U-336S and U-336SA

User's Manual

Version 3.0

ZyXEL

TOTAL INTERNET ACCESS SOLUTION

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ZyXEL warrants to the original end user (purchaser) that this product is free from any defects in materials or workmanship for a period of up to two (2) years from the date of purchase. During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, ZyXEL will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal value, and will be solely at the discretion of ZyXEL. This warranty shall not apply if the product is modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

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FCC Part 15 Information

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operations.

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 commercial environment. 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.

If this equipment does cause harmful interference to radio/television reception, which can be determined by turning the equipment off and 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Shielded RS-232 cables are required to be used to ensure compliance with FCC Part 15, and it is the responsibility of the user to provide and use shielded RS-232 cables.

Information for Canadian Users

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operation, and safety requirements. The Industry Canada does not guarantee that the equipment will operate to a user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications

company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly. The customer should be aware that the compliance with the above conditions may not prevent degradation of service in some situations.

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

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

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

This digital apparatus does not exceed the class A limits for radio noise emissions from digital apparatus set out in the radio interference regulations of Industry Canada.

The declarations of CE marking:

$C\mathcal{E}$

Note: This applies only for U-336S model.

This product has been approved for connection to the Public Switched Telecommunication Network using interfaces compatible with ITU-TSS recommendation I.420 (Basic Rate ISDN user access). This product complies with the following directives:

1. The Council Directive 89/336/EEC of 3 May 1992 on the approximation of the laws of the member states relation to Electro Magnetic Compatibility. (EMC Directive)

2. Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunication terminal equipment. (The Telecom Terminal Equipment Directive)

3. 93/68/EEC of 22 July 1993 amending the Directives 89/336/EEC, 91/263 /EEC and 92/31/EEC.(Marking Directive)

   The Council Directive 92/31/EEC of 28 April 1992 amending directive on the approximation of the laws of the member states relating to EletoMagnetic Compatibility.

Contacting ZyXEL

If you have questions about your ZyXEL product or desire assistance, contact ZyXEL Communications Corporation in one of the following ways:

- **Phone**: In North America call between 8:00 AM and 5:00 PM PST at (714) 693-0808

   Outside North America, you can dial +886-3-5783942 between 8:00AM and 5:00PM Taiwan time (GMT +8:00).

- **Fax**: ZyXEL in North America: (714) 693-8811 or Taiwan: +886-3-5782439

- **E-mail**:

- **Sales inquiries**: sales@zyxel.com in North America
  sales@zyxel.com.tw outside North America.
- **Technical support**: support@zyxel.com in North America.
  support@zyxel.com.tw outside North America.

- **Product information**: Visit our site on the World Wide Web:
  http://www.zyxel.com.

- **FTP**: Information , such as ZyXEL software and ROM updates for
  North America can be found at this FTP address: ftp.zyxel.com

  For European versions and related files, use the address:
  ftp.zyxel.co.at

- **Postal Service**: You can send written communications at the
  following address:

  ZyXEL Communications Corporation

  6, Innovation Road II, Science-Based Industrial Park

  Hsinchu, Taiwan 300, R.O.C.

  or

  ZyXEL Communications Inc.

  1650 Miraloma Avenue

  Placentia, CA92870, U.S.A.

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1 **Introduction**

Congratulations on the purchase of your U-336S/SA modem - one of ZyXEL's premier high-performance products. The U-336S and the U-336SA modem are world renown for their ability to maintain ultra high speeds and clear, quality connections while communicating around the globe.

This User's Guide describes the use of both U-336S and U-336SA models and gives instructions for their installation and operation. All the features are common to both the models except for different input terminal. The U-336S modem requires an AC power adapter whereas the U-336SA can be directly connected to the AC power outlet.

If you do not find information on a specific topic, or if you would like more information about a topic covered in your User's Manual, please call ZyXEL Technical Support at **714-693-0808**. Other means of contacting ZyXEL are listed in the Contacting ZyXEL section.

Required Equipment

In addition to the ZyXEL modem you just purchased, you must have the following equipment to operate your modem:

- Computer terminal.

- Available PC serial port with a high-speed 16550 UART.

- Standard "straight-through" RS-232 cable (pins 1-8, 20, 22).

- Available telephone jack.

- One AC power adapter (external model) for U336S modem only.

- Available AC wall outlet.

- Telephone line from your telephone company (dial-up or leased line).

- Data and fax communication software.

Modem Features

No other 33.6 Kbps modem gives you so much for so little. Your modem is equipped with an array of standard and ZyXEL-famous Intelligent features designed to make your data communications faster, easier, and more convenient.

Standard Features

- Ultra-high speed modem supports V.34bis for 33,600bps and is backwards compatible

- Operates in all environments including: Windows 95, DOS, Windows, Macintosh, OS/2, UNIX, Novell, Amiga, and IBM AS400/RS6000.

- V.42 and MNP 4/3 error correction.

- V.42bis and MNP 5 data compression.

- DTE serial interface with speeds up to 460.8Kbps.

- 20 x 2 LCD display.

- 10 LED indicators.

- Extended AT command set with V.25bis.

- Operates on 2-wire dial-up or 2-wire leased line.

Intelligent Features

- Automatic data and voice call detection allows you to use a single telephone line to handle both types of calls.

- Asynchronous and synchronous modes for reliable serial data communication.

- Fast retrain with automatic fall-forward and fall-back. Your modem will automatically fall back to lower speeds when communicating with slower modems and when encountering unstable or variable line conditions.

- Call-back security and password protection restricts access to authorized callers only.

- Caller ID identifies incoming calls before you answer (you must subscribe to this service through your telephone company in order for your modem to identify callers).

- Distinctive ring detects data and voice calls (this feature requires communication software that supports distinctive ring, such as ZFAX)

- Remote configuration capability.

- EDR (extended Distinctive Ring).

- Flash EPROM memory lets you easily upload new firmware, providing you with easy access to new features.

- ZyXEL exclusive Kernel Recovery Mode for no hassle recovery from failed flash uploads - no factory repairs.

Fax Compatibility

- EIA Class 1, 2, and 2.0 Fax commands.

- ITU-T V.17 G3: up to 14,400bps.

- ITU-T V.29 G3: up to 9,600bps.

- ITU-T V.27ter G3: up to 4,800bps.

- ZyXEL Fax AT commands.

Technical Specifications

- Operating mode: auto-dial/answer.

- Flow control: software XON/XOFF or hardware CTS/RTS.

- Configuration settings: software programmable with non-volatile memory for phone number/profile storage.

- Diagnostics: self test, analog loopback (with self test), digital loopback, and remote digital loopback (with self test).

- Dialing type: tone/pulse dialing.

- Line interface: 2-wire dial-up or 2-wire leased line.

- Call progress monitoring: dial tone, busy, and ring back detection.

- Audio Monitor: programmable volume control.

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2   **Installation**

This chapter describes the panel function and installation procedure for the U-336S/SA.

A shielded RS-232 cable is required to ensure compliance with FCC Part 15, and it is the responsibility of the user to provide and use a shielded RS-232 cable. Make sure your installation site is clean and well ventilated. The ventilation slot of your ZyXEL modem located on the sides and bottom should not be covered and should allow free movement of air.

Front Panel

The U-336S and the U-336SA models have 10 LED indicators, a 20 x 2 LCD display, and four key switches. The following figure shows the front panel of the U-336S.
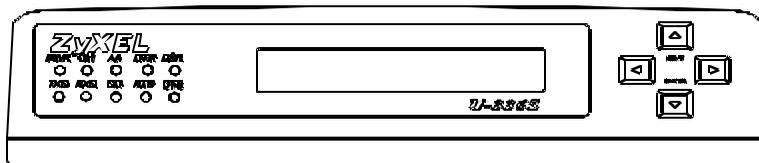
Figure 2-1 Front Panel

The next figure shows the front panel of the U-336SA modem.
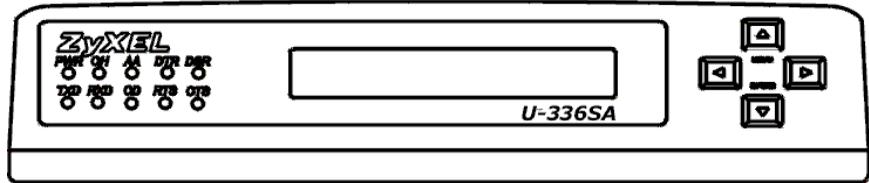
Figure 2-2 U-336SA Front Panel

Front Panel LEDs

PWR Power ON indicator, loghts up when your modem is turned ON.

OH Off-Hook indicator, lights up when your modem is in data mode or off-hook. It goes out when your modem is in talk mode or on-hook.

AA Auto-Answer indicator, lights up when your modem is in the Auto Answer Mode; flashes when modem rings. In error control mode, it flashes when retransmitting.

DTR Data Terminal Ready indicator, lights up when your DTE or computer indicates that it is ready to begin communication.

DSR DTE mode: Data Set Ready Indicator, lights up when the modem is ready for communication.

TXD Transmit indicator, ON when your DTE/computer transmits data on the serial port.

RXD Receive indicator, ON when your DTE/computer receives data on the serial port.

CD Carrier Detect indicator; lights up when a valid carrier is detected present on the line.

RTS DTE mode: Request To Send indicator; indicates the signal status of RS232 signal RTS from DTE. RTS is used for hardware flow control in asynchronous data transmission.

CTS DTE mode: Clear To Send indicator; lights up when modem can accept data for transmission. It indicates the signal status of RS232 signal CTS.

Front Panel Switches

The four arrow keys are for panel operations, allow intuitive menu tree operation and display modem status. Refer to Panel Operstion section in the Chapter *LCD Panel Operation* for details of menu key operations.

Rear Panel Markings

The U-336S/SA rear panels are shown below:
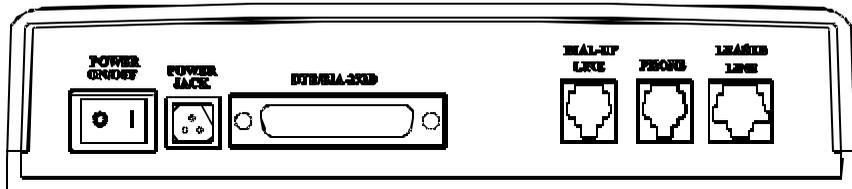
Figure 2-3 U-336S Rear Panel
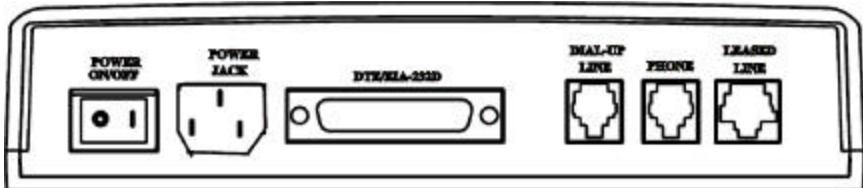
Figure 2-4 U-336SA Rear Panel

Explanations of the connectors and switch on the rear panel are given below.

• **POWER**

Power switch, turns the modem ON or OFF.

- **POWER JACK**

  Input terminal for power. Use the supplied AC adapter for U-336S model. For U-336SA model you can use your power cord to directly connect to the AC power outlet.

- **LINE**

  Dial-up line RJ-11 terminal jack, for connection to a 2-wire dial-up or 2-wire leased line.

- **PHONE**

  RJ-11 terminal jack, for connection to a telephone set.

- **EIA-232D**

  Serial port DB25S connector, for connection to the serial port of a DTE (computer/terminal). Pin assignments are listed in Chapter 12 Connector Pinouts for your reference. The signal-pin assignments for RJ-11 phone jacks are also listed in Chapter 12 Connector Pinouts.

Modem Connection

When you connect your U-336S modem to the power line, make sure you only use the power adapter that is supplied with this unit. Use of another adapter may not allow your modem to operate and could result in serious damage to the unit.

This adapter is rated for direct connection to an AC power outlet. Connect your modem as shown in Figure 2-5 U-336S Modem Connections.

To DTE/Computer — To Leased Line — POWER ON/OFF — POWER JACK — DTE/EIA-232D — DIAL-UP LINE — PHONE — LEASED LINE — To Power Adapter — To Dial-Up Line — To Telephone
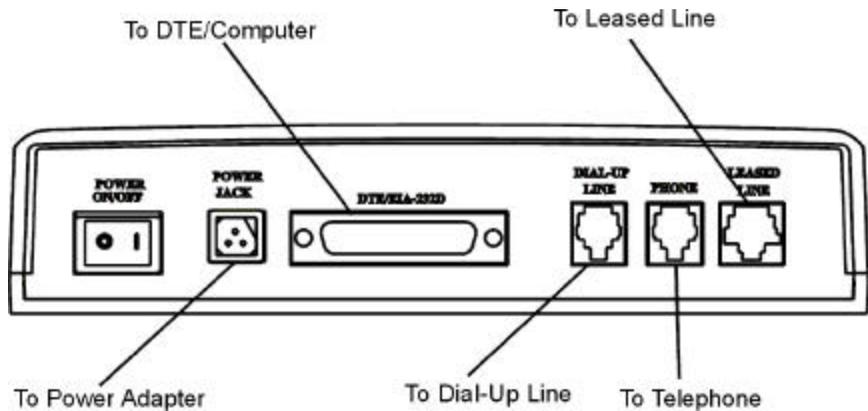
Figure 2-5 U-336S Modem Connections

For the U-336SA you don't need an AC adapter. Use the supplied power cord to connect your modem to the AC power outlet.

To DTE/Computer — To Leased Line — POWER ON/OFF — POWER JACK — DTE/EIA-232D — DIAL-UP LINE — PHONE — LEASED LINE — To power outlet — To Dial-Up Line — To Telephone
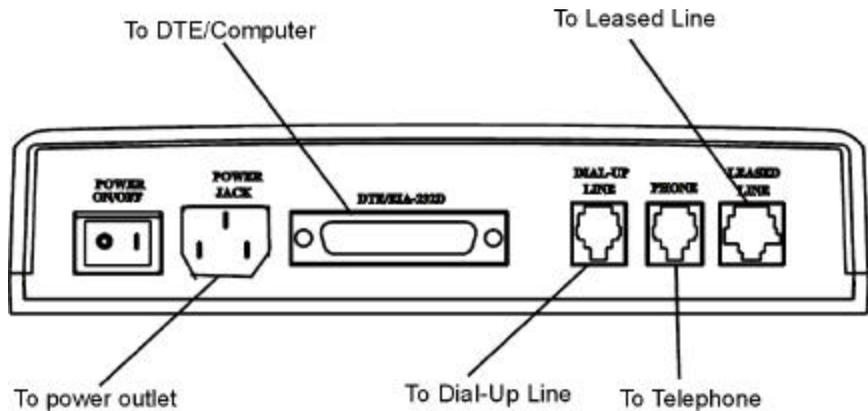
Figure 2-6 U-336SA Modem Connections

If a leased line is not used, simply leave the connection open. There are no DIP switches or configuration settings that you need to worry about. Your modem comes factory pre-set and allows you to fully configure the modem from the LCD display. User configurations are also

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conveniently stored in user selectable non-volatile memories and can be recalled as often as needed.

Powering Up

Once your modem's power switch is turned ON, a series of diagnostic tests will be performed while a message is shown on the LCD panel. For a more detailed description of these diagnostic tests, please refer to Chapter 10 Diagnostics & Troubleshooting.

After performing the diagnostic tests, your modem will display the current modem settings on the LCD panel as shown below:

Your modem is now ready for use.


```
Multi-auto V42b  DL
D R O A    115200 AS
```

LINK OPTION
ERROR CONTROL
LINE TYPE
DATA FORMAT
DTE RATE
ANSWER MODE
ORIGINATE MODE
REDIAL LAST NUMBER
DIALING
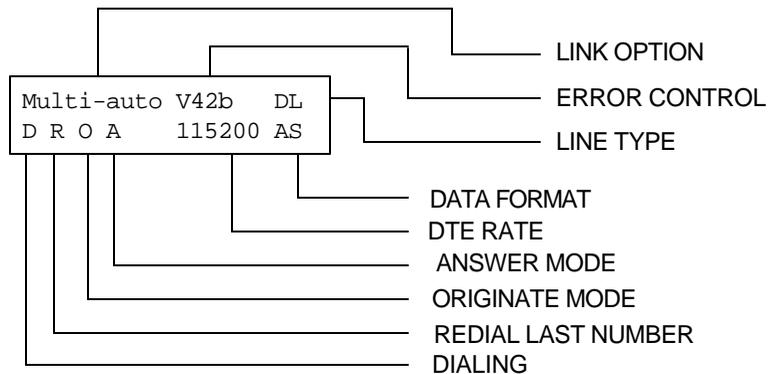
Figure 2-7 Idle Screen

3 **Basic Modem Operation**

This chapter covers the basic commands and techniques involved in modem operation. In many cases, this is the only information you will need in order to get up and running with communication software, and to start making connections with your modem.

Understanding AT Commands

The U-336S/SA communicates asynchronously with computers using AT commands. AT commands are used to configure and control your modem. Commands are usually sent to the modem by way of communication software, but can also be entered manually by the user with the computer keyboard.

