
E	1
L (0 - 3)	2
M (0 - 3)	1
N (0 - 1)	1
Q (0 - 2)	0
V (0 - 1)	1
W (0 - 2)	0
X (0 - 6)	4
Y (0 - 1)	0
&A (0 - 1)	0
&B (0 - 1)	1
&C (0 - 3)	0*
&D (0 - 3)	0
&E (0 - 1)	1
&I (0 – 2)	0
&K (0,3,4,8,12,16,20)	3
&L (0 - 2)	0
&N (0 - 1)	0
&O (0 - 1)	1
&P (0 - 1)	0
&Q (0 - 6)	6
&R (0 - 1)	1
&S (0 - 3)	0
&U (0 - 1)	1
&X (0 - 2)	0
&Y (0 - 3)	0
%A (0 - 127)	13
%C (0 - 1)	1
%V (0-4)	0
\A (0 - 3)	3
\C (0 - 2)	1
\G (0 - 1)	0
\K (1,3,5)	5
\N (0 - 7)	7
\V (0 - 1)	0

***NOTE**: For PCs set &C1

Async/Orig. & Ans. for Term/PCs

PARAMETERS

PARAMETER	SETTING &F0
Line type	Dial-up
Line speed (max)	33,600 bps
Line speed (min)	300 bps
DTE speed	230,400 bps
Dialer in use	AT
Speed conversion	On
Data format	Asynchronous
V.42*bis*/MNP 2–5	Auto
Flow control	RTS/CTS
CTS	Forced
DSR	Forced
DTR	Forced
CXR	Forced
Auto answer	On
Call progress	On
Echo characters	On

S-REGISTERS

REGISTER	&F0	REGISTER	&F0
0	1	11	95
1	0	18	0
2	43	25	5
3	13	26	1
4	10	36	1
5	8	37	0
6	2	38	20
7	30	40	0
8	2	41	0
9	6	46	13
10	14	47	17
		48	19

Factory Default: AT&F1

AT Commands

AT Command	&F1
B	1
E	0
L (0 – 3)	2
M (0 – 3)	1
N (0 – 1)	1
Q (0 – 2)	0
V (0 – 1)	1
W (0 – 2)	0
X (0 – 6)	4
Y (0 – 1)	0
&A (0 – 1)	0
&B (0 – 1)	1
&C (0 – 3)	2
&D (0 – 3)	2
&E (0 – 1)	1
&I (0 – 2)	0
&K (0,3,4,8,12,16,20)	3
&L (0 – 2)	0
&N (0 – 1)	0
&O (0 – 1)	1
&P (0 – 1)	0
&Q (0 – 6)	6
&R (0 – 1)	0
&S (0 – 3)	1
&U (0 – 1)	1
&X (0 – 2)	0
&Y (0 – 3)	0
%A (0 – 127)	13
%C (0 – 1)	1
%V (0-4)	0
\A (0 – 3)	3
\C (0 – 2)	1
\G (0 – 1)	0
\K (0 –	5
\N (0 – 7)	7
\V (0 – 1)	0

Async/AutoAns. for BBS Computers

Parameters

Parameter	Setting &F1
Line type	Dial-up
Line speed (max)	33,600 bps
Line speed (min)	300 bps
DTE speed	230,400 bps
Dialer in use	AT
Speed conversion	On
Data format	Asynchronous
V.42*bis*/MNP 2–5	Auto
Flow control	RTS/CTS
CTS	Track RTS
DSR	Normal
DTR	Normal
CXR	Port contender
Auto answer	On
Call progress	On
Echo characters	Off

S-Registers

Register	&F1	Register	&F1
0	1	11	95
1	0	18	0
2	43	25	5
3	13	26	1
4	10	36	0
5	8	37	0
6	2	38	20
7	30	40	0
8	2	41	0
9	6	46	13
10	14	47	17
		48	19

APPENDIX E ASCII Character/Decimal/ Hex Conversion Tables

General

These are binary equivalents of hexadecimal and decimal numbers:

BINARY	DECIMAL	HEXADECIMAL
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

Hexadecimal examples:

11111111	=	FF hex
10011101	=	9D hex
00010001	=	11 hex

This table lists the ASCII decimal, hexadecimal and equivalent character values.