Command statements must be written in a specific form in order for your modem to recognize them. A command statement always begins with the letters **AT** or **at**. It is then followed by one or more commands and the <Enter> key.

AT commands can only be issued when your modem is in "command mode" or "off-line."

Once your modem has established a connection with another modem it is said to be "on-line" or in "data mode." In this mode, the characters sent to your modem by your computer are transmitted to the remote modem rather than being interpreted by your modem as commands.

Using the Windows 95 Hyper Terminal Program

In order to issue an AT command statement, you first need to run a communication program such as the Microsoft Windows "Hyper Terminal" program. This program provides a simple method to manually enter AT commands so you can do such things as "customize" the settings of your modem, or store commonly used phone numbers.

Once your modem is connected to your computer's serial port and telephone line, open the Windows 95 "Accessories" program group, and open the Hyper Terminal Program.

The program will prompt you for a name and Icon to use for your new connection. Type the name **Test Connection** and press <Enter>.

Next, you will be prompted for country information, area code and phone number, and the device used to make the connection. For this test purpose, do not enter a phone number; simply choose the COM port your modem is connected to from the "Connect Using" list. Click "OK" when finished.

The next window sets the COM port settings. The settings used for your modem should be as follows.

Bits per second:	57600
Data bits:	8
Parity:	None
Stop bits:	1
Flow Control:	Hardware

Click "OK" when finished. After you have done this, save your new connection by selecting "Save" from the "File" menu and click "OK." A new connection icon will be added to your Hyper Terminal folder.

You are now ready to start entering AT commands.

In the terminal window, type:

```
AT<Enter>
```

Your modem responds

```
OK
```

This confirms that the modem and your computer are communicating correctly.

To test the telephone line connection issue the manual answer command.

Type:

```
ATA<Enter>
```

Your modem will pick up the phone line, and try to communicate. Normally, this command is only used to answer an incoming call made from another modem, thus the high pitched tone you will hear from the speaker. To abort the operation, press any key, or select "Disconnect" from the "Call" menu.

Dialing and Answering Techniques

Depending on what communications software you use to make modem connections, you may not have as much control of how the modem dials the telephone number. This section shows some useful examples of the AT commands used for dialing and answering operations. The command characters specific to each function are shown in bold type.

Dialing using the ATD Command

Touch Tone Dialing:	ATD**T** 555 1212
Pulse Dialing:	ATD**P** 555 1212

Tone and Pulse Dialing:	AT**DP** 555 1212 **WT** 24
Dialing Through a PBX:	AT**DT** 9 **W** 555 1212

Pausing During Dialing:	AT**DT** 9**,,**555 1212

Dialing Without Waiting for Dial Tone:	AT**X0D**, 555 1212
Originating a call using an Answer Tone:	AT**DT** 555 1212,,,,,,**R**
Redialing the Last Number Called:	AT**DL**
Waiting for Five Seconds of Silence:	AT**DT** 800 555 1212 **@**
	123456,1 714 555 1212

Transferring a Call (using flash hook): AT**DT!** 2468

Auto-Answer and Hook Controls

Enabling Auto-Answer:	AT**S0=n**

Disabling Auto-Answer:	AT**S0=0**
Manually Answering a Call:	AT**A**
Take modem off-hook:	AT**H1**
Hang up modem (on-hook):	AT**H0**
Manually Disconnecting a Call:	+++AT**H**

Quick Tips when issuing AT Commands

- The ENTER or RETURN key must be pressed to execute a command.

- Multiple AT commands can be combined into one line. For example, AT&D2 and AT&N0 can be combined into one line AT&D2&N0.

- Your modem processes commands from left to right. The AT command that appears to the right might over-write the command to the left if they are trying to accomplish tasks or set modes that cannot coexist.

- If you see duplicated characters for each one you type, your modem and software both have their "echo" feature turned on. The modem command echo state is switched off using ATE0 and on using ATE1 (default). To eliminate the double characters, turn off the software's command echo rather than using the ATE0 command. If you see no characters in your terminal window when you type, the modem's echo setting is probably set to off. In this case, issue the ATE1 command.

- When a command is successfully issued and accepted, a modem responds with a "Result Code." Your modem supports both "verbose" result codes (i.e. "OK"), and "numerical" result codes (i.e. "0"). You can use the ATV command to set it one way or the other as follows.

Command	Description
ATV0	Select numerical result code.
ATV1	Select verbose result code.

There are a few basic commands that do not require the "AT" command prefix. These are as follows:

Command	Description
A/	Repeats the last issued AT command once.
A>	Repeats the last issued AT command once, or re-dials the last dialed number up to 9 times until a key is pressed or a connection is made.
\<any key\>	Terminates the current connection attempt, if pressed while modem is handshaking.
+++	Escape code sequence. Entered while the modem is in Data Mode. Returns modem to Command Mode.

The U-336S/SA supports several groups of AT commands:

AT Command Set/Type	Example
Basic AT (Hayes compatible)	ATB0
Basic AT$ (on line help)	AT$
Extended AT& commands	AT&N0
Extended AT* commands	AT*I1
Fax AT+ commands	AT+FCLASS=2
S-Register command	ATS0=1
S-Register bit-mapped command (set S-Register bit 1 equal to 1)	ATS13.1=1
S-Register inquiry command	ATS0? Or ATS13.1?

You may browse the lists of available commands for each command set by using the on-line help commands: AT$, AT*$, AT&$, and ATS$. Further detail on AT commands will be covered in the chapters that pertain to their use.

Modem Result Codes

When you execute or try to execute an AT command, your modem sends a result code to let you know whether the command was executed. An OK result code means the AT command you sent was executed. If you receive an ERROR code, it means the command was invalid.

The U-336S/SA also provides result codes that show:

- Whether or not a Dial Tone was detected when the modem originated a call.

- If a busy signal was detected when the modem originated a call.

- If a remote telephone ring was detected when dialing.

- The speed, protocol, and error control/data compression method used.

- If your modem has detected an incoming ring.

Result codes can originate from any of eight result code sets. The **ATX***n* command lets you choose which set of result codes your modem uses. By default, your modem uses result codes equivalent to the **ATX5** command.

The result code options will be covered more thoroughly in later chapters.

Viewing S Register Values

Status registers (or "S-registers") contain values that determine the modem's operating characteristics. Whenever you send an AT command to your modem, you are actually changing the value of an S-register.

You can use the **S*r*?** command to view the value of S-register '*r*'. For example, to view the value of S-register S0, which controls auto-answering, type ATS0? and press Enter. The modem responds with a three-digit character showing the value of this register, followed by OK. A value of 002, for example, means your modem will auto-answer incoming calls after the second ring.

Some S-registers are bit mapped. For these registers, you can use the **S*r.b*?** command to read their values.

For example, to read the value of S-register S35, bit 7, type **ATS35.7?** and press Enter. The modem responds with an appropriate value, followed by OK.

Changing S Register Values

You can use the **ATS0=*n*** command to change the value of an S-register.

For example, to have your modem auto-answer an incoming call after two rings, set S-register 0 to 2. Be sure the *n* value is between 1 and 255. If *n* is set to 0, your modem will not answer incoming calls.

Non-Volatile Memory

The U-336S/SA has an amount of memory set aside for storing user information such as frequently used phone numbers and default command settings. The latter is particularly useful when using your modem to call a variety of different locations that require different settings. For this reason, your modem provides a number of user "Profiles" that can be accessed through simple AT commands. This section covers the topics of storing phone numbers, and saving default settings in the power-on profile.

Storing Phone Numbers

The AT command to store a phone number is in the format **AT&Z*s*=*n***.

The '*s*' is a number from 0 to 49 that represents the location in memory that the phone number is to be stored, and the '*n*' is the phone number itself.

Example: To store the number '1-714-555-1212' in memory location '2', type:

```
AT&Z2=17145551212<Enter>
```

You can store up to 50 telephone numbers.

Dialing Stored Phone Numbers

The AT command syntax used to dial a stored number is **ATDS=*n***.

The '*n*' is the memory location of the stored number you want to dial.

✏ **NOTE:**   AS A GENERAL RULE, WHEN A LETTER IN AN AT COMMAND DEFINITION IS SHOWN IN ITALIC TYPE, THE LETTER IS NOT TO BE ENTERED AS PART OF THE COMMAND, BUT RATHER IS REPRESENTATIVE OF A NUMBER OR STRING EXPECTED AS INPUT. FOR EXAMPLE: THE LETTER 'S' IN THE ATDS=*N* COMMAND IS ACTUALLY TYPED, UNLIKE THE 'S' IN THE AT&Z*S*=*N* COMMAND WHICH REPRESENTS A NUMBER.

Saving Settings and User Profiles

There are some cases where you may wish to save the settings you have made as the default settings that are recalled when your modem is powered up. The **AT&WZ** command selects the current settings as the power-on profile.

There are four profiles that can be changed by the user, and one factory default profile. The following table lists the syntax for the commands involved in storing, recalling, and viewing profile settings:

AT&V*n*	Views the settings in profile (*n-1*); *n*=0 to 5; *n*=0 views current settings.
AT&W*n*	Stores the current settings in user profile *'n'; n*=0 to 3.
ATZ*n*	Resets the current settings with the settings in profile *'n'*, *n*=0 to 4.

Profiles 0 to 3: User profiles.

Profile 4: Factory default profile.

Helpful Hints for PC Computers

Most PCs are equipped with more than one serial port. Standard cables are readily available from many suppliers. Usually, serial ports are manufactured in two forms, either with a 25-pin male jack or a 9-pin male jack. For high speed serial connections at 230.4Kbps or 460.8Kbps, use a low-capacitance cable. Also, keep the cable as short as possible.

The serial port is driven by interrupts. Every interrupt needs a certain amount of overhead processing time. Too many interrupts reduce the computer's efficiency. The UART 16450 is very commonly used in serial port devices. For every character (byte) received, it generates an interrupt. If your hardware allows it and if your software supports it, replace the 16450 UART with a 16550 model. This newer chip has an internal buffer and generates an interrupt for up to every 16 characters (several trigger levels are available). With this UART installed, you may drive your serial port at 57600 bps and above.

While data is written from the transfer-buffer to your hard-disk, characters may be lost at the serial port. This is due to the fact that disk-access interrupts have a higher priority than serial port interrupts. If you are running at a high serial speed, e.g. 230.4Kbps or 460.8Kbps,

on your PC, be sure to enable the disk cache by including SMARTDRV execution in your AUTOEXEC batch file.

Default Modem Settings for PC's

The U-336S/SA factory settings are configured for operation with PC type computers and communication software. In most cases, no additional settings will be required. The following are some of the default settings that are used for operation with PC computers and software:

AT Command	Description
E1	Echoes command characters.
&C1	Carrier detect follows remote carrier.
&D2	Modem disconnects on DTR on-to-off transition.
&K4	Use both V.42 and MNP 4 error correction, and use both V.42bis and MNP 5 data compression.
&N0	Modem negotiates highest possible connection speed.

ZyXEL Serial/Parallel I/O Card

For high-speed PC to modem communication, ZyXEL produces a special I/O adapter card. This card includes a serial port and a parallel port, each with special features, particularly when working with a ZyXEL modem, for example:

The serial port is 16550-compatible for most communication software usage. It has a speed of up to 460.8Kbps and data loss errors will not occur when working with a ZyXEL modem's serial port. This solves high-speed communication problems in Windows and other multi-

tasking systems. The serial port has a 32-byte transmission and a 32-byte receival FIFO to increase communication program efficiency.

Helpful Hints for Mac Computers

Special AT Command Settings for Mac

For operation with Mac computers, you may use the factory default settings with one exception. You must set the modem to ignore the DTR signal as follows.

Type:

 AT&D0<enter> *(set modem to ignore DTR)*

 AT&WZ<enter> *(saves the settings to power-up profile)*

Mac Serial Port

When you connect your modem to a Macintosh computer, make sure the cable is a hardware handshaking type. These cables are readily available. Macintosh Lisa model 128 and 512 don't have hardware handshaking. The serial port on these (very outdated) models is provided as a 9-pin connector similar to that of a PC. The serial port on all other Macintosh models is a Mini-8.

Mac Software Tips

All terminal programs which make use of the hardware handshaking feature can be used on the Apple Macintosh. Such programs are readily available as PD, shareware or commercial software. One of the most powerful shareware programs available is ZTerm.

Fewer programs are available to make use of the ZyXEL's fax features. One program which has found wide acceptance is FaxSTF which can be installed like a printer driver allowing you to send faxes from almost

any program which runs on your Macintosh. At the same time it allows automatic fax receiving. This program includes powerful line manager software which makes sure fax software does not interfere with other programs using the serial ports. If the modem is turned off when you start your Macintosh with the line manager activated, the computer may seem to freeze for a few minutes. During this time the line manager software tries to locate and to set up the modem. Turn on your modem before you start your Macintosh to avoid this delay.

MaxFax is another fax software for Macintosh computers.

Drivers are available which allow use of the serial ports at speeds up to 230.4 Kbps. These drivers are currently available for Power Macs and AV Macs only.

Helpful Hints for UNIX-Based Computers

Serial Cable

Please consult the documentation that came with your workstation to find the part number of or information on how to make a serial cable for your workstation. The cable should be a hardware-handshaking type. Please refer to Chapter 12 Connector Pinouts for a complete list of signals provided for the modem's serial port.

Basic Modem Settings for UNIX

Unix environments usually don't like modem responses or echoing of commands. Therefore you should set **ATE0Q1**.

Depending on your Unix setup, the cable and software used, you may have to disable carrier detection using **AT&C0**.

Unix Software Tips

In order to use your ZyXEL modem from a terminal or an X-Windows application, you need a program such as Minicom or Seyon.

If you wish to make use of your ZyXEL modem's special features, special gettys such as mgetty or vgetty are needed. These programs are available from several ftp-sites. Some archives also contain source files.

You should suppress the modem's result code to (**ATQ1**) because some applications may be confused by them.

4 **LCD Panel Operation**

This chapter explains how to place and receive calls using the U-336S/SA front panel. An introduction to the panel operation of your modem is presented. Your modem comes with a menu driven 20 x 2 LCD display. All functions of the modem are displayed and selectable from this menu. Finally, this chapter will familiarize the user with the menu tree structure which categorizes modem operations for easy and quick reference. Modem users can also use the panel menu operations and use the equivalent AT commands listed in this chapter.

If you use your modem with a PC the factory default settings should be just right for you. Connect the modem according to the instructions in Chapter 2, install the communication software, follow the instructions in this chapter, and you're all set!

LCD Panel

The modem's actions, options, and parameters can be set, changed, and viewed from the front panel, or viewed and changed through AT commands by the computer or terminal connected to the modem. We will discuss panel operations in this chapter with reference to equivalent AT commands. Note that in most cases you will use your communication software to send AT commands to your modem. Only in very rare circumstances will it be necessary to use the modem's panel.

Once turned on, the modem goes into the Idle Screen state (except if a leased line is selected). It then waits for commands from a

computer/terminal or any key pad operation from the front panel. On the LCD screen, there are four on-screen buttons:

D	Dialing operation with submenus.
R	Redial last number.
O	Originate mode on-line.
A	Answer mode on-line.

The cursor is blinking above one of these on-screen buttons, a dark rectangle which may be moved using the keys next to the display. The modem also displays the current status and settings in the idle screen:

Information	Example	
Link Option	V34	(V.34)
Link Speed	33600	(bps)
Error Control	V42	(implied by V.42bis)
Data Compression	V42b	(V.42bis)
Line Type	DL	(Dial-up line)
	2LO	(2-wired leased line originate mode)
	2LA	(2-wired leased line answer mode)
Data Format	AS	(asynchronous)
	SD	(Sychronous data)
	S	(Sychronous)
DTE Speed	115200	(bps)
ORG/Ans	2LO	(2w leased line originate)

Panel Operation

Use the four arrow keys to manipulate the menu tree.

Left/Right arrow keys	used for horizontal item selection and option selection.
Up arrow key	also called the MENU key, is used for vertical

	menu selection and is used to access the previous menu. The up arrow key also serves as a quit command when you want to stop the current action.
Down arrow key	also called the ENTER key, is used solely to register the chosen selection and is very similar to the Carriage Return key or Enter key on a standard keyboard.

Menu Tree

In command state, there are three main menu trees. The IDLE menu is the default, and can be accessed after the modem is powered on or reset. The second is the CONFIGURATION menu, which also includes a submenu. The third is the DIAGNOSTIC menu. All three menu trees can be accessed by pressing the up or down arrow key. When the modem is in the data state, there is one idle screen and other data state status screens in Non-V.34 connection which can be accessed by pressing the left or right arrow key. (There are nine and five data state status screens for V.34 and Non-V.34 mode display respectively.)

LED Status Screen

Either in idle state or data state, there is an LED status screen that can be accessed and displayed by pressing the left or right arrow key at the menu's top level. This LED status screen has five status indicators - DCD, DSR, CTS, RTS, and SQ. These status indicators are identical to the LED indicators of the non-LCD modems. Values in one of the other screen displays may give much more detailed information than some of these status indicators; e.g., a data state screen means DCD is on, and an idle screen means DCD is off; SQ is better explained by the S/N ratio reading and the other impairment readings of data screen 2.