ASCII Conversion Tables

ASCII Symbol	Decimal	Hex	<CONTROL> <Keyboard
(NUL)	0	00	@
(SOH)	1	01	A
(STX)	2	02	B
(ETX)	3	03	C
(EOT)	4	04	D
(ENQ)	5	05	E
(ACK)	6	06	F
(BEL)	7	07	G
(BS)	8	08	H
(HT)	9	09	I
(LF)	10	0A	J
(VT)	11	0B	K
(FF)	12	0C	L
(CR)	13	0D	M
(SO)	14	0E	N
(SI)	15	0F	O
(DLE)	16	10	P
(DC1)	17	11	Q
(DC2)	18	12	R
(DC3)	19	13	S
(DC4)	20	14	T
(NAK)	21	15	U
(SYN)	22	16	V
(ETB)	23	17	W
(CAN)	24	18	X
(EM)	25	19	Y
(SUB)	26	1A	Z
(ESC)	27	1B	[
(FS)	28	1C	\
(GS)	29	1D	]
(RS)	30	1E	^
(US)	31	1F	DEL

ASCII Symbol	Decimal	Hex
(SP)	32	20
!	33	21
“	34	22
#	35	23
$	36	24
%	37	25
$	38	26
‘	39	27
(	40	28
)	41	29
*	42	2A
+	43	2B
,	44	2C
-	45	2D
.	46	2E
/	46	2F
0	47	30
1	49	31
2	50	32
3	51	33
4	52	34
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
:	58	3A
;	59	3B
<	60	3C
=	61	3D
>	62	3E
?	63	3F
@	64	40

ASCII Symbol	Decimal	Hex
A	65	41
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D
^	94	5E
_	95	5F
‘	96	60

ASCII Symbol	Decimal	Hex
a	97	61
b	98	62
c	99	63
d	100	64
e	101	65
f	102	66
g	103	67
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E
o	111	6F
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B
|	124	7C
}	125	7D
~	126	7E
DEL	127	7F

APPENDIX F
Decimal-to-Binary Bit-Map Register Conversion Table

General

Consider the factory setting of register S23. Look at the S23=29 row in below and the Sum-of-bits row to see how the decimal value 29 converts to a bit pattern.

Bit number	7	6	5	4	3	2	1	0
Value	128	64	32	16	8	4	2	1
S23=29	0	0	0	1	1	1	0	1
Sum of bits	0 +	0 +	0 +	16+	8+	4+	0 +	1 = 29

TABLE F-1. DECIMAL-TO-BINARY CONVERSION

S23 represents three separate functions: RDLB detect, serial port speed, and modem parity. The default setting of S23 is RDLB accepted (1), the serial port speed is 19,200 bps (6), and the parity is space (1).

Each of these functions is mapped onto different parts of the bit pattern and should be thought of as separate binary elements.

To determine the settings of the three variables controlled by register S23, convert the register's decimal number (ATS23?) into an 8-bit binary number, starting at bit 0. Then map that binary number into the appropriate bits for RDLB, serial port speed, and parity setting.

Bit 0 Detect RDLB (&T4 and &T5 command)

0 = Deny RDLB request (&T5)
1 = Accept RDLB (&T4)*

Bit 3,2,1 Serial port speed of the Z32

0 = 300 bps
1 = 57,600 bps
2 = 1200 bps
3 = 2400 bps
4 = 4800 bps
5 = 9600 bps
6 = 19,200 bps*
7 = 38,400 bps

***NOTE**: Bits 3,2,1 are valid only if S39 bit 3=0.*

Bit 5,4 Parity

0 = Even
1 = Space*
2 = Odd
3 = Mark / none

Bit 7, 6 Not used

Example: To set the serial port speed to 38,400 bps, the decimal value of bits 3, 2, 1 of your 8-bit binary number must equal 7. (Serial port speeds are determined by three bits of information.) Starting at bit 0, the decimal number 7 is converted into the binary number 111 (4 + 2 + 1 = 7). Now take the number 111 and place it in bit locations 3, 2, 1. Convert your new binary number (old 00011101, new 00011111) to its decimal value (31) and set register S23 to that value (ATS23=31) . The serial port speed is now set to 38,400 bps.