Double Arrows on The Screen

In some menu screens, you will see double left arrows (<<) or double right arrows (>>). This means there are more items on the left or right. Use the left or right arrow key to select them. If you can only see a double right arrow, this indicates that the current item is the first item of the menu. By pressing the left arrow key, the screen will wrap over to the last item. On the other hand, if you only find a double left arrow displayed, this indicates that your current item is the last item in that menu. Similarly, pressing the right arrow key at this point will cause the screen to wrap around to the first item.

Dialing

From the IDLE SCREEN (1) you can use the right or left arrow key to scroll through D, R, O, and A. Move the blinking cursor to D, press <enter>, and you will go into the DIALING DIRECTORY.

Valid digits/characters for dialing are:

0 1 2 3 4 5 6 7 8 9 * #		
,	(Comma)	Pause.
;	(Semicolon)	Return to command state.
@	(at-character)	5 second silent wait.
!		Hook flash.
P		Pulse dial.
R		Reverse dial.
T		Tone dial.
W		Wait for dial tone.
-	(Dash)	Digit separator.
←	(Backspace)	Backup one character and delete.

Dial Memory

The first menu in the dialing directory is DIAL MEMORY. Pressing the ENTER key will display the following screen:

z #00:12345	<ENTER>	Dial out the number
<< >> SELECT MEMORY		

Equivalent AT Commands:

AT&Z?	View all stored phone numbers.
ATDSn	n = 0 - 49; dial stored number.

The first stored number shown on the menu is the default dial number which can be selected from the DEFAULT DIAL menu. By pressing the left or right arrow key, you can view up to 50 different numbers stored in the memory. Pressing the ENTER key will cause the selected number to be dialed. The first line of the LCD can display up to 16 characters. However, up to 25 characters can be entered. Characters 17 through 25 are displayed on the second line of the LCD display.

Storing a Number

Pressing the right arrow key from the DIAL MEMORY display will move the menu to STORE NUMBER. Pressing the ENTER key at this point will produce the following screen display:

z #00: 12345	<ENTER>	z #00:
<< >> SELECT MEMORY		<< >> SELECT DIGIT

Changing an existing number:

z #00:1234567	<ENTER>	z #00:
<< >> SELECT MEMORY		<< >> SELECT DIGIT

Equivalent AT Commands:

AT&Z?	View all stored phone numbers.
AT&Zn=1234567	Store phone number in memory location n (n=0-49).

Up to 50 different numbers can be viewed and set. If you want to add a number to the memory, select an unused memory location and press ENTER. The blinking cursor will change into an underscore and will move to the next position on the right side of the colon. SELECT MEMORY will change to SELECT DIGIT. Press the left and right arrow keys to scroll through the valid digits and characters for dialing. Pressing ENTER will confirm the selected digit and cause the cursor to move to the next position.

Repeat the above procedure to finish entering the number, then press ENTER again to save the entry in the EEPROM. The stored numbers will remain in the memory until you revise or delete them. Pressing the up arrow key in the process will abort and exit the current number entry and nothing will be changed or saved.

View and Store a Number

If you want to view or store a phone number into the EEPROM in lease line operation or data state. You can select "PHONE NUMBER" screen and enter it. The operation is the same as the above.

Dialing a Number

The same procedure as in the STORE NUMBER operation is used when entering numbers. Once the number entry is completed, press the ENTER key to dial the number.

_	<ENTER>	1234567_
<< >> SELECT MEMORY		<< >> SELECT MEMORY

Equivalent AT Commands:

| ATD1234567 | Dial phone number. |

Manual Dial

Use of a telephone set to make a call, in which case an answer tone comes back, is normally called Manual Dial. Once the other side answers, access O (Originate) by using the left or right arrow key so the blinking cursor settles on the O. Then press the ENTER key to start the modem handshaking sequence.

Equivalent AT Commands:

| ATD | Go on-line in Originate mode. |

When dialing a person, use the telephone to make the call. When someone on the other side answers, decide who will be the Originate modem and who will be the Answer modem. Once an agreement is reached, use the left or right arrow key to select the O or A for Originate or Answer. Then press the ENTER key to start the modem handshaking sequence.

Equivalent AT Commands:

| ATD | Go on-line in Originate mode. |
| ATA | Go on-line in Answer mode. |

When you want to switch from modem to voice communication, simply lift up the handset of both sides and press the ENTER key while the blinking cursor is on the H or Hang Up. The LCD display will show DISCONNECTING? to ask for a confirmation. Press ENTER again and the modem will change from data to voice communication. When both sides wish to return to data communication, one side should press O while the other side presses A (as explained previously). This

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operation will reinitiate the modem handshaking and enable data communication.

Equivalent AT Commands:

+++	Escape sequence code; causes a modem to return to command state. Enter the escape sequence while in data state and wait for the modem to respond.
ATH	Go on-hook; disconnect the modem.
ATD	Go on-line in Originate mode.
ATA	Go on-line in Answer mode.

Repeat Last Dial

Access R (Repeat last dial) by pressing the left or right arrow key and the ENTER key. Before a connection is made, any key pressed from the front panel or terminal keyboard will abort the redial operation.

Equivalent AT Commands:

ATDL	Repeat last dial.
A/	Repeat last command once.
A>	Repeat last command once, retry the last call up to 9 times. (country specific)

Auto Answer

Move to the STATUS REGISTER menu, and change the S0 value to the desired number of rings until the modem automatically answers. Setting this value to zero disables auto answer.

Equivalent AT Commands:

| ATS0=0 | Disable auto answer. |
| ATS0=n | Automatically answer on the nth ring. |

Dialing Messages

Dialing will cause the following screen to be displayed on the LCD:

```
DIALING .....................
1234567
```

The dialed phone number will be displayed on the second line of the LCD screen. If the number exceeds 20 digits, only the first 20 digits/characters will be displayed. If the modem's DIAL-UP LINE jack is not plugged in or not connected, the LCD screen will display the following:

```
NO DIAL TONE............
1234567
```

The modem will then return to the IDLE STATUS screen. If the line is busy, after three to five seconds, the LCD displays:

```
BUSY ............................
1234567
```

The modem will then return to the IDLE STATUS screen. If the phone company is ringing the remote modem, a RINGING message is sent to the terminal. Setting S42.6 = 1 will disable this RINGING result code. If any key interruption occurs (from the terminal or panel) and breaks in before the connection is made, the screen displays:

```
ABORT...........................
1234567
```

The modem will then return to the IDLE STATUS screen. If the time interval depicted in the S7 register expires, and the line is still not connected, the LCD screen shows:

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```
DISCONNECTING..........
1234567
```

The modem will then return to the IDLE STATUS screen. If the first handshaking signal has been detected, the LCD screen will display:

```
HANDSHAKING............
1234567
```

If a connection has been made, the LCD will display the actual connected status. These are V.34 data state screens:

V.34b 33600 33600 DL	\<RIGHT\>	SNR= 41.5 CLC= 0	\<RIGHT\>
H >> 55820 51324 AS	\<LEFT\>	TXL=-11.0 RXL=-21.3	\<LEFT\>

\<RIGHT\>	RTG= 0 RTR= 0	\<RIGHT\>	V42b/SREJ BLS=256
\<LEFT\>	FRG= 0 FRR= 0	\<LEFT\>	BLR= 0 FRE= 0

\<RIGHT\>	NEC=-40.4 RTD= 0	\<RIGHT\>	PHJ= 0.0 FRO=- 0.0
\<LEFT\>	FEC= -57.2 EFO= 0	\<LEFT\>	EDL= 0

\<RIGHT\>	NLE= ON NLD= ON	\<RIGHT\>	TSH=MIN RSH=MIN
\<LEFT\>	TRE= 64 CND= 64	\<LEFT\>	TFI = 7 RTFI= 10
	*		*

\<RIGHT\>	TXC=1920 RXC=1920	\<RIGHT\>	PROBING
\<LEFT\>	TXB=3429 RXB=3429	\<LEFT\>	
	*		*

Note: The on-line status screens with "*" are available one in V.34 mode.

On-line Status Screen 1

Status	Display	Unit/Meaning
Link Option	V34b	V.34bis
Line Speed	33600	bps/ TX/RX speed in V-34
Error control	V42b	V.42bis/only display in Non-V.34 mode
Line Type	DL	Dial-up Line
Data Format	AS	Asynchronous
Instant Transmission Throughput	55820	bps/Blank in synchronous mode
Instant Receiving Throughput	51324	bps/Link Speed in synchronous mode

On-line Status Screen 2

Status	Display	Unit
Signal to Noise Ratio	30.9	dB
Receiving Signal level	-25.1	dBm
Transmition Signal level	-11	dBm
Carrier lost Counts	0	

On-line Status Screen 3

Status	Display	Unit
Retrain Granted	0	
Retrain RequesTed	0	
FRN (Fast Rate reNegotiation) Granted	0	
FRN Requested	0	

On-line Status Screen 4

Status	Display	Unit
Link Layer Status	V42b/SREJ	
Block Size	256	bits
Blocks Retransmitted	0	blocks
FCS (Frame Check Sum) Errors	0	bits

On-line Status Screen 5

Status	Display	Unit
Near End Echo	-22.3	dB
Far End Echo	-57.2	dB
Round Trip Delay	0	ms
Echo Frequency Offset	0	Hz

On-line Status Screen 6

Status	Display	Unit
Phase Jitter	-0.0	degree
Frequency Offset	-0.1	Hz
Echo delay	0	1/baud

On-line Status Screen 7

Status	Display	Unit
None Linear Encoder	ON (OFF)	
None Linear Decoder	ON (OFF)	
Trellis Endcoder	64,32,16	state
Convolutional Decoder	64,32,16	state

On-line Status Screen 8

Status	Display	Unit
Transmitted Shaping	MIN (MAX)	
Received Shaping	MIN (MAX)	
Transmitted filter index	0~10	
Received filter index	0~10	

On-line Status Screen 9

Status	Display	Unit
Transmitted Carrirr	1959	Hz
Received Shaping	1959	Hz
Transmitted Baud rate	3429	Baud
Received Baud rate	3429	Baud

On-line Status Screen 10

Status	Display	Unit
Probing Result	Channel Spectrum probed at V34 phase two.	

Pressing the left or right arrow key in any one of the ON-LINE STATUS screens will cause the LCD to scroll through the four screens. We will discuss the ON-LINE -STATUS screens 2, 3, and four in more detail in the section Line Condition Status Display in chapter ten.

Pressing the ENTER key while in any ON-LINE STATUS screen will cause the LCD to display the following:

DISCONNECT ? z YES NO	<ENTER>	DISCONNECTING……

Equivalent AT Commands:

| +++ | Escape sequence code; causes a modem to return to command state. Enter the escape sequence while in data state and wait for the modem to respond. |
| ATH | Go on-hook(hang up); disconnect the modem. |

Pressing the up arrow key (MENU) or selecting NO will switch the screen back to the ON-LINE STATUS screen 1 and the modem remains on-line. Pressing ENTER will hang up the line and cause the modem to revert to the IDLE STATUS screen to await your next command.

Pressing the up arrow key (MENU) in any of the four data state screens will change your current screen to the CONFIGURATION menu.

Panel Lock

The panel keyboard can be locked to prevent inadvertent changes in modem settings. This is done by setting the S-register S28 bit 1 to 1 or using the PANEL LOCK menu from the panel, or by issuing the AT*L1 command from the terminal. Issuing the AT*L0 command will return the key operation to normal. Alternatively, pressing the left and right arrow keys simultaneously will unlock the panel. In locked panel mode, the ENTER key will lose its effectiveness in changing or saving settings; panel command execution is also disabled. However, viewing in the panel is not affected.

This chapter introduces you to the use of the U-336S/SA for synchronous operation. The modem can be used as a synchronous modem when it is connected to a synchronous computer or terminal. It is of course necessary to make sure that the remote modem and system are also set to synchronous mode. Synchronous operation applies to all

of the non-FSK modes the modem is supplied with. Before synchronous transfers are started, some initial settings should be made.

V.25bis Command Set

To enable V.25bis commands use the **AT*I1** command.

For synchronous applications, the modem is permanently set in normal situations for use with one application. Save the desired settings in the power-on profile, and the modem will be initialized to synchronous mode (**&M3**) with V.25bis command enabled (***I1**) when powered on.

A special command RST is provided to get the modem back to asynchronous AT command mode from V.25bis mode. You can enter this RST command in either synchronous or asynchronous V.25bis mode.

Syntax	Command with Parameters*	Description
CRN	CRN <dialstring>**	Call request with number provided.
CRS	CRS n	Call request with number from memory, 0 # n # 49; n is the memory location.
PRN	PRN n; <number>	Saves <number> to address n (0 # n #49).
RLN	RLN***	Requests list of all stored numbers.
DIC	DIC	Ignores incoming call.
CIC	CIC	Accepts incoming call.
CFI	CFI XX	Call failure indication: ET Engaged Tone. NS Number is not stored. RT RING Tone.

Syntax	Command with Parameters*	Description
		AB Abort Call.
		NT Answer Tone is not detected.
INC	INC	Incoming call.
VAL	VAL	Valid.
INV	INV	Invalid.
LSN	LSN n; <number>	List of stored numbers. (Response to RLN)
RST	RST	Changes to the asynchronous AT command mode.

Clock Options

Synchronous data must be transmitted and received with a common timing clock. This timing clock is used to transmit data from the DTE to the modem which modulates the data according to this clock. The receiving modem recovers the clock and data from the carrier and sends the data to the receiving DTE along with the clock. There are three types of transmission synchronous clock sources to choose from:

1. The **internal clock** is the one that suits most applications and is the default; in this case, the clock signal is generated by the local modem.

2. The **slave clock** is that the clock signal is generated by recieved data .

3. The **external clock** is that the clock signal provided by the DTE.

| INTERNAL | AT&X0 | The modem provides the clock and sends it to the DTE. Adaptive rate can be used. (Default) |
| EXTERNAL | AT&X1 | The DTE provides the clock and sends it to the modem. Must use auto-retrain, |

		cannot use adaptive rate.
SLAVE	AT&X2	Recovered receiver clock serves as transmission clock.

RTS Options

There are two RTS options. The choice depends on application and host/terminal requirements. In asynchronous mode RTS is used as a hardware flow control signal.

IGNORED	AT&R1	RTS is ignored; always assumed to be ON. (Default)
CTS TRACKS RTS	AT&R0	Delay before CTS responds to RTS's change. The delay is set in the S26 register.

Command State Options

For synchronous data communication, there are two options you can choose from to define how the modem will operate in the command state.

SYNC DATA	AT&M1	The modem accepts asynchronous commands in command state, but exchanges data synchronously in data state.
SYNC	AT&M3	The modem accepts synchronous command (V.25bis) and exchanges data synchronously with a remote modem.

Dialing from Synchronous Mode

1. **Dial from the terminal using asynchronous commands**: Set **&M1** and use asynchronous AT commands to dial the number.

Once the modem is connected, the modem will enter synchronous operation.

2. **Dial through the computer using V.25bis commands**: Some communication software packages on synchronous computers can dial using V.25bis synchronous commands. In this case, set **&M3** and ***I1** and the modem will accept V.25bis commands and make a synchronous connection.

3. **Using DTR to dial a stored number in synchronous mode**: Store the telephone number by the asynchronous command **&Zn=**. Use the DEFAULT DIAL parameter menu or ***Dn** command to select the default dial pointer. Set **&D1** and either **&M1** or **&M3,** then raise DTR from your terminal or communication software. The modem will dial the default stored number. After the modem is connected, the modem will enter synchronous operation.

4. **Manual dial**: Set the modem to synchronous mode (**&M1** or **&M3**), then dial a number from a telephone set. When you hear the answer tone, type **ATD** (if &M1 is set). The modem will go into synchronous operation after connection.

Answering from Synchronous Mode

Auto-Answer

Set the modem to synchronous mode. Set the S-register **S0** to equal the number of rings before auto-answer occurs. Set it from the terminal (if **&M1** is set) using the asynchronous AT command, or select the STATUS REGISTER menu to change the **S0** value.

Manual Answer

Type **ATA** from the terminal (if **&M1** is set) or press "A" in the idle screen of the LCD panel.

5   **Leased Line Operation**

A leased line is a permanent telephone line connection between two fixed points. It can be dedicated copper wires or a leased telephone circuit from the telephone company. Four-wire leased lines use one pair of wires to transmit data and a second pair to receive. Two-wire leased lines transmit and receive on the same pair of wires. Your modem supports 2 -wire leased lines only.

Connecting to a Leased Line

The U-336S/SA default line is a dial-up type. The leased line must be connected to the jack labeled **Line**. Set your modem for leased-line operation by typing commands from the terminal. The leased-line phone jack pin assignments are shown in Chapter 12 Connector Pinouts.

Power Level Setting

Your modem's leased-line mode transmission power level can be adjusted from **0 dBm** to **-27 dBm** in **1 dBm** increments.

AT-Command	Description
AT*P0 . . . AT*P15	The default is -9dBm. The adjustable range is from 0 to -15dBm, effective in leased-line operation only. If bit 3 of S35 is set, this range will change to -12 to -27dBm.

Leased Line Handshaking

In a typical dial-up connection, the originating modem dials the number and waits for the answering modem's carrier signal. The answering

modem can be commanded to either answer the call immediately, or after a specified number of rings.

In a leased-line connection, the communication circuit between two modems is always present. Dialing and waiting for rings does not occur in this situation. If these two modems want to establish a data link, one must be designated as the originator and the other as the answerer. You can set this manually or automatically.

Manual Connect

Set the modem to leased-line mode. Type the asynchronous command **ATD** to the originating modem and **ATA** to the answering, or press the A/O button on the front panel of the originating modem **in**, and press the A/O button on the front panel of the answering modem **out**. Use **AT*Mn** or set **S14b0** to select originate or answer mode.

Auto Handshake

If you want handshaking to occur automatically upon power-up, you have to save the leased-line configuration to the power-on profile. Please remember to set the handshake mode before you save the configuration. Be sure that one modem is set to originate mode and the other to answer mode.

AT-Command	Description
AT*M0	When operating over a leased line, modem will handshake in originate mode. (Default)
AT*M1	When operating over a leased line, modem will handshake in answer mode.

Aborting from Leased-Line Operation

If the leased line has not been connected, pressing the D/V switch on the front panel will drop the line and re-attempt to connect to the leased line.

Terminating a Leased Line Connection

A leased line can be terminated two ways:

- Going on-line manually.

- Turning the power OFF and ON. If you have set the leased line as the power-on default, the modem will try the leased line again.

6 **Special Functions**

This chapter describes special features of the U-336S/SA, and offers instructions on how each is used.

Security Functions

Your modem provides a security function that prevents unauthorized users from making connections. Two types of **security functions** are provided.

- Type 1 security is used when the remote modem is also a ZyXEL modem.

- Type 2 security is used when the remote modem is any other brand.

The **type 1** connection, the dial-in remote modem will send in its supervisor password for checking at the initial connection , and the local modem will check this password against its pre-stored acceptable password list.

The **type 2** connection, the remote terminal will be prompted to enter the password at the initial connection and the local modem will do the password checking.

Levels of Security

Two levels of security are provided:

- With **level 1 security,** the local modem will maintain the connection if the password is OK, otherwise the line disconnected.

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- With **level 2 security,** dial back the phone number corresponding to the dial-in password. The line simply disconnects if the password does not match.

User Passwords

Fifty user passwords may be defined. The corresponding 50 dial-back numbers are the modem's 50 stored phone numbers. Any character (ASCII 0-127) can be used in the password, the maximum password length is 8 characters.

Security functions are only accessible through AT commands in terminal mode. Any access attempt will result in the modem's prompting the user to enter the supervisor password. The attempt will be rejected if the entered password is not correct. The default supervisor password is ZyXEL when the modem is shipped from the factory. This supervisor password is also the password sent for automatic password checking in a type 1 connection. To modify the supervisor password, use **AT*HS**.

You will be asked for the original password and a new password and then to re-enter the new password for verification. For example:

```
Password: (Enter supervisor password)
********
Password: (Enter new supervisor
password)
********
```

The command **AT*V** will list the 50 user passwords and the supervisor password on the screen for viewing. Again, you will be prompted to enter the supervisor password first.

```
The following commands will enable
different types and Verify: (Enter the
new supervisor password again)
```

```
* * * * * * * *
```

OK

The command **AT*Hn** will modify the nth user password. You will be prompted to enter the supervisor password first and then be prompted to enter the nth user password.

Levels of security:

Command	Function
*G0	Disable security function.
*G1	Enable type 1 and level 1 security, with password check.
*G2	Enable type 1 and level 2 security, with password check and callback.
*G3	Enable type 2 and level 1 security, with password check.
*G4	Enable type 2 and level 2 security, with password check and callback.
*G5	Enable type 2 and level 2 security, with password check and callback, remote site enters the callback number.

📌 **NOTE:** BEFORE THE SECURITY TYPE OR LEVEL CAN BE CHANGED, THE MODEM REQUIRES THE SUPERVISOR PASSWORD.

For type 2 security, the remote site will be prompted to enter the user password. A maximum of 3 tries in 40 seconds is allowed. If a correct password is not entered within this time limit the line will be disconnected. If the remote site is to enter the callback number it will be prompted to do so.

Remote Configuration

Remote configuration on the U-336S/SA is provided as a profile by profile batch mode. When on-line, the remote modem's current configuration or one of its profiles can be read into one of the local modem's user profiles. This profile is modified locally and the line can be disconnected during this time.

Local profile modification is done by loading this profile as the active settings and then modifying and saving the active settings back to the profile. Then the connection is reestablished and the profile transmitted to the remote modem.

Reading a remote profile **b** into a local profile **a** is achieved with the command:

AT*Rab

a=0-3	Local user profile number.
b=0-3	Remote user profile number.
b=4	Remote active configuration.
b=5	Remote factory default.

Return the modems to on-line status again. The local modem can upload (write) its profile to the remote modem's profile and have the remote modem reset from the new profile. This is done with the command:

AT*Wab

a=0-3	Local user profile number.
a=4	Local active configuration.
a=5	Local factory default.
b=0-3	Remote user profile number.

The remote profile read and write commands - ***Rab** and ***Wab** - only work in the on-line condition. The connection speed and mode do not matter. The remote modem must be set to accept remote configuration by executing the **AT*F1** command. The **AT*F0** command will set the modem up to deny remote configuration requests. Because the modem uses the remote digital loopback mode to request remote configuration information, the remote digital loopback request must also be granted (**AT&T4**) on the remote modem to accept the remote configuration request.

Batch mode remote configuration is a convenient feature allowing you to pre-configure a remote modem in one of the local modem's user profiles and send it to the remote modem in one action. It is particularly useful when there are many remote modems and a set of standard configurations is available so you can store them into user profiles. You just need to configure the remote modem into one of the standard configurations by activating the remote configuration once.

Caller Number Delivery (Caller ID)

Caller Number Delivery (CND), commonly called **Caller ID,** is a new kind of phone service that may be offered by your local phone company. Check your phone company for availability. You must subscribe to it and usually pay an additional monthly service charge this service.

With CND service, the phone company's central office will send the coded caller information to the called station. This information is sent once between the first and second rings. Your modem can decode this caller information and present it to the connected computer/terminal during the second ring period as part of the call progress ring message. The modem will also report the Caller ID information if asked by the command **AT*T.**

There are two kinds of caller information message formats sent by the phone company.

- One is the single message format which includes date, time, and caller ID

- The other is the multiple message format which also includes the caller name as registered with the phone company.

The command **ATS40.2=*n*** is used to enable (**n=1**) or disable (**n=0**) the Caller ID detection function. The default is disabled. Enable it only when you have this service and want to enable its detection.

✍ **NOTE:** THE CALLER ID MESSAGE MAY CAUSE SOME COMMUNICATION SOFTWARE THAT IS NOT EXPECTING IT TO BECOME CONFUSED. IF YOU PLAN TO USE THE CALLER ID FEATURE, BE SURE YOU ARE USING SOFTWARE THAT SUPPORTS IT (SUCH AS ZFAX).

In single message format, the modem will send a ring message to the terminal as follows:

```
RING
TIME: <MM-DD hh:mm>
CALLER NUMBER: <CALLER_ID> or CALLER
NAME:<CALLER_NM>
RING
```

MM is the two-digit month message, DD is the two-digit date message, hh is the hour and mm is the minute of the time, and CALLER_ID is the phone number of the caller or CALLER_NM his/her name.

The following is an example of a caller ID message as it might appear on your screen:

```
RING
TIME: 04-28 12:30
```

```
CALLER NUMBER: 7135551414 or CALLER
NAME: Brent Harper
RING
```

In the multiple message format, if the caller's number and name are available, the ring message will display both:

```
RING
TIME: MM-DD hh:mm
CALLER NUMBER: <Caller_ID>
CALLER NAME: <Caller_Name>
RING
```

Here is an example:

```
RING
TIME: 04-28 12:30
CALLER NUMBER: 7135551414
CALLER NAME: Tracy Huang
RING
```

If the caller number and name are not available, the ring message will appear as follows:

```
RING
TIME: 04-28 12:30
REASON FOR NO NUMBER: OUT_OF_AREA
REASON FOR NO NAME: PRIVACY
RING
```

The last CND message that the modem received can be displayed by using the AT*T command.

Setting **S48.0=1** will cause the modem to report CND information in its ASCII coded hexadecimal raw data format. The DTE software is responsible for explaining the data.

Distinctive Ring

Distinctive Ring is a phone service that may be offered by your phone company. Check your phone company for availability. With this service, you can have several phone numbers assigned to the same phone line. The phone company will send a different type of ring signal for each phone number being called. The subscriber can distinguish which number is called by which type of ring is received.

One benefit of this feature is the ability to have three numbers on the same line allowing you to list the three numbers for voice, data, and fax, respectively. You can then have your fax machine answer only the ring corresponding to the fax number and have your modem answer only the ring corresponding to the data number. A voice call will not be answered by either fax machine or data modem and it will only be answered when someone picks up the phone. You can also have the answering machine answer only the voice ring. A more complicated use is that you can have one number for multiple uses, such as one number for both data and fax.

A ring signal is a composition of repeated on and off states. Different types of rings usually correspond to different compositions of the "ON"

part (cadence) of the ring. Your modem can distinguish up to four types of ring signals and can be commanded to answer or not answer any one of these four types of ring signals. Following is a list of these four types of ring signals. These are the ring types used in the USA. The difference among the ring types is the two-second ON part of the ring signal. It comprises a long, double short, or triple short ring.

S-register **S40 bits 3-6** are used for distinctive ring control. Each bit controls the answering of a particular ring type. Setting a bit to "1" (on) enables answering, setting it to "0" (off) rejects the ring. Note that the ring may still be heard even if it is not counted as an accepted ring by the modem.

The control relationships between bits 3-6 in register S40 and the different ring types are:

Type	Bit (on)	Ring Sequence
1	3	1.2s or 2s on; 4s off
2	4	0.8s on, 0.4s off, 0.8s on; 4s off
3	5	0.4s on, 0.2s off, 0.4s on, 0.2s off, 0.8s on; 4s off
4	6	0.3s on, 0.2s off, 1s on, 0.2s off, 0.3s on; 4s off

☞ NOTE: IF ALL OF THESE BITS ARE "0" (OFF), ANY RING WITH A DURATION LONGER THAN 100 MS WILL BE ACCEPTED. USE THIS DEFAULT IF YOU DO NOT HAVE DISTINCTIVE RING SERVICE.

If more than one type of Distinctive Ring is turned on, RING n will be reported for an incoming ring signal where n is the ring type number.

☞ NOTE: COUNTRIES OTHER THAN THE U.S. MAY HAVE DIFFERENT SPECIFICATIONS FOR DIFFERENT RING TYPES. THE MANUFACTURER MAY APPEND OTHER SETS OF RING TYPE SPECIFICATIONS TO SUIT EACH COUNTRY'S NEEDS.

Extended Distinctive Ring (EDR)

Extended Distinctive Ring (EDR) is a special feature designed for single telephone line home use to receive fax or data calls without interfering with regular voice calls. When most users install a fax/modem at home, they won't subscribe to an extra telephone line for occasional fax or data calls; however, fax/data calls do come in from time to time.

If a user lets the fax/data software application answer, voice calls will be missed. On the other hand, if the user or an answering machine answers, fax or data calls may either be missed or the person who answers the call has to go through some procedure to get this call connected to the proper application. Either way is not desirable.

Once enabled with the proper settings, EDR can:

1. Detect the data/fax CNG tone without physically answering the call. After a CNG tone is detected, the modem will report RING or RING n to the application software. The software can cause the modem to answer the call.

2. Detect several DTMF tones without physically answering the call. The DTMF tones, once detected by the modem, will be reported as RING or RING n to the software application.

With these two functions, your modem can be installed with an answering machine or voice telephone set at home. In most cases, the modem should not be set to answer regular rings, nor to report them. Thus, the software will not instruct the modem to answer the call when the phone rings. When a call comes in, the answering machine will answer the phone and play a voice message. At this moment, the modem, having detected the ring signal is gone, will start to listen to the line for CNG tone or DTMF tones.

If the remote caller is an unattended fax machine, it will send a CNG tone for a period of time. The modem will detect the CNG tone and

report RING to the software immediately. The software application can then issue commands to answer the call and receive the fax. If the remote caller is using a fax phone which does not send out a CNG tone and is waiting for a fax answer tone in order to press the START button, the caller can press a designated DTMF tone, which will activate the modem to report and subsequently be ordered to answer the fax call.

Setting Up EDR

The new EDR can be used at home where multiple phones are installed in parallel. Once this function is enabled, the modem will go into EDR mode after the ring disappears, and it will be able to detect the data/fax CNG tone and DTMF tones, and report them as different types of rings. The EDR settings are defined in S-register S51.

S51 Bit-mapped register: (default: 0)

Bits	Bin.	Dec.	Description
(7,6)	00	0	Disable data CNG tone detection (default).
	01	64	Report RING for data CNG tone.
	10	128	Report RING 1 for data CNG tone.
	11	192	Report RING 3 for data CNG tone.
(5,4)	00	0	Disable Fax-CNG tone detection (default).
	01	16	Report RING for fax CNG tone.
	10	32	Report RING 1 for fax CNG tone.
	11	48	Report RING 2 for fax CNG tone.
(3,2)	00	0	Disable DTMF tone detection (default).
	01	4	Report RING for a DTMF tone.
	10	8	Report RING <DTMF> for a DTMF tone.
	11	12	Reserved
(1,0)	00	0	Disable EDR (default).
	01	1	Report RING twice.
	10	2	Report RING four times.

Bits	Bin.	Dec.	Description
	11	3	Report RING six times.

EDR detection (either CNG or DTMF tones) will be disabled once detection occurs. However, a customer's program might not answer because the setting of the software may require multiple rings to answer. S51 bits 0-1 control the number of rings that the modem will report once the CNG or DTMF tone is detected.

The timing relationship between the Caller ID (if enabled), EDR, and ring detection is as follows:

```
ring1    ring2    ring3
***--------***--------***----------------------------