APPENDIX G
Callback and Password Security

This appendix explains the 10 number callback security feature for Zypcom modems. The security password command (control W represented as ^W) was added under the overall operation of Zscript command language. Zscript a autologon script language is expanded for answer side password and callback security operation.

Security is available in dial-up mode only, the modem can be configured to provide security — password and callback — on incoming calls using ^W Zscript command. The ^W security command is only active on incoming calls unlike the other Zscript commands.

The modem's pass-through password and callback security features will function only in asynchronous communication modes (&Q0, &Q5, &Q6, or &Q7) as is the case with all other Zscript commands. When the modem is optioned for security using the ^W command, the modem will not respond to remote control requests on the side channel due to security being enabled.

NOTE: The security features described herein provide a deterrent to unauthorized access. No communications system can be made perfectly secure. Zypcom cannot guarantee the invulnerability of any communications system. Zypcom does not assume any liability arising out of the application or use of any security functions described herein. Neither does it convey any license under its parent rights nor rights of others.

Zscript Password and Callback Security Command (^W)

With password or callback security operation enabled, the modem will verify the authenticity of a password before allowing access to the computer. If password also has a telephone number the modem will callback the user after the password has been verified. The security protection schemes used for incoming calls is summarized below.

- Any remote modem calls the local Zypcom modem with security enabled (^W in a stored memory location) at any supported asynchronous line speed.
- Zypcom modem answers and handshakes successfully with remote modem.
- With the ^W command stored in a memory (&Zn) location the Zypcom does not send the connect message or update the EIA lead (CXR) until a valid password is received.
- Remote user sends carriage return.
- The Zypcom modem sends PASSWORD? which is displayed on remote terminal.
- Remote user types in a valid password (password is not echoed to the screen) followed by a carriage return or <CRLF>.
- Zypcom modem confirms password and in the case of a pass-through call initiates access to the

computer (CXR is raised to the attached DTE) or in the case of a callback the Zypcom modem hangs up the call (the remote DTE screen sees the NO CARRIER message) and the Zypcom modem dials the telephone number stored in the same memory location that contained the verified password.

NOTE 1: Once the modem is connected it will wait approximately 60 seconds for the first <CR> if not received the modem will hang-up. Once the modem issues PASSWORD? it will wait 60 seconds for the user password followed by a <CR>. In the case of callback the Zypcom modem hangs up after validating the password and waits 20 seconds before calling the telephone number associated with the valid password (if incoming ring occurs at this time the modem will not answer the call). If the Zypcom modem finds that during the callback process a busy line occurs, or no dialtone, or ring no answer, etc. the Zypcom modem will not attempt to make a second try.

DTE Response Messages

Below are the messages sent to the DTE attached to the Zypcom security enabled modem. These messages can be turned off by the ATE0Q1&W command.

Password security with valid password:

--no messsage--

CXR lead (pin 8) is raised

Password security with invalid password:

AUTOLOGON FAILED

Callback security with valid password:

H0DT7832501

CONNECT 57600

Callback security with invalid password:

AUTOLOGON FAILED

Security Commands

The modem's security configuration is controlled from the DTE by a special security command. This command is implemented by using the Hayes AT&Z command to store it in memory. The modem is not accessible in remote control mode whenever ^W security command is stored in memory.

The modem incorporates 10 memory locations for storing security passwords and callback telephone numbers. To implement the ^W security command, use the Hayes AT&Z command to store the ^W command (control W) in a specific memory location.

Zscript Commands (^W is the new security command)

COMMAND	DESCRIPTION
^W	Set user password for security operation. If a callback telephone number is present and valid password occurs, callback is in 15-20 seconds after hang-up. If the callback number is busy or no answer occurs, modem does not retry. If no callback number is present and a valid password occurs the modem raises its EIA signal (CXR).
^T	Enter data to be transmitted.
^R	Enter data to be received.
^C	Enter the command field (always last in the Zscript sequence and should never used in a memory location with ^*W*).
^A	Equivalent to <ENTER>.
^P	Causes the modem to pause for 2 seconds before continuing to process.
^X	Allows any Hex value to be sent like line feed (Hex0A). Each ^X sends only two hex values.
<ENTER>	Completes the Zscript sequence