          3sec  3s   3s   3s   S7 time-out

  +------+---+------+---+------+---+------------+----

 CID/EDR RD  EDR  RD EDR  RD    EDR      RD
```
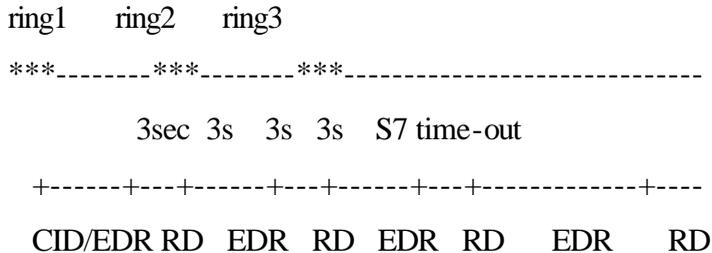
CID=Caller ID task   **RD**=Ring Detection task   **EDR**=EDR task

☞ **NOTE:**   DURING THE EDR PERIOD, ANY AT COMMAND WILL DISABLE THE EDR FUNCTION.

EDR Application Example

If we use ZFAX as our fax receiving application and we don't want it to answer the call unless it is a fax call, the way to set it up would be:

1. Set ZFAX to answer on 2 rings.

2. Set **S51.0=1** to enable EDR and report RING twice. The modem will not report a normal RING and ZFAX will not answer a call unless EDR RING is reported.

3. Set **S51.4=1** to enable fax CNG tone detection. It is reported as RING.

4. Set **S51.2=1** to enable DTMF tone detection. It is reported as RING. If the remote fax machine does not generate the CNG tone, ask a fax caller through your answering machine message to press "*" (or any other DTMF key) if he or she wants to send a fax.

Save the settings in a profile and reset the modem with **AT&WZ**.

7 **Fax Operation**

The U-336S/SA can be used as a fax machine. In the sections below, we will describe how the modem works as a fax machine, the ITU-T T.30 fax protocol, the Class 1,2, and 2.0 fax commands and ZyXEL extended fax AT commands. Also covered are the status report result codes, the flow control protocol associated with ZyXEL fax AT commands, and some specific fax applications. The instructions for using the included modem/fax/voice utility program are included on the software disk. Some distributors and dealers may have included other software with your modem. For help with such software, refer to the software instructions.

Fax Basics

Fax is the abbreviation for facsimile. There are four major parts in a fax machine: the scanner, encoding and decoding device, modem, and printer. Before a page can be sent, it is first scanned. The bit-mapped data is encoded with data compression and is then transmitted across the phone line by an internal modem module. The remote facsimile receives the data with its internal modem, decodes it back to bit-mapped image data, and prints it on paper.

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 or fax machine unless such message clearly contains in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business or other entity, or individual sending the message and the telephone number of the sending

machine or such business, or entity, or individual. In order to program this information into the fax function of your modem, please refer to the documentation of the fax software you will be using.

Modem as Fax Machine

Modems can also be designed to include a fax transmitting and receiving function similar to a fax card. Since the modem's interface with the computer is the standard serial RS-232 interface, this interface is used for both modem and fax operations. Fax image coding and decoding must be done in the computer. Modem/Fax, also called fax/modem, can be either an external stand-alone unit or a plug-in card. External stand-alone units can be connected to any computer with a standard RS-232 serial port.

Your modem supports Group 3 send and receive facsimile functions. For normal fax operation, you must connect the modem to a computer, usually a PC. The computer serves as the input/output device for the fax function. The RS-232 serial connection or the ZyXEL serial port interface connects you modem to the computer. Your modem uses the same interface for both data and fax applications. In fax operations, the modem performs protocol handshaking and image data transfer. The computer handles image data creation, capturing, conversion, compression, decompression, retrieval, and storage.

ITU-T T.30 Fax Protocol

The ITU-T T.30 fax protocol is known as the G3 fax handshake signals and procedures. The modem takes full control of this protocol - initiating and terminating fax calls, managing the communication session, and transporting the image data. Therefore, the modem relieves the computer fax software of the T.30 protocol handling.

You modem allows for fax speeds up to 14400 bps when transmitting to a fax machine which complies with the V.17 fax standard. Speeds will fall back to 12000, 9600, or 7200 bps in poor line conditions. When connecting to a G3 fax device, your modem allows for fax speeds up to 9600 bps and will automatically fall back to 7200, 4800, and 2400 bps if the line quality is poor.

Fax Command sets

The U-336S/SA supports four command sets for fax operation:

- Class 1 command set

- TIA PN-2388 Class 2 command set

- TIA 592 Class 2.0 command set

- ZyXEL Extended Fax AT command set

Defining the Fax Command Sets

The EIA Class 1 and Class 2 fax commands are a set of AT fax commands defined by EIA/TIA (Telecommunications Industry Association) for controlling fax/modems from a computer through the serial RS-232 interface. All fax/modems and fax software supporting this standard will be compatible with each other.

Class 1 commands control on-line modem negotiation while Class 2 commands allow the modem to do many negotiations simultaneously. The Class 1 protocol uses the modem to transmit fax data only. The complete organizational overhead for this protocol is handled by the connected computer. The Class 1 command set is also called the TIA-578 standard.

Several revisions of the class 2 standard exist. Implementations conforming to different revisions may not work together. A formally approved version is the Class 2.0 command set, also called the TIA-592 standard.

Class 1 Command Set

Command	Value	Description
+FCLASS=n		Service class selection
	n=0	Set to Data mode
	n=1	Set to Class 1 mode
	n=2	Set to Class 2 mode
	n=2.0	Set to Class 2.0 mode
	n=6	Set to ZFAX mode
	n=8	Set to Voice mode

✍ **NOTE:** IF S57.4=0 (DEFAULT), THE RESPONSE TO THE +FCLASS=? COMMAND WILL NOT REPORT CLASS 1 CAPABILITY. THIS IS DUE TO THE FACT THAT SOME FAX SOFTWARE PACKAGES MAY GET CONFUSED BY THIS RESPONSE.

Command	Value	Description
+FTS=n	0-255	Stop transmission and pause, in 10 ms units.
+FRS=n	0-255	Wait for silence, in 10 ms units.
+FTM=<MOD>		Transmit data with <MOD> carrier.
+FRM=<MOD>		Receive data with <MOD> carrier.
+FTH=<MOD>		Transmit HDLC data with <MOD> carrier.
+FRH=<MOD>		Receive HDLC data with <MOD> carrier.

The <MOD> parameter for the preceding commands take the following values:

Fax Operation 67

Value	Modulation	Speed	Requirements
3	V.21 ch. 2	300	required for FTH & FRH
+FTH and +FRH support value 3 (V.21 ch. 2 / 300 bps) only.			
24	V.27ter	2400	required for FTM & FRM
48	V.27ter	4800	required for FTM & FRM
72	V.29	7200	required for FTM & FRM
73	V.17	7200	required for FTM & FRM
74	V.17 w/st	7200	required for FTM & FRM
96	V.29	9600	required for FTM & FRM
97	V.17	9600	required for FTM & FRM
98	V.17 w/st	9600	required for FTM & FRM
121	V.17	12000	required for FTM & FRM
122	V.17 w/st	12000	required for FTM & FRM
145	V.17	14400	required for FTM & FRM
146	V.17 w/st	14400	required for FTM & FRM

* w/st means with V.17 short training

Class 2 Command Set

The following Class 2 commands are supported and implemented per
TIA PN2388 (8/20/90):

Command Syntax	Description
+<command>=<value>	Execute a command or set a parameter.
+<command>=?	Read permissible settings.
+<command>?	Read current setting.

Supported Commands (per TIA PN2388 8/20/90)

Command	Value	Description
+FAA=*n*		Auto-answer mode parameter:
	n=0	Answer as set by +FCLASS.
	n=1	DCE answers and auto-determines type.

Command	Value	Description
+FBADLIN= *<value>*	0-255	Bad line threshold (number of consecutive bad lines for a bad page parameter): Determine if Copy Quality OK on the T.30 flow chart . <value>=0 to 255; a value of 0 implies that error checking is disabled.
+FBOR=*n*		Phase C data bit order:
	n=0	Select direct bit order.
	n=1	Select reversed bit order in receiving mode for phase C data.
+FBUF?		Buffer size; read only parameter: Allow DTE to determine the characteristics of the DCE's buffer size.
+FCIG=*"string"*		Local fax station ID string, for polling Rx.
+FCLASS=*n*		Service class selection: Refer to +FCLASS Class 1 command in previous section.
+FCON		DCE responds fax connection .
+FCQ=*n*		Copy quality check capability parameter
	n=0	No copy quality check capability.
	n=1	Only check 1D phase C data.
	n=2	Check both 1D and 2D phase C data.
+FCR=*n*		"Capability to receive" parameter
	n=0	DCE will not receive message data or poll a remote device.
	n=1	DCE receives message data or polls a remote device.
+FDCC=*vr,br,wd ,ln,df,ec,bf,st*		DCE capabilities parameters.
	vr=0	Vertical resolution: Normal; 98 lpi.

Command	Value	Description
	vr=1	Vertical resolution: Fine; 196 lpi.
	br=0	Bit rate: 2400 bit/s; V.27ter.
	br=1	Bit rate: 4800 bit/s; V.27ter.
	br=2	Bit rate: 7200 bit/s; V.29 or V.17.
	br=3	Bit rate: 9600 bit/s; V.29 or V.17.
	br=4	Bit rate: 12000 bit/s; V.17.
	br=5	Bit rate: 14400 bit/s; V.17.
	wd=0	Page width: 1728 pixels in 215mm.
	wd=1	Page width: 2048 pixels in 255mm.
	wd=2	Page width: 2432 pixels in 303mm.
	ln=0	Page length: A4; 297mm.
	ln=1	Page length: B4; 364mm.
	ln=2	Page length: unlimited length.
	df=0	Data compression format: 1-D; modified Huffman.
	df=1	Data compression format: 2-D; modified Read.
	ec=0	Error correction disabled.
	ec=1	Enable error correction mode.
	bf=0	Disable binary file transfer.
	st=0	Minimum scan time/line: 0 ms.
	st=1	Minimum scan time/line: 5 ms.
	st=2	Minimum scan time/line:10 ms (normal); 5 ms (fine).
	st=3	Minimum scan time/line:10 ms.
	st=4	Minimum scan time/line:20 ms (normal); 10ms (fine).
	st=5	Minimum scan time/line:20 ms.
	st=6	Minimum scan time/line:40 ms (normal); 20ms (fine).
	st=7	Minimum scan time/line:40 ms.

Command	Value	Description
+FDCS=*vr,br,wd,ln,df,ec,bf,st*		Current session parameter; refer to +FDCC command.
+FDIS=*vr,br,wd,ln,df,ec,bf,st*		Current session negotiation parameter; refer to +FDCC command.
+FDR		Receive phase C data command; initiates document reception.
+FDT=*df,vr,wd,ln*		Transmit phase C data command: release the DCE to proceed with negotiation.
+FET=*n*		End of page or document command:
	n=0	More pages; same document.
	n=1	End of document; another document follows.
	n=2	No more pages or documents.
	n=4	Procedure interrupt; another page follows.
	n=5	Procedure interrupt; end of document, another document follows.
	n=6	Procedure interrupt; end of document.
+FK		Regular fax abort command.
+FLID=*"string"*		Local ID string parameter.
+FLO=*n*		Flow control options:
	n=0	No flow control.
	n=1	Set XON/XOFF software flow control.
	n=2	Set CTS/RTS hardware flow control.
+FLPL=*n*		Document for polling command:
	n=0	The DTE has no document available for polling.
	n=1	Indicate a document available for polling.
+FMDL?		Request DCE model .

Command	Value	Description
+FMFR?		Request DCE manufacturer .
+FMINSP=*n*		Minimum phase C speed parameter:
	n=0	2400 bps.
	n=1	4800 bps.
	n=2	7200 bps.
	n=3	9600 bps.
	n=4	12000 bps.
	n=5	14400 bps.
+FPHCTO= *<value>*	0-255	DTE Phase C response time-out: Determine how long the DCE will wait for a command after reaching the end of data when transmitting in Phase C. <value>=0 to 255; 100 ms units.
+FPTS=*n*		Page transfer status
	n=1	Received page good.
	n=2	Page bad; retrain requested.
	n=3	Page good; retrain requested.
	n=4	Page bad; procedure interrupt requested.
	n=5	Page good; procedure interrupt requested.
+FREL=*n*		Phase C received EOL alignment:
	n=0	The EOL patterns are bit aligned as received.
	n=1	The last received bits of EOL patterns are byte aligned by the DCE, with necessary zero fill bits inserted. Refer to TIA PN-2388 for details.
+FREV?		Request the DCE revision identification.
+FSPL=*n*		"Enable polling" command:
	n=0	Disable polling.

Command	Value	Description
	n=1	Enable polling.

All other +F commands are not supported, but the modem will respond OK. In many cases this means "don't care." See PN 2388 for command details.

Class 2 Command Responses

Response	Value	Function and Description
+FCFR		Confirmation .
+FCIG:"string"		Report remote ID response CIG.
+FCON		Facsimile connection response.
+FCSI:"string"		Report remote ID response CSI.
+FDCS:vr,br,wd,ln,df,ec,bf,st		Report session parameters response; refer to +FDCC=.... command.
+FDIS:vr,br,wd,ln,df,ec,bf,st		Report session negotiation parameters response; refer to +FDCC=.... command.
+FDTC:vr,br,wd,ln,df,ec,bf,st		Report remote capabilities response; refer to +FDCC=.... command.
+FET:n		Post page message response; refer to the +FET=n command.
+FHNG:n		Call termination status response.
	n=00	Normal and proper end of connection.
	n=10	Transmit error on phase A hang up code.
	n=20	Transmit error on phase B hang up code.
	n=40	Transmit error on phase C hang up code.
	n=50	Transmit error on phase D hang up code.
	n=70	Receive error on phase B hang up code.
	n=90	Receive error on phase C hang up code.
	n=100	Receive error on phase D hang up code.
+FNSC:"HEX string"		Report the non-standard facilities command frame.

Response	Value	Function and Description
+FNSF:"HEX string"		Report the non-standard facilities frame response.
+FNSS:"HEX string"		Report the non-standard setup frame response.
+FPOLL		Remote polling indication.
+FPTS:n		Receive page transfer status response; refer to +FPTS=n command.
+FTSI:"string"		Report remote ID response TSI.
+FVOICE		Transition to Voice response.

Class 2 Flow Control

Flow control is necessary to match the DTE-DCE data rate to the line signaling rate while transmitting or receiving Group 3 (T.4) data. In Class 2 fax mode, both hardware (RTS/CTS) and software (XON/XOFF) flow control are enabled.

Class 2.0 Command Set

Command Syntax	Description
+<command>=<value>	Execute a command or set a parameter.
+<command>=?	Read permissible settings.
+<command>?	Read the current setting.

Supported Commands

Command	Value	Description
+FAA=*n*		Auto-answer mode parameter:
	n=0	DCE answers as set by +FCLASS.
	n=1	DCE answers and auto-determines call type.
+FBO=*n*		Phase C data bit order:
	n=0	Select direct bit order.
	n=1	Select reversed bit order in receiving

Command	Value	Description
		mode for phase C data.
+FBS?		Buffer size parameter; read only.
+FCC=*vr,br,wd ,ln,df,ec,bf,st*		DCE capability parameter. Refer to +FDCC command in Class 2 for parameter settings.
+FCLASS=*n*		Service class selection. Refer to +FCLASS Class 1 command in previous section.
+FCO		DCE response fax connection made.
+FCQ=*<rq>,<tq>*		Copy quality check capability parameter
	rq=0	DCE Receive Copy Quality Checking disabled.
	rq=1	DCE Receive Copy Quality Checking enabled.
	rq=2	DCE Receive Copy Quality Correction enabled.
	tq=0	DCE Transmit Copy Quality Checking disabled.
	tq=1	DCE Transmit Copy Quality Checking enabled.
	tq=2	DCE Transmit Copy Quality Correction enabled.
+FCR=*n*		"Capability to receive" parameter
	n=0	DCE will not receive message or poll a remote device.
	n=1	DCE receives message data or polls a remote device
+FCT=*n*	0-255	DTE phase C time-out parameter. n=0-255, 1s units.
+FDR		Receive phase C data command initiates

Command	Value	Description
		document reception
+FDT		Transmit phase C data command: releases the DCE to proceed with negotiation
+FEA=*n*		Phase C received EOL alignment parameter
	n=0	Determine that T.4 EOL patterns are bit aligned (as received).
	n=1	Determine that the last received bits of T.4 EOL patterns are byte aligned by the DCE, with necessary zero fill bits inserted.
+FIE=*n*		Procedure interrupt parameter
	n=0	Procedure interrupt requests from the remote station are ignored, and not reported to the DTE.
	n=1	Procedure interrupt requests from the remote station are accepted, negotiated and reported using the +FVO response.
+FIP		Initialize facsimile parameters to factory default.
+FIS=*vr,br,wd,l n,df,ec,bf,st*		Current session parameter. refer to +FDCC Class 2 command in previous section parameter settings.
+FKS		Session termination command.
+FLI=*"string"*		Local ID string parameter.
+FLO=*n*		Flow control options:
	n=0	No flow control.
	n=1	Set XON/XOFF software flow control.
	n=2	Set CTS/RTS hardware flow control.
+FLP=*n*		Document for polling command:
	n=0	The DTE has no document for polling.
	n=1	Indicated document available for polling.

Command	Value	Description
+FMI?		Request DCE manufacturer identification.
+FMM?		Request DCE model identification.
+FMR?		Request DCE revision identification.
+FMS=*n*		Minimum phase C speed parameter. refer to +FMINSP Class 2 command in previos section for parameter settings.
+FNR=*rpr,tpr, idr, nsr*		Negotiation message reporting control parameters:
	rpr=0	Receiver parameters are not reported. +FIS: and +FTC: response reports are suppressed.
	rpr=1	Receiver parameters are reported. +FIS: and +FTC: response reports are generated.
	tpr=0	Transmitter Parameters are not reported. +FCS: response reports are suppressed. (+FCS parameter is still loaded)
	tpr=1	Transmitter Parameters are reported. +FCS: response reports are generated.
	idr=0	ID Strings are not reported. +FTI: +FCI: and +FPI: response reports are suppressed.
	idr=1	ID Strings are reported. +FNF:, +FNS: and +FNC: response reports are generated.
	nsr=0	Non-standard frames are not reported. +FTI: +FCI: and +FPI: response reports are suppressed.
	nsr=1	Non-standard frames are reported. +FTI:, +FCI: and +FPI: response reports are generated.

Command	Value	Description
+FNS=*"string"*		Non-standard byte string parameter. "string": string of hexadecimal coded octets.
+FPI=*"string"*		Local fax station ID string, for polling Rx.
+FPR=*n*		Serial port rate control parameter:
	n=0	Automatic DTE rate detection by the DCE.
	n>0	Serial rate is fixed at the value multiplied by 2400 bps. For example, when n=8, the DTE rate is equal to 19200 bps (8x2400).
+FPS=*n*		Page transfer status: refer to the +FPTS Class 2 command in previous sections for settings.
+FRQ=*pgl,cbl*		Receiving quality threshold parameters:
	pgl= 0-64 (HEX value)	Specify the percentage of good lines (e.g. with negotiated number of pixels) required for a page considered acceptable. The percentage of good lines would be computed by the equation: $100 \times (<lc> - <bl>) / <lc>$ lc: total line count as reported in the +FPS: response. bl: bad line count as reported in the +FPS: response. If the resulting value is less than the value in <pgl>, the page is unacceptable.
	cbl= 0-FF (HEX value)	Specify the maximum tolerable number of consecutive bad lines. If this value is exceeded for a given page, the DCE shall consider the page unacceptable.
+FSP=*n*		Enable polling command:

Command	Value	Description
	n=0	Disable polling.
	n=1	Enable polling.

Class 2.0 Command Responses

Response	Value	Function and Description
+FCI:"CSI ID string"		Report remote ID response, Called Station ID
+FCO		Fax connection established response.
+FCS:*vr,br,wd,ln ,df,ec,bf,st*		negotiated session parameters (DCS frame information) response. Refer to +FIS= comnd.
+FET:<ppm>		Post page message response:
	ppm=0	Another page next, same document.
	ppm=1	Another document next.
	ppm=2	No more pages of documents.
	ppm=3	Another page next, same document, procedure interrupt requested.
	ppm=4	Another document next, procedure interrupt requested.
	ppm=5	No more documents or pages, procedure interrupt requested.
+FHS:<hsc>		Call termination status:
	hsc= 0-0F	Call placement and termination. Refer to TIA-592 for details.
	hsc= 10-1F	Transmit phase A and miscellaneous errors. Refer to TIA-592 for details.
	hsc= 20-3F	Transmit phase B hang up codes. Refer to TIA-592 for details.
	hsc= 40-4F	Transmit phase C hang up codes. Refer to TIA-592 for details.
	hsc= 50-6F	Transmit phase D hang up codes. Refer to TIA-592 for details.

Response	Value	Function and Description
	hsc= 70-8F	Receive phase B hang up codes. Refer to TIA-592 for details.
	hsc= 90-9F	Receive phase C hang up codes. Refer to TIA-592 for details.
	hsc= A0-BF	Receive phase D hang up codes. Refer to TIA-592 for details.
+FIS:*vr,br,wd,ln,* *df,ec,bf,st*		Remote fax station capabilities (DIS frame information) response refer to +FIS=... command for a description of sub-parameters.
+FNC: "NSC FIF string"		Report NSC (non-standard Commands) frame
+FNF: "NSF FIF string"		Report NSF (non-standard Facilities) frame.
+FNS: "NSS FIF string"		Report NSS (non-standard Setup) frame.
+FPI: "CIG ID string"		Report remote ID response-Polling Station ID (CIG).
+FPO		Remote polling indication.
+FPS:*ppr,lc,blc,c* *blc,lbc*		.30 phase C page reception response:
	ppr=1	Received page good.
	ppr=2	Page bad; retrain requested.
	ppr=3	Page good; retrain requested.
	ppr=4	Page good; remote request for procedure interrupt accepted.
	ppr=5	Page bad; retrain requested; remote request for procedure interrupt accepted.
		The receiving DCE may count <lc>, <blc>, <cblc> and <lbc> due to DCE

Response	Value	Function and Description
		buffer overflow and report them:
		lc: line count
		blc: bad line count
		cblc: maximum consecutive bad line count
		lbc: lost byte count
+FTC:*vr,br,wd,ln,df,ec,bf,st*		Remote fax station capabilities (DCT frame information) response refer to +FIS=... command for the description of sub-parameters.
+FTI: "TSI ID string"		Remote ID response-Transmit Station ID (TSI).
+FVO		Report transition to voice.

Extended Fax AT Command Set

Extended Fax AT Commands are unique to ZyXEL modems. The computer controls the modem through a set of extended fax AT commands and the modem responds with a set of status report result codes. During data state, compressed fax image data is flowing between the modem and computer. The default serial connection speed is 38400 bps, and it is higher than the fax link rate. CTS/RTS hardware flow control is used to regulate the data flow.

Your modem accepts the extended fax AT commands to set the modem mode and fax parameters. Besides the extended fax AT commands, the modem accepts all the other AT commands described in this chapter. For instance, you can use ATD to make a fax call, or ATA to answer an incoming fax call. When using the extended Fax AT commands, you need to send the command AT+FCLASS=6 first. Following are the fax related AT commands:

Mode Setting

Command	Function
#F	Set the modem into V17G3 FAX mode same function as the extended AT command AT&N32.
#B0	Set fax receiving mode. The connection parameters and received fax data are sent to DTE continuously following the connect message. (Default)
#B1	Set fax receiving mode. The messages are separated from the received fax data. The modem sends CONNECT FAX and ZyXEL first, then it waits for the DC2 character (hex18) to send the fax data. When the modem receives a DC2 from the DTE, it starts to send the fax connection parameters/SnnnnVnTnRnLnCnP<string><CR><LF> then the received fax data. In this mode, the modem will wait for DC2 at the beginning of every page. The DTE software should detect the page separator RTC and then sends the DC2 to receive the next page of fax data. This mode is used with a BBS receiving faxes.
#B2	This mode is for the polling feature of the modem. In this mode, the modem will send a polling signal to the remote fax device to ask to receive a fax from the remote fax device. The received fax data will be sent to the DTE continuously following the connection message.
#B3	Displays the ring cadence.

Parameter Setting

Command	Function
#V0	Set to normal vertical resolution.
#V1	Set to high vertical resolution.
#T0	Set to one dimensional coding scheme.

Command	Function
#T1	Set to two dimensional coding scheme.
#R0	Set recording width: 1728 picture elements along a scan line length of 215 mm.
#R1	Set recording width: 2048 picture elements along a scan line length of 255 mm.
#R2	Set recording width: 2432 picture elements along a scan line length of 303 mm.
#L0	Set maximum recording length: A4 (297 mm).
#L1	Set maximum recording length: B4 (364 mm).
#L2	Set maximum recording length: unlimited.
#C0	Set minimum scan line time capability of the receiver: 20 ms at 3.85 line/mm, T(7.7)=T(3.85).
#C1	Set minimum scan line time capability of the receiver: 5 ms at 3.85 line/mm, T(7.7)=T(3.85).
#C2	Set minimum scan line time capability of the receiver: 10 ms at 3.85 line/mm, T(7.7)=T(3.85).
#C3	Set minimum scan line time capability of the receiver: 20 ms at 3.85 line/mm, T(7.7)=1/2 T(3.85).
#C4	Set minimum scan line time capability of the receiver: 40 ms at 3.85 line/mm, T(7.7)=T(3.85).
#C5	Set minimum scan line time capability of the receiver: 40 ms at 3.85 line/mm, T(7.7)=1/2 T(3.85).
#C6	Set minimum scan line time capability of the receiver: 10 ms at 3.85 line/mm, T(7.7)=1/2 T(3.85).
#C7	Set minimum scan line time capability of the receiver: 0 ms at 3.85 line/mm, T(7.7)=T(3.85).
#P*<string>*	Set local phone number to the phone number following the character 'P' can store up to 25 characters. The modem will exchange this phone number with the remote fax machine during initial handshaking.

Status Report Result Codes

When the U-336S/SA is in fax mode, each ATD or ATA command will make the modem try to establish a fax connection. Your modem will send a status report result code back to the DTE (computer).

NO DIAL TONE	Tried to dial but no dial tone is detected.
NO CARRIER	Handshake fails or no carrier is detected or time-out.
BUSY	Other party's phone line is busy.
NO ANSWER	Quiet answer is not detected before time-out.
CONNECT FAX	See below.

When a fax connection is successfully established, the modem returns this message:

```
CONNECT FAX/SnnnnVnTnRnLnCnP<string>
```

This message includes the connection speed and the fax parameters explained in the table below.

Field	Description
S*nnnn*	Fax connection speed; nnnn is a 4-digit number representing the connection speed. nnnn =1440, 1200, 9600, 7200, etc., 1440 and 1200 stand for 14400 and 12000.
V*n*	Vertical resolution; n = 0 or 1.
T*n*	Coding scheme; n = 0 or 1.
R*n*	Recording width; n = 0, 1, or 2.
L*n*	Recording length; n = 0, 1, or 2.
C*n*	Scan line time; n = 0 to 7.
P*<string>*	Remote fax number.

After each fax disconnection, the following result code is sent back to the DTE:

```
DISCONNECTnP<string>
```

This result code informs DTE of the disconnecting status.

Field	Description
DISCONNECT0	Disconnect with remote confirmation.
DISCONNECT1	Disconnect without remote confirmation.
P<string>	Remote fax number.

The basic AT commands ATV0 and ATQ1 do not affect the above CONNECT and DISCONNECT status report result codes. The modem will always return the same status format as above.

Flow Control

In extended fax AT command mode, the U-336S/SA always uses hardware (CTS/RTS) flow control. The flow control signaling used sending a fax is:

- CTS is used by your modem for DTE flow control. When the modem turns CTS off, the buffer inside the modem is full and cannot accept any more data. The computer should send data only when CTS is ON.

- RTS is used by the computer to signal your modem that the fax message is finished. As soon as RTS off is detected, the modem starts the post message handshaking to make sure that the remote facsimile has received the fax message successfully. Then it hangs up the phone and sends a status report to the DTE.

If you want to send a multi-page fax, just add the RTC signal between the fax message of two pages. The modem detects the RTC signal

automatically, handshakes the multi-page procedure with the remote facsimile and sends the next page.

The following flow control signaling is used while receiving a fax:

- CTS is not used when receiving fax.

- RTS is used to inform your modem that the computer cannot accept data at this moment. The modem will not pass received data to the DTE if RTS is turned off.

When finished receiving the fax message, your modem will turn off CD then send a status report result code to the DTE.

Fax Reception from a BBS

The U-336S/SA can automatically detect data and fax calls and allow BBS software to receive faxes on the same phone line. To allow your BBS to receive incoming faxes, make the following set-up changes in your BBS:

1. Add the string #B1+FCLASS=6 to the init string. Be sure the +FCLASS=6 command is the last command.

2. Change one of the messages in the list to CONNECT FAX.

3. Set the external mail string to ZyXEL and give it an error level.

4. In your BBS batch file, if the error level matches the external mail, execute

   ```
   rcvfax 2 /p:comport [/w:workpath]
   ```

   This setting will enable the BBS to receive a fax and store it automatically.

The following is a sample setting for the FrontDoor system.

- Add these commands to the init string:

  ```
  X7#B1+FCLASS=6
  ```

- Change the connection message to:

300	CONNECT	4800	CONNECT 4800
1200	CONNECT 1200	9600	CONNECT 7200
1275	CONNECT FAX	19200	CONNECT 9600
2400	CONNECT 2400	38400	CONNECT 14400

- Set external mail as:

String	Error Level
1 ZyXEL	100
2	
3	

The following is a sample setting in the BINKLEY.CFG file for a Binkley system.

```
Init AT&FX7S0=1#B1+FCLASS=6
ExtrnMail ZyXEL errorlevel
```

8 **AT Command Set Summaries**

Basic AT Command Set

Command	Options	Function & Description	Ref.
A/		Re-execute the last command once.	
A>		Re-execute the last command once or repeat the last call up to 9 times. (See also S8)	
\<any key\>		Terminate current connection attempt when enter in handshaking state.	
+++		Escape sequence code, entered in data state, wait for modem to return to command state.	

All the Following Commands Require a "AT" Prefix:

Command	Options	Function & Description	Ref.
A		Go on-line in answer mode. (See also S39.2, S43.6)	
Bn		Handshake option.	S28.7
	B0 *	Select CCITT V.22 for 1200 bps	
	B1	Select Bell 212A for 1200 bps communication.	
D*s*		Dial s (numbers and options) that follow (see also S38.0, S35.4). The options of s are listed as follows:	

Command	Options	Function & Description	Ref.
	0-9, #, *	Digits for dialing	
	P	Pulse dialing	S23.1
	T	Ton dialing	S23.1
	,	Pause for a time specified in S8. Remaining digits will be dialed as in-band DTMF.	
	;	Return to command state after dialing	
	!	Hook flash	
	@	Wait for a 5 second silence before proceeding	
	R	Reverse handshake (go on-line in Answer mode)	S17.5
	W	Wait for second dial tone. Remaining digits will be dialed as in-band DTMF	
DL		Repeat last ATD command	
DS*n*	n=0-49	Dial number stored in non-volatile RAM at location 'n'; use "+" to dial two consecutive numbers for bundling or MPPP calls	S44.3
E*n*		Command mode local echo of keyboard commands	S23.0
	E0	Echo off	
	E1 *	Echo on	
H*n*		On/off hook control	
	H0 *	Hang up (on-hook) the modem or ISDN, same as 'ATH'	
	H1	Off hook the modem	
I*n*		Display inquired information	
	I0	Display numerical product code, same as 'ATI'	

Command	Options	Function & Description	Ref.
	I1	Display product information and ROM checksum	
	I2	Display modem link status report	
	I12	Display physical layer status	
L*n*	n=0-7 4 *	Speaker volume control. The higher the value, the higher the volume	S24.5-7
M*n*		Speaker control	S21.1-2
	M0	Speaker always OFF	
	M1 *	Speaker ON until call is answered	
	M2	Speaker always ON	
	M3	Speaker ON after the last digit is dialed out and OFF when carrier is detected	
N*n*	n=0-7 5 *	Ring volume control.'N0' will disable the audio ring function	S24.1-3
O		Return to on-line state	
O1		Force modem to request a retrain	
Q*n*		Result code displayed	S23.7
	Q0 *	Modem returns result code	
	Q1	Modem does not return result code	
	Q2	Modem returns result code but quiet after answering on a RING (see also S42.2)	S40.1
Sr.b=*n*		Set bit 'b' of S-register 'r' to value 'n'. 'n' is a binary digit '0' or '1'	
Sr.b?		Display value of bit 'b' of S-register 'r'	
Sr=*n*		Set S-register 'r' to value 'n'. 'n' must be a decimal number between 0 and 255	
Sr?		Display value stored in S-register 'r'	

Command	Options	Function & Description	Ref.
T		Ton dial	S23.1
UPX		Download firmware to the Flash EPROM by using Xmodem protocol	
V*n*		Sets display type for Result Codes	S23.6
	V0	Display result code in numeric form. (See also S35.7 and the result code table of 'ATXn')	
	V1 *	Display result code in verbose form.	
X*n*	n=0-7 5 *	Result code options, see the Options Table	S23.3-5
Z*n*	n=0-4	Reset modem and set power-on profile.	S15.5-7
	Zn	Reset modem and load user profile n (0-3).	
	Z4	Reset modem and load factory settings.	
$		Basic command summary help	
&$		Extended 'AT&' command summary help	
*$		Extended 'AT*' command summary help	

Description of ATI2 Output:

The Link Status Report output appears as follows:

```
ZyXEL MODEMS LINK STATUS REPORT


Chars Sent       0 Chars Received    0
Octets Sent      0 Octets Received   0
Blocks Sent      0 Blocks Received   0
```