NOTE: *AT&V2 will display all memory locations contents.*

Zscript Rules for Security Commands

- ^W and register S34 are active on the answer side only.
- Memory locations 0 through 9 may be used for answer side security Zscripts or for storing originate side autologon Zscripts.
- Any memory location with a ^W while S34=0 causes all memory locations to become active and searched for a matching password.
- The entire command string, including the AT&Z command, cannot exceed 68 characters. Modem responses (Transmit):, (Security Pswd):, etc. are not included in the 68 character count
- To clear memory location enter nothing in to it (ex. clear location 2, AT&Z2=<CR> to clear location 0, AT&Z0=<CR>). To clear all locations enter AT&ZC<CR>.
- &V2 displays all memory locations along with any Zscript commands or data. To display a single memory location type “AT&Zn?”.
- ^C (<CONTROL> C) command can not be used in a memory location if ^W command is present and is always the last command in the memory location otherwise.
- Commands ^T, ^R, ^X, ^P and ^A can be used in conjunction with the ^W command but are primarily for originate side autologon Zscripts.

Passwords Rules

- Passwords and commands may be entered in capitals or lowercase letters. (However, they will be stored and subsequently displayed as capitals). Passwords are not case sensitive.
- Special characters (! @ ?, etc.) may be used for passwords entered via the DTE interface.
- The callback phone number is stored before the ^W command not after (783 2501^Wscott). Do not use hyphens (-) in the telephone number.

Enabling Callback Operation

Use the command AT&Z to store the ^W security password command, the callback phone number and password to be used. All memory locations with a ^W are to be scanned for password match. Set S-register S34=0 and write to memory &W.

The following example uses the ^W (Security Pswd) command to program memory location 0 for callback operation:

STEP	TYPED BY USER	ECHOED TO THE SCREEN
1	ATS34=0&W	ATS34=0&W
		OK
2	AT&Z0=T783 2501	AT&Z0=T783 2501
3	^W	(Security Pswd):
4	BLUE	(Security Pswd): BLUE
5	<ENTER>	OK

A remote user can now call the Zypcom security modem to initiate a callback call. The remote user first calls the callback modem, after the modems complete their handshake and connect, the remote user presses the <enter> key and is prompted by the message **PASSWORD?**. The remote user then types the assigned password (BLUE) and presses <ENTER>. Upon receipt of the correct password (BLUE) the answering modem will hang-up this call. The remote modem will disconnect in 15 to 20 seconds automatically upon loss of carrier (NO CARRIER). The callback modem that has verified the password will initiate a callback in 20 seconds after disconnecting. Once this callback connection is established (CONNECT 57600), data may pass freely. The data link will work as described for error control or non-error control operation.

Enabling Password Security with a Response

STEP	TYPED BY USER	ECHOED TO THE SCREEN
0	ATS34=0&W	ATS34=0&W
		OK
1	AT&Z0=	AT&Z0=
2	^W	(SecuritPswd):
3	GOLD	(Security Pswd): GOLD
4	^T	(Transmit):
5	Welcome to the Zypcom BBS!^X0A^A	(Transmit): Welcome to the Zypcom BBS!(Hex)0A(Return)

6	<ENTER>	OK

In this example, the user will have to enter a carriage return and receive the PASSWORD? prompt. After the password (GOLD<CR>) is sent and the modem verifies the password it will transmit the response (Welcome to the Zypcom BBS!) immediately.

Zscript Commands Notes

When automatically answering a call (S0=1) the modem will execute all security Zscript sequences with ^W stored in a memory location if register S34=0. The S34 register can also be used to enable only one Zscript sequence by setting it to that memory location plus 1 (enabled memory location 3 set S34=4). Register S34 controls the answer side Zscripts but has no effect when the modem originates a call. When S34=0, all ^*W* passwords are valid. S34=1 only the password or Zscript in memory location 0 is valid. S34=255 no security sequences are valid. S34 default is S34=255.