```
Blocks Resent     0 Max Outstanding   0
Max Block Size    0 Retrains Requested
                  0
Link Duration     0 Retrains Granted  0
FRN Requested     0 FRN Granted       0
FCS Errors        0 Round Trip Delay  0
Xmitter Underrun  0 Receiver Overrun  0
Last Speed/Protocol 33600
Disconnect Reason   Local hang up
```

Data Type	Description
Chars	Data received from or sent to DTE (PC). (Formatted as 7,E,1 or 7,O,1 or 8,N,1 etc.)
Octets	Data received from or sent to remote modem in error control mode. (Compressed if data compression was enabled.)
Block	Framed Octets. (Delimited by the unique bit pattern "01111110" known as a flag.)

Output Parameter	Output Value Description
Chars Sent	Number of characters DTE has sent to modem
Chars Received	Number of characters modem has sent to DTE
Octets Sent	Number of data bytes sent to remote modem
Octets Received	Number of data bytes received from remote modem
Blocks Sent	Number of data blocks sent to remote modem
Blocks Received	Number of data blocks received from remote modem

Output Parameter	Output Value Description	
Blocks Resent	Number of blocks resent due to remote modem request. (If there were many blocks resent, you may have experienced line trouble or protocol incompatibility.)	
Max Outstanding	Maximum blocks received without acknowledgment by remote modem.	
Max Block Size	Maximum octets contain in a block	
Retrains Requested	The number of times local modem requested retrain.	
Link Duration	Total link duration time (in minutes).	
Retrains Granted	The number of times remote modem requested retrain.	
T401 Time-outs	For protocol maintenance, modem probably recovered.	
T402 Time-outs	For protocol maintenance, modem probably recovered.	
FCS Errors	Errors in frame (block) checksum. (If there were many FCS Errors, you may have experienced problems on the line.)	
Round Trip Delay	Time (Units 1/2400 sec.)	
Xmitter Underrun	For modem's processor power measurement.	
Receiver Overrun	For modem's processor power measurement.	
Disconnect Reason	Local Hang-up	Remote Hang-up
	Carrier Lost	On-Line (Not disconnected)
	Resent Expiration	Protocol Error

Output Parameter	Output Value Description	
	Break Time-out	DTR Dropped
	Carrier Lost 1 (No handshaking response)	Carrier Lost 2 (Remote hang-up, busy tone)
	Security check ATH command D/V hang up	Keyboard Abort Inactivity

Extended AT& Command Set

Command	Options	Function & Description	Ref.
&Bn		Data rate, terminal-to-modem. (DTE/DCE)	S28.6
	&B0	DTE rate follows connection rate. (See also S44.6)	
	&B1 *	DTE/DCE rate fixed at DTE setting (See also S18, S20, and S44.6)	
&Cn		Carrier Detect (CD) options	S21.4
	&C0	CD always ON (See also S42.7)	
	&C1 *	CD tracks presence of carrier (See also S38.3, S42.7)	
&Dn		Data Terminal Ready (DTR) options. (See also S25)	S21.6-7
	&D0	Ignore DTR signal, assume DTR is always ON.	
	&D1	108.1, DTR OFF-ON transition causes dial of the default number. (See also 'AT*Dn' and S48.4)	
	&D2 *	108.2, Data Terminal Ready, DTR OFF causes the modem to hang up.	

Command	Options	Function & Description	Ref.
	&D3	Same as &D2 but DTR OFF causes the modem to hang up and reset from profile 0.	
&F		Load factory settings to RAM as active configuration.	
&Gn		Guard tone options	S28.4-5
	&G0 *	No guard tone (within USA, Canada).	
	&G2	1800 Hz guard tone.	
&Hn		Data flow control, DTE/DCE.	S27.3-5
	&H0	Flow control disabled.	
	&H3 *	Hardware (CTS/RTS) flow control	
	&H4	Software (XON/XOFF) flow control.	
&Jn		Type of Phone line	S28.0
	&J0	Single phone line, RJ-11	
	&J1	Multiple phone/modem line, RJ12/RJ13	
&Kn		Modem error control and data compression.	S27.0-2
	&K0	No error control.(Same as AT&K)	
	&K1	MNP4 (See also S41.0).	
	&K2	MNP4+MNP5 (See also S38.5, S41.0).	
	&K3	V.42+MNP4.	
	&K4 *	V.42+V.42bis, compatible with &K2 (See also S38.5).	
&Ln	&L0 *	Dial-up line	S14.2-3
	&L1	2W leased line	
	&L2	4W leased line	
&Mn		Synchronous/asynchronous mode	S14.6-7

Command	Options	Function & Description	Ref.
		selection	
	&M0 *	Asynchronous mode with data buffering	
	&M1	Asynchronous command, synchronous data	
	&M2	Direct asynchronous mode, no data buffering	
	&M3	Synchronous mode	
&Nn		Modem link mode options (DCE/DCE). (See also S43.7, S48.1)	S19
	&N0 *	Multi-Auto, auto negotiate highest possible link rate: V.34, ZyX 19200, ZyX16800, V.32bis, V.32, V.22bis, V.22 and Bell 212A, G3 Fax V.17/V.29/V.27ter and cellular modes. (See also S38.4, S43.0, S43.1, S43.3 and S48.5)	
	&N1	V.33 14400/12000 (models with 4-wire leased lines only)	
	&N2	V.33 12000 (models with 4-wire leased lines only)	
	&N3	V.32 9600T/9600/7200T/4800	
	&N4	V.32 9600/7200/4800	
	&N5	V.32 4800	
	&N6	V.29 9600 (models with 4-wire leased lines only)	
	&N7	V.29 7200 (models with 4-wire leased lines only)	
	&N8	V.29 4800 (models with 4-wire	

Command	Options	Function & Description	Ref.
		leased lines only)	
	&N9	V.27bis 4800 (models with 4-wire leased lines only)	
	&N10	V.27bis 2400 (models with 4-wire leased lines only)	
	&N11	V.26bis 2400 (models with 4-wire leased lines only)	
	&N12	V.23 1200/75 (See also S48b3, S52b7)	
	&N13	V.23 600/75 (See also S52b7)	
	&N14	V.22bis 2400/1200	
	&N15	V.22 1200	
	&N16	V.21 300	
	&N17	V.32bis 14400/12000/9600/7200/4800	
	&N18	V.32bis 12000/9600/7200/4800	
	&N19	V.32bis 7200/4800	
	&N24	BELL 212A 1200	
	&N25	BELL 103 300	
	&N32	G3 Fax V.17/V.29/V.27ter 14400/12000/9600/7200/4800/2400 (See also S42.4).	
	&N34	ZyXEL 19200	
	&N35	ZyXEL 16800	
	&N36	ZyXEL 14400	
	&N37	ZyXEL 12000	
	&N38	ZyXEL 9600	
	&N39	ZyXEL 7200	
	&N42	CELL 14400	
	&N43	CELL 12000	

Command	Options	Function & Description	Ref.
	&N44	CELL 9600	
	&N45	CELL 7200	
	&N46	CELL 4800T	
	&N60	V.34 33600	
	&N61	V.34 31200	
	&N62	V.34 28800	
	&N63	V.34 26400	
	&N64	V.34 24000	
	&N65	V.34 21600	
	&N66	V.34 19200	
	&N67	V.34 16800	
	&N68	V.34 14400	
	&N69	V.34 12000	
	&N70	V.34 9600	
	&N71	V.34 7200	
	&N72	V.34 4800	
	&N73	V.34 2400	
&Pn		Pulse dial make/break ratio	S23.2
	&P0 *	make / break, 39% / 61%	
	&P1	make / break, 33% / 67%	
&Rn		RTS (Request To Send) function selection	S21.5
	&R0	CTS tracks RTS, response delay is set in S26	
	&R1 *	Ignore RTS, assumes RTS always ON	
&Sn		Data Set Ready (DSR) function selection.	S21.3
	&S0 *	DSR overridden, DSR always ON.	
	&S1	DSR according to CCITT (ITU-	

Command	Options	Function & Description	Ref.
		TSS). (See also S41.5, S44.4)	
&Tn		Modem testing.	S16
	&T0	Terminate test in progress.	
	&T1	Initiate Analog Loop-back (ALB) test.	
	&T3	Initiate Local Digital Loop-back (LDL) test	
	&T4	Grant Remote Digital Loop-back request from remote modem	S14.1
	&T5	Deny Remote Digital Loop-back request from remote modem	S14.1
	&T6	Initiate Remote Digital Loop-back (RDL) test	
	&T7	Initiate Remote Digital Loop-back with self test (RDL+ST)	
	&T8	Initiate Analog Loop-back with self test. (ALB+ST)	
&Vn		View profile settings.	
	&V0	View current active settings.	
	&Vn	View the (n-1) user profile settings (n=1-4)	
	&V5	View factory default settings.	
&Wn	n=0-3	Write current settings to user profile n in non-volatile RAM. (See also S35.6)	
&Xn		Synchronous mode timing (clock) source selection	S14.4-5
	&X0 *	Modem provides synchronous transmit clock signal (Internal clock to pin 15 of EIA-232D)	

Command	Options	Function & Description	Ref.
	&X1	Terminal provides synchronous transmit clock signal (External clock from pin 24 of EIA-232D)	
	&X2	Received carrier provides synchronous transmit clock signal (Remote or Slave clock to pin 15 of EIA-232D)	
&Yn		Break handling. Destructive Break clears the buffer. Expedited Break is sent immediately to the remote system. (For internal modem only.)	S28.2-3
	&Y0	Destructive, expedited.	
	&Y1 *	Nondestructive, expedited.	
	&Y2	Nondestructive, unexpedited.	
&Z?		Display all the phone numbers stored in non-volatile RAM.	
&Zn=s	n=0-49	Write phone number/s to NVRAM at location n (n=0-49) use AT*Dn or ATS29=n to set the default dial pointer.	

Extended AT* Command Set

Command	Options	Function & Description	Ref.
*Cn		Character length, including start, stop and parity bit.	S15.3-4
	*C0 *	10-bit character length.	
	*C1	11-bit character length.	
	*C2	9-bit character length.	
	*C3	8-bit character length.	
*Dn	n=0-49	Set default dial pointer at telephone	S29

Command	Options	Function & Description	Ref.
		directory location n.	
	*D0 *	(See also S35.4 and S38.0)	
*En		Modem error control negotiation.	S21.0
	*E0 *	if error control negotiation fails, keep the non-error control connection.	
	*E1	If error control negotiation fails, disconnect the call (hang-up).	
*Fn		Remote configuration enable	S36.0
	*F0 *	Deny remote configuration	
	*F1	Accept remote configuration (Remote Digital Loop-back must be granted, &T4)	
*Gn		Security function selection	S36.5-7
	*G0 *	Disable security function	
	*G1	Enable type 1 security, with password check (ZyXEL to ZyXEL only)	
	*G2	Enable type 1 security, with password check and call back (ZyXEL to ZyXEL only)	
	*G3	Enable type 2 security, with password check	
	*G4	Enable type 2 security, with password check and call back	
	*G5	Enable type 2 security, with password check and call back, remote user enters the call back number	
*Hn	n=0-49	Modify user password table at location n.	
*HS		Modify supervisory password (Default: "ZyXEL")	

Command	Options	Function & Description	Ref.
*In		Command set selection	S17.6-7
	*I0 *	AT command set	
	*I1	V.25bis command set	
	*I2	Dumb mode	
*Mn		Leased line auto-handshake mode selection	S14.0
	*M0	Set to Originate mode	
	*M1	Set to Answer mode	
*Pn	n=0-15 *P9 *	Set leased line transmission power level; ranges from 0 dBm to -15 dBm (default: -9 dBm) (see also S35.3)	S17.1-4
*Qn		Action taken when line quality changes.	S27.6-7
	*Q0	No action to poor signal quality.	
	*Q1	Retrain action taken if signal quality is poor. (See also S41.2)	
	*Q2 *	Adaptive rate, automatic fall-back or forward.	
	*Q3	Disconnect if signal quality is poor.	
*Rab		Read remote profile "b" to local user profile "a"	S36.1
	a=0-3	Local user profile number "a"	S37.4-7
	b=0-3	Remote user profile number "b"	S37.0-3
	b=4	Remote active configuration	
	b=5	Remote factory default configuration	
*Sn		Secondary channel options	
	*S0 *	Secondary channel disabled	
	*S1	Secondary channel enabled	
*T		Recall the last CND (Caller ID) information.	S40.2

Command	Options	Function & Description	Ref.
*V		View the Password table	
*Wab		Write local configuration profile "a" to remote user profile "b" and reset remote modem from profile "b"	S36.1
	a=0-3	Local user profile number "a"	S37.4-7
	a=4	Local active configuration	
	a=5	Local factory default configuration	
	b=0-3	Remote user profile number "b"	S37.0-3

The AT+F commands are located in the chapter 7 Fax Operation

9 **Status Registers & Result Codes**

S-Register Descriptions

In most bit-mapped S-registers, the default bit value is 0. Non-0 default values are followed by an asterisk. In some cases, default values are shown in the reference column preceded by +. Some bits are reserved for factory use and should not be changed.

Basic S-Registers "ATSn=x"

Command	Function & Description	+Ref.
S0=	Set the number of rings on which the modem will answer. 0 value disable auto-answer	+000
S1=	Counts and stores number of rings from an incoming call	+000
S2=	Define escape code character, default '+' (43 dec.). A value of 128-255 disables the escape code	+043
S3=	Define ASCII Carriage Return	+013
S4=	Define ASCII Line Feed	+010
S5=	Define ASCII Backspace. A value of 128-255 disables the Backspace key's delete function	+008
S6=	Set the number of seconds the modem waits before dialing if 'X0' or 'X1' is selected. If a setting of 'X2' to 'X7' is selected, the modem will dial as soon as it detects a dial tone. This	+003

Command	Function & Description	+Ref.
	register also sets the time-out interval for the "W" dial modifier to wait for the dial tone. (See also S41b4)	
S7=	Set duration, in number of seconds modem waits for a carrier	+060
S8=	Set duration, in seconds, for pause (,) option in Dial command and pause between command re-executions for Repeat (>) command	+002
S9=	Set duration, in tenths of a second of remote carrier signal before recognition (Ignored if in non-FSK or half-duplex operation)	+006
S10=	Set duration, in tenths of a second, modem waits after loss of carrier before hanging up	+007
S11=	Set duration and spacing, in milliseconds, of dialed Touch-Tones	+070

Extended S-Registers "ATSn=x"

Command	bit	dec	hex	Function and description	Ref.
S13=	bit	dec	hex	Bit-mapped register	+000
	1	2	2	Capture modem manufacturer information during V.42 handshake, can be displayed at ATI2 <Last Speed/Protocol> line if available ('Flash' or 'ZyXEL' stands for ZyXEL connection)	
S14=	bit	dec	hex	Bit-mapped register:	+002
	0	0	0	Modem auto-handshake on Originate mode	*M0
		1	1	Modem auto-handshake on Answer mode	*M1

Command	bit	dec	hex	Function and description	Ref.
	1	0	0	Grant Remote Digital Loop-back test request	&T4
		2	2	Deny Remote Digital Loop-back test	&T5
	3,2	0	0	Dial-up line (Default)	&L0
		4	4	2-wire leased line	&L1
		8	8	4-wire leased line	&L2
	5,4	0	0	Internal clock (Default)	&X0
		16	10	External clock	&X1
		32	20	Remote clock	&X2
	7,6	0	0	Asynchronous data with buffering (Default)	&M0
		64	40	Asynchronous command, synchronous data	&M1
		128	80	Direct asynchronous, no data buffering	&M2
		192	C0	Synchronous	&M3
S15=	bit	dec	hex	Bit-mapped register	+130
	0,1	0	0	Even parity	
		1	1	Odd parity	
		2	2 *	No parity	
	2	0	0 *	1 stop bit	
		4	4	2 stop bits	
	4,3	0	0 *	10 bit character length	*C0
		8	8	11 bit character length	*C1
		16	10	9 bit character length	*C2
		24	18	8 bit character length	*C3
	7-5	0	0	Profile 0 as active settings after power on	Z0
		32	20	Profile 1 as active settings after	Z1

Command	bit	dec	hex	Function and description	Ref.
				power on	
		64	40	Profile 2 as active settings after power on	Z2
		96	60	Profile 3 as active settings after power on	Z3
		128	80 *	Factory default as active settings after power on	Z4
S16=		dec	hex	Test status register	+000
		0	0	No test in progress	&T0
		1	1	Loop-back test in progress	&T1
		3	3	Local Digital Loop-back test in process	&T3
		6	6	Remote Digital Loop-back test in process	&T6
		7	7	Remote Digital Loop-back with self-test in process	&T7
		8	8	Analog Loop-back with self test in progress	&T8
S17=	bit	dec	hex	Bit-mapped register	+018
	0	0	0	Disable secondary channel (default)	*S0
	4-1	0-30	0-1E	Set leased line transmit power level from 0 to -15 dBm. (See also S35b3) (Default *P9)	*Pn
	5	0	0	Normal dial (Default)	D
		32	20	Reverse dial, go on-line in answer mode.	DR
	7,6	0	0	AT Commands set (Default)	*I0
		64	40	V.25bis command set	*I1
		128	80	Dumb mode (no command	*I2

Command	bit	dec	hex	Function and description	Ref.
				accepted)	
S18=		dec	hex	Force modem to fix baud rate when answering	+000
		0 *	0	Disable fixed baud function	
		1-46	1-2E	Enable baud rate to be fixed when answering. Baud rate value settings (n) the same as S20	
S19=		dec	hex	Modem connection mode, same	+000/ &Nn
		0-73	0-49	setting value as 'AT&Nn' command	
S20=		dec	hex	DTE speed (bps). Auto detected from AT Command	+003
		0	0	230400 bps	
		1	1	115200 bps (Default)	
		2	2	76800 bps	
		3	3	57600 bps	
		4	4	38400 bps	
		5	5	19200 bps	
		6	6	16800 bps	
		7	7	14400 bps	
		8	8	12000 bps	
		9	9	9600 bps	
		10	A	7200 bps	
		11	B	4800 bps	
		12	C	2400 bps	
		13	D	1200 bps	
		14	E	460800 bps	
		15	F	300 bps	
		16	10	307200 bps	

Command	bit	dec	hex	Function and description	Ref.
		17	11	153600 bps	
		18	12	102400 bps	
		20	14	61440 bps	
		21	15	51200 bps	
		22	16	624000 bps	
		24	18	124800 bps	
		25	19	62400 bps	
		26	1A	41600 bps	
		27	1B	31200 bps	
		28	1C	24960 bps	
		29	1D	20800 bps	
		46	2E	921600 bps	
Note: Only the speeds up to S20=15 are supported by auto speed detection.					
S21=	bit	dec	hex	Bit mapped register	
	0	0	0	Maintain non-error control connection when modem error control handshake fails	*E0
	1	1	1	Drop connection when modem error control handshake fails	*E1
	1-2	0	0	Speaker always OFF	M0
		2	2	Speaker ON until carrier is detected (default)	M1*
		4	4	Speaker always ON	M2
		6	6	Speaker ON after last digit is dialed out until carrier detected	M3
	3	0	0	DSR always ON	&S0
		8	8	According to CCITT (see also S44.4, S41.5)	&S1
	4	0	0	CD always ON	&C0

Command	bit	dec	hex	Function and description	Ref.
		16	10	CD tracks presence of data carrier (see also S38.3)	&C1
	5	0	0	CTS Follows RTS in synchronous mode. Response delay set in S26	&R0
		32	20	Ignore RTS (CTS always ON) in synchronous mode. (Default)	&D2
	6-7	0	0	Assume DTR always On	&D0
		64	40	108.1, DTR OFF-ON transition causes dial of the default number	&D1
		128	80	108.2 Data Terminal Ready, DTR OFF causes the modem to hang up and return to command state	&D2
		192	C0	108.2, DTR OFF causes the modem to hang up and reset the modem to profile 0 after DTR dropped	&D3
S23=	bit	dec	hex	Bit mapped register	+105
	0	0	0	Command echo disabled	E0
		1	1	Command echo enabled	E1
	1	0	0	Tone dial. (Default)	T
		2	2	Tone dial.	P
	2	0	0	Pulse dial make/break ratio = 39% / 61%	&P0
		4	4	Pulse dial make/break ratio = 33% / 67% (Default)	&P1
	3-5	0	0	ATX0 (See result code table)	X0
		8	8	ATX1	X1
		16	10	ATX2	X2

Command	bit	dec	hex	Function and description	Ref.
		24	18	ATX3	X3
		32	20	ATX4	X4
		40	28	ATX5, error control result code enabled (Default)	X5
		48	30	ATX6, error control result code enabled	X6
		56	38	ATX7, error control result code enabled	X7
	6	0	0	Display result code in numeric format (see S35.7)	V0
		64	40	Display result code in verbose format	V1
	7	0	0	Modem returns result code	Q0
		128	80	Modem does not return result code (see also S40.1)	Q1
S24=	bit	dec	hex	Bit mapped register	
	2-0	0-7	0-7	Ring Volume control, increment of 2 in decimal value	N0-7
	6-4	16-112	10-70	Speaker volume control, increments of 32 in decimal value	L0-7
S25=		0-255	0-FF	Specify the time delay that DTR signal needs to be OFF before it will be recognized, in 10 ms units. If S25=0, the delay time is set to 4 ms	+000
S26=		dec	hex	RTS/CTS delay	+000
		0-255	0-FF	Set the delay, in 10 millisecond units between the RTS and modem's CTS response in synchronous mode (see '&Rn'	&Rn

Command	bit	dec	hex	Function and description	Ref.
				command)	
S27=	bit	dec	hex	Bit mapped register	
	0-2			Modem error control	
		0	0	No error control	&K0
		1	1	MNP4 + MNP3 (see also S41.0)	&K1
		2	2	MNP4 + MNP5 (see also S38.5, S41.0)	&K2
		3	3	V.42+MNP4	&K3
		4	4	V.42 + V.42bis (compatible with &K2)	&K4
	3-5	0	0	Flow control disabled	&H0
		24	18	Hardware (RTS/CTS) flow control	&H3
		32	20	Software (XON/XOFF) flow control	&H4
		40	28	Reserved	&H5
	6-7			Signal quality	
		0	0	No response to poor signal quality	*Q0
		64	40	Retrain action taken if signal quality *Q1 is poor	*Q1
		128	80	Adaptive rate (auto fall-back /forward) when signal quality changes	*Q2 S41.2
		192	C0	Disconnect when signal quality is poor	*Q3
S28=	bit	dec	hex	Bit mapped register	+068
	0	0	0	Single line RJ-11 phone jack (default)	&J0

Command	bit	dec	hex	Function and description	Ref.
		1	1	Multiple phone/modem line, RJ12/RJ13 phone jack	&J1
	1	0	0	Panel key is normal (default)	&Y0
		1	2	Panel key is locked	&Y1
	2-3	0	0	Destructive, expedited break	&Y2
		1	4	Non-destructive, expedited break (default)	
		10	8	Non-destructive, un-expedited break	
	4-5	0	0	No guard tone	&G0
		16	10	Reserved	&G1
		32	20	1800 Hz guard tone	&G2
	6	0	0	DTE/DCE rate follows link rate (See also S18, S44b6)	
		1	64	DTE/DCE rate is fixed at the DTE setting, range from 300-460.8 Kbps (default, also see S18, S44b6)	
	7	0	0 *	Select V.22 for 1200 bps communication	B0
		128	80	Select Bell 212A for 1200 bps communication	B1
S29=		0-49	0-31	Set default dial phone number pointer, use AT&Zn=s to store phone numbers	+000 *D
S31=		0-255	0-FF	Holds the ASCII decimal value of the XON	+017
S32=		0-255	0-FF	Holds the ASCII decimal value of the XOFF	+019
S35=	bit	dec	hex	Bit mapped register	

Command	bit	dec	hex	Function and description	Ref.
	0	1	1	Use CELL 4800T trells coded 4800 for V.32 4800 (available with cellular mode only)	
	1	2	2	Disable aborting from terminal during modem handshaking	
	2	4	4	V.26 alternative A. (see also '&N11')	
	3	8	8	Add 12 dBm attenuation to the leased line transmission power	
	4	16	10	When Data/Voice with is pressed, modem will dial the default number.	*Dn S29
	5	32	20	Enable Selective Reject in V.42 (Default)	
	6	64	40	Enable password protection to profile saving. When 'AT&W0' is issued, and profile 0 in the NVRAM has this bit set, the supervisory password will be requested. This bit in profile 0 also protects the supervisory password from a hardware reset.	*W0
	7	128	80	Enable extended numerical result codes from 50-71 when an error corrected connection is made. Use with ATV0. (see result code table)	V0 S23.6
S36=	bit	dec	hex	Bit-mapped register	+000
	0	0	0	Deny remote request for configuration (Default)	*F0

Command	bit	dec	hex	Function and description	Ref.
		1	1	Grant remote request for configuration	*F1
	1	0	0	Write from local profile a to remote profile b	*Wab
		2	2	Read from remote profile b to local profile a	*Rab
	7-5			Security function control	
		0	0	Disable security function (Default)	*G0
		32	20	Enable type 1 security with password check. (ZyXEL to ZyXEL only)	*G1
		64	40	Enable type 1 security with password check and call-back (ZyXEL to ZyXEL only)	*G2
		96	60	Enable type 2 security with password check	*G3
		128	80	Enable type 2 security with password check and call-back	*G4
		160	A0	Enable type 2 security with password check and call-back, remote site enters the call-back number	*G5
S37=	bit	dec	hex	Bit-mapped register for remote configuration using panel menu control	+000
	3-0	0-5	0-5	Remote profile number	*Wab
	7-4	0-80	0-50	Local profile number	*Rab
S38=	bit	dec	hex	Bit mapped register	+000
	0	1	1	Repeatedly dialing default	*Dn

Command	bit	dec	hex	Function and description	Ref.
				number	S29
	3	8	8	DCD ON/OFF sequence follows UNIX standard, DCD high before connect message is sent, DCD off after last DCE response is sent	&C1 S21.4
	4	16	10	Auto-mode fax receiving disabled	&N0
	5	32	20	Disable MNP5	&Kn
S39=	bit	dec	hex	Bit mapped register	+000
	2	4	4	Answer in originating mode	ATA
	3	8	8	Class 2 Fax Bitfax compatibility: +FCON at 2400 next phase at 19200	
	4	16	10	Class 2 Fax mode DTE shifting: +FCON at current DTE, shift to 19,200 when entering into the next phase	
	5	32	20	Disable srambler/descrambler in V.26bis mode. Enables compatibility with older V.26bis modems which have no such unit (default)	
S40=	bit	dec	hex	Bit mapped register	+000
	1	2	2	No result code displayed in answer mode	Q2
	2	4		Enables caller ID detection	
	3	8		Enables type 1 ring detection	
	4	16		Enables type 2 ring detection	
	5	32		Enables type 3 ring detection	

Command	bit	dec	hex	Function and description	Ref.
	6	64		Enables type 4 ring detection	
S41=	bit	dec	hex	Bit mapped register	+000
	0	1	1	Special MNP compatibility (see also S27.0, S38.5)	&Kn
	2	4	4	Disable retrain abort, up to 5 min. for special satellite line condition	S27.6 *n
	3	8	8	Enable CCITT signals 140 and 141 on EIA-232D interface	
	4	16	10	In X2-X7 setting, modem waits for S6 seconds before dialing and ignores dial tone detection	
	5	32	20	DSR follows DCD and pulses for 0.5 sec DCD on-off transition	&Sn
	6	64	40	Force S0>=2	S0
	7	128	80	Ignore calling tone, not to be used as fax detection	
S42=	bit	dec	hex	Bit mapped register	+000
	1	2	2	Enables throughput averaging	
	2	4	4	CND message will be forced on even if AT02 is set	
	3	8	8	Disable escape sequence code in answer mode	
	4	16	10	Disable V.17, 14,400 Fax in calling mode, no effect to answering mode &N32	
	5	32	20	Disable Data/Voice button	
	6	64	40	Disable 'RINGING' result code	Xn
	7	128	80	DCD forced on but pulse off for	&C0

Command	bit	dec	hex	Function and description	Ref.
				0.5 seconds at carrier loss	
S43=	bit	dec	hex	Bit mapped register	+000
	0	1	1	Disable ZyXEL 16800 in Multi-Auto mode	&N0
	1	2	2	Disable ZyXEL 19200 in Multi-Auto mode	&N0
	2	4	4	Disable cellular mode automatic transmit power adjustment (see also S49b0-3)	&N0
	3	0	0	Enable cellular mode in Multi-Auto mode.	&N0
		8	8	Disable cellular mode in Multi-Auto	&N0
	6	64	40	Enable 1.5 sec, pause between off-hook and modem answering	
	7	128	80	Modem hang-up if the line condition does not permit modem to run highest speed set by '&Nn' command	
S44=	bit	dec	hex	Bit mapped register	+000
	3	8	8	ATDSn initiates auto-dial of the stored numbers consecutively until connection is made	DSn
	4	16	10	DSR follows DTR (see also S41.5)	&S1
	5	32	20	Enable V.13 half-duplex simulation in synchronous mode	
	6	64	40	When selected with '&B0', DTE speed fixed at 38400 when the link speed is above 9600. DTE	&Bn

Command	bit	dec	hex	Function and description	Ref.
				speed fixed at 9600 if link speed is 7200, DTE speed follows link speed. When selected with &B1, DTE speed fixed at current rate when an ARQ connection is made, when a non-ARQ connection is made, DTE speed follows the link speed. (See also S18)	
	7	128	80	Enable UK (Australian, Singapore, Indian, etc.,) type short-to-short (discontinuous) ring-back detection.	
S45=		dec 0-255	hex 0-FF	Delay during which the CND silence detection is disabled, in 20 ms units. (See also S46)	+087
S46=		dec 0-255	hex 0-FF	CND silence detection interval To process the CND, silence must be detected for the specified interval, in 20 ms units	+003
S48=	bit	dec	hex	Bit-mapped register	+000
	0	1	1	Cause CND information to be reported in raw format	
	1	2	2	Enable DATA ONLY mode. Auto-detect V.34/ZyX/V.32bis/V.22bis/V.23/V.21 Bell 103 when answering. If the connection try fails, the modem will continuously recycle the handshaking procedure until the S7 register	

Command	bit	dec	hex	Function and description	Ref.
				times out.	
	2	4	4	Enable data calling tone (CNG) sending	
	3	8	8	Reverse the V.23 channel speed. Originate mode modem speed (Send/Receive) 1200/75; Answer mode modem speed (Send/Receive) 75/1200	&N12
	4	16	10	(Work with &D1 command) DTR ON will have the modem dial the default number and DTR OFF will have the modem hang-up and reset to profile 0. When the modem is idle (waiting for command), it will not dial any number when DTR changes from ON to OFF	
S49=	bit	dec	hex	Bit-mapped register	+006
	3-0	0-15	0-F	Set cellular mode transmit power level -9 to -24 dBm. (See also S43b2)	
	7	0	0	For cellular mode only. Modem is installed in office (Default)	
		128	80	For cellular mode only. Modem is connected to a mobile phone	
S50=		dec	hex	Inactively timer, in 10 second units	+000
		0-255	0-FF	The modem counts when there is no data flow in or out of the RS-232 serial port. A connection is disengaged when the counter	

Command	bit	dec	hex	Function and description	Ref.
				reaches the preset value. Set value '0' to disable this function.	
S51=	bit	dec	hex	Bit-mapped register	
	1-0	0	0	Disables EDR	
		1	1	Reports RING twice	
		2	2	Reports RING four times	
		3	3	Reports RING six times	
	3-2	0	0	Disables DTMF tone	
		4	4	Reports RING for a DTMF tone	
		8	8	Reports RING 'DTMF' for a DTMF tone	
		12	0C	Reserved	
	5-4	0	0	Disables fax-CNG tone detection (Default)	
		16	10	Reports RING for fax CNG tone	
		32	20	Reports RING 1 for fax CNG tone	
		48	30	Reports RING 2 for fax CNG tone	
	7-6	0	0	Disables data CNG tone detection	
		64	40	Reports RING for data CNG tone	
		128	80	Reports RING 1 for data CNG tone	
		192	B2	Reports RING 3 for data CNG tone	
S52=	bit	dec	hex	Bit-mapped register	+000
	4-3	0-24	0-18	Receive level adjustment	

Command	bit	dec	hex	Function and description	Ref.
		0	0	-43 dBm (Default)	
		8	8	-33 dBm	
		16	10	-26 dBm	
		24	18	-26 dBm	
	7	0	0	Select 'Mark' as the first signal of the V.23 handshaking sequence (Default)	&N12
		128	80	Select 'Space' as the first signal of the V.23 handshaking sequence	&N12
S56=		dec	hex		+050
		0-255	0-FF	Hook flash detect time, in units of 10ms, country specific	
S57=	bit	dec	hex	Bit-mapped register	
	4	16	10	Enables the reporting of Class 1 capability in the response to +FCLASS=?	
	6	0	0	Disabled busy detection when dialing is proceeding (Default)	
		64	40	Enables busy detection in dialing period	
S62=	bit	dec	hex	Bit mapped register	+000
	0	0	0	Force the modem to use the new values of S18 to fix the baud rate when answering.	
		1	1	Force the modem to use the old values of S18 (compatible with 1496 series modem) to fix the baud rate when answering.	

	Bit	S-register bit number, 'b', used in 'ATSr.b=n' and 'ATSr.b=?'
	dec	Decimal value, 'x', used in 'ATSn=x'
	hex	Equivalent Hexadecimal value.
	+nnn	Factory default when listed in 'Reference' column.
Note:		'AT' is omitted when an AT command is referred to in the 'Reference' column..

Result Code Options

"ATXn" Result Code Option Table

The following table shows the different options available when setting the ATXn command.

The default value for 'n' is 5 when your modem is shipped.

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
0	OK	V	V	V	V	V	V	V	V
1	CONNECT	V	V	V	V	V	@	$	#
2	RING **	V	V	V	V	V	V	V	V
3	NO CARRIER	V	V	V	V	V	V	V	V
4	ERROR	V	V	V	V	V	V	V	V
5	CONNECT 1200		%	%	%	%	@	$	#
6	NO DIAL TONE		V		V	V	V	V	V
7	BUSY				V	V	V	V	V
8	NO ANSWER				V	V	V	V	V
9	RINGING*				V	V	V	V	V
10	CONNECT 2400		%	%	%	%	@	$	#
11	CONNECT 4800		%	%	%	%	@	$	#
12	CONNECT 9600		%	%	%	%	@	$	#
14	CONNECT 19200		%	%	%	%	@	$	#
15	CONNECT 7200		%	%	%	%	@	$	#

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
16	CONNECT 12000	%	%	%	%	@	$	#
17	CONNECT 14400	%	%	%	%	@	$	#
18	CONNECT 16800	%	%	%	%	@	$	#
19	CONNECT 38400	%	%	%	%	@		
20	CONNECT 57600	%	%	%	%	@		
21	CONNECT 76800	%	%	%	%	@		
22	CONNECT 115200	%	%	%	%	@		
23	CONNECT 230400	%	%	%	%	@		
24	CONNECT 460800	%	%	%	%	@		
25	CONNECT 921600	%	%	%	%	@		
26	CONNECT 307200	%	%	%	%	@		
27	CONNECT 153600	%	%	%	%	@		
28	CONNECT 102400	%	%	%	%	@		
29	CONNECT 61440	%	%	%	%	@		
30	CONNECT 51200	%	%	%	%	@		
31	CONNECT 624000	%	%	%	%	@		
32	CONNECT 124800	%	%	%	%	@		
33	CONNECT 62400	%	%	%	%	@		
34	CONNECT 41600	%	%	%	%	@		
35	CONNECT 31200	%	%	%	%	@	$	#
36	CONNECT 24960	%	%	%	%	@		
37	CONNECT 20800	%	%	%	%	@		
38	CONNECT 33600	%	%	%	%	@	$	#
39	CONNECT 28800	%	%	%	%	@	$	#
40	CONNECT 26400	%	%	%	%	@	$	#
41	CONNECT 24000	%	%	%	%	@	$	#
42	CONNECT 21600	%	%	%	%	@	$	#

*   Use S42.6 to disable 'RINGING' result code

** When more than one type of Distinctive Ring is
turned on (S40b3-6) 'RING n' will be reported,
n=Ring Type # (1-4)

Result Code Chart Symbol Reference:

V	Supported
%	Reports the DTE Speed as: \<cr>\<lf>CONNECT DTE_Speed\<cr>\<lf>
@	CONNECT DTE_Speed/Protocol DCE_Speed/Error_Control † Example: CONNECT 38400/V.32bis 14400/V.42bis
$	\<cr>\<lf>CONNECT DCE_Speed[/Error_Code]\<cr>\<lf> Example: CONNECT 14400/ARQ
#	CONNECT DCE _Speed/Error_Code/Error_Control † Example: CONNECT 14400/ARQ/ MNP5

† Data