APPENDIX H Flash Memory

Flash Memory Download

The Zypcom Z34-SX and Z34-SE standalone modems (as well as rackmount modems Z34-RX, Z34-RE, Z32t-RX and Z32b-RX) are equipped with the ability to be completely reconfigured. This modem can receive updated DSP and controller firmware which is contained in flash memory. The new code can be downloaded into the modem through two methods. The first, local download, transfers the updated firmware using the modem's serial port. This method requires a user or service technician to perform the update locally by using an attached PC with communications software. The advantage to this method is speed. A local download can be completed in approximately three minutes.

The second method is remote download. This procedure allows a customer service engineer to remotely update a user's modem without intervention at the remote site. For security purposes, the process is initiated by using the auxiliary channel and is password protected. To effect the download, the remote modem utilizes the Xmodem protocol to interact directly with the customer service engineer's PC. This method allows the update to take place remotely without the need for technically trained people at the remote site. The disadvantage is speed. Depending on the line connect rate, the remote download will typically take about twenty minutes to complete.

The detailed procedure for both local and remote downloads follows. We recommend, with both methods, that Procomm be used to transfer the hex code file to the modem. However, other communications software will work, like Windows 95 Hyperterminal. A detailed procedure for a serial download using Windows 95 Hyperterminal is also provided.

Before trying to upgrade your modem's firmware verify that the modem is currently at a minimum of version 1.12. If your modem is not, then you should call Zypcom to obtain the necessary chips because your modem can not be flash downloaded using the methods below. Once the V1.12 or higher code is in your modem then the latest program file ".HEX" can be downloaded via the methods described in the next sections.

IMPORTANT: *The modem program files that have an extension ".HEX"* ***cannot*** *be loaded into Z34-SX/Z34-SE (or RX-Series or Z34-RE) modems that use the ATMEL flash memory chips, only AMD or Motorola chips can be used correctly. Modems that have a serial number which begins with 6, 7, 8 or 9 will have the correct flash memory chips.*

VERY IMPORTANT: *Program files with the ".HEX" extension can only be loaded into modems that do not have a "H" in the third digit of the serial number. Files with the ".HRD" extension are used for modems that have an "H" in the third digit of the serial number.*

Local Download Using Procomm

1. Copy the latest firmware file from the Zypcom web site (www.zypcom.com) into the Procomm upload sub-directory on the local PC (e.g. C:\PCPLUS\UPLOAD\ ).

Examples of program files:

Z34R1_39.HRD is version 1.33 for the Z34-RX

Z34S1_36.HRD is version 1.31 for the Z34-SX/Z34-SE

2. Connect the modem to the COM port of a PC and boot-up Procomm. Once Procomm has started, set the following options from the setup facility within the program:

   a) Set the com port (AltP) to a speed of 57600, 8-data bits, N-parity, 1-stop bit.
   b) Select the setup utility (AltS) and under Terminal Options set hardware flow control RTS/CTS: ON.
   c) Within Protocol Options, select ASCII Protocol Options and set Character Pacing=0, Line Pacing=0, Pace Character=0, CR Translation=none, LF Translation=none. Then select General Protocol Options and set Abort Xfer if CD Lost=NO.

3. Once the Procomm (or other communications software) options have been set, send the following command:

AT&F&W<enter>resets modem

OK

ATI3<enter>

Z34-SX/Z34-SE V 1.12 Modem current version

OK

ATI6

6KH101209 Serial number

Important: This modem will use a ".HRD" file

or, if a serial number without "H" is reported,

6K1100207 Serial number

Important: This modem will use a ".HEX" file

OK

AT*W64<enter>

The modem will respond:

FLASH READY !
UPLOAD FILE NOW !

4. Select file upload in Procomm by pressing the Page Up key. The program will prompt for file transfer protocol. Choose ASCII and press <enter>. Procomm will now prompt for the file name. Enter the path and filename of the new hex code (e.g. C:\PCPLUS\Upload\Z34S1_33.HRD or what ever is correct for your modem).

5. The file transfer should now proceed. Upon completion the modem will respond with the following message:

   WRITTEN SUCCESSFULLY

   AT&F&W<enter>

   OK

   AT*H<enter>

Note: The modem LEDs (lights) will go off then back on

6. This completes the procedure. The modem is now ready to be put back in service. The unit's original serial number is retained and automatically written into the updated program code. New firmware revision numbers will be presented in response to the ATI3 command.

Local Download Using Windows 95 HyperTerminal

1. Using Windows Explorer drag and drop the new flash code file into the HyperTerminal sub-directory (C:\program files\accessories\hyperterminal) on your PC.

   NOTE: Do not do a Win95 Hyperterminal download on 386/486 computers.

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2. Connect the modem to the COM port of the Pentium PC. Start Hyperterminal (start|programs|accessories). Once the Hyperterminal window appears, double click on the hypertrm icon. Click cancel on the connection description screen. Go to the files menu and click on properties. On the new connection properties

screen click on connect using and select direct-to-com2 (select the COM port number the modem is attached to). Next click on configure and set 57600/8/N/1 and hardware flow control. Click OK and click OK again.

3. Once Hyperterminal options have been set, send the following command:

AT&F&W<enter>resets modem

OK

ATI3<enter>

Z34-SX/Z34-SE V 1.12 Modem current version

OK

ATI6

6KH101209 Serial number

Important: This modem will use a ".HRD" file

or, if a serial number without "H" is reported,

6K1100207 Serial number

Important: This modem will use a ".HEX" file

OK

AT*W64<enter>

The modem will respond:

FLASH READY !
UPLOAD FILE NOW !

4. Select the transfer menu and click on send text file. Highlight the file you are going to send (Z34S1_31.HEX or Z34S1_36.HRD which ever is correct for your modem — see note on first page) to the modem and click on open.

5. The file transfer should now proceed (modem's TXD LED is on almost constantly). Upon completion the modem will respond with the following message:

   WRITTEN SUCCESSFULLY

now type,

AT&F&W<enter>
OK
ATI3<enter>
Z34-SX/Z34-SE V 1.3x

OK
AT*H <enter>
OK

after the modem's LEDs go off then back on, reconfigure the modem options for your application

6. This completes the procedure. The modem is now ready to be put back in service. The unit's original serial number is retained by the controller and automatically written into the updated flash memory.

Remote Download

1. The customer service engineer should contact the customer and instruct the user to unplug the modem from any DTE equipment and default the modem to factory settings. This can be accomplished by holding both the Test and Data switches on while powering-on the modem. The customer should then attach the modem to be upgraded to an outside dial-up telephone line. The service technician needs to obtain the telephone number of the unit.

2. The service engineer should then load Procomm on his PC and set the following options:

   a) Set the COM port (AltP) to a speed of 57600, 8-data bits, N-parity, 1-stop bit.

   b) Select the setup utility (AltS) and under Terminal Options set hardware flow control RTS/CTS: ON.

3. Once the communications software options have been set, send the following command. Type:

   AT&F<enter>

   AT*W128<enter>

   The modem will respond: **OK**

   Dial the telephone number of the remote user's modem. Once the communications link has been established, type the escape sequence: **+++**

   The modem will respond: **OK**

   Enable remote modem access by typing:
   AT^S1<enter>

The modem will respond: **OK**

Type: **AT^R1<enter>**

The modem will respond: **REMOTE PASSWORD?**

Type factory default password for the remote modem. For example: **ZYPCOM<enter>**

Wait for the **OK** message. At this point, you are communicating with the remote modem. Type:

AT*W128<enter>

Once this message is sent and **OK** has been received, return the modem to normal operation by sending the following command string:

Exit remote modem access by typing:
AT^R0<enter>

The modem will respond: **OK**

Type: **ATO<enter>**

The modem will respond: **Connect 57600**

The modem will respond: **FLASH READY !**
UPLOAD FILE NOW !

4. Select file upload in Procomm by pressing the Page Up key. The program will prompt for file transfer protocol. Choose Xmodem and press <enter>. Procomm will now prompt for the file name. Enter the path and filename of the new hex code (e.g., C:\PCPLUS\Upload\Z34S1_36.HRD).

5. The remote modem initiates the file transfer by sending a "C" character to Procomm fifteen seconds after returning to normal operation. The file transfer should now proceed. Upon completion, the modem will respond with the following message:

WRITTEN SUCCESSFULLY

6. This completes the procedure. The modem is now ready to be put back in service. The unit's original serial number is retained by the controller and automatically written into the updated flash memory. New firmware revision numbers will be present in response to the AT I commands. Reset modem options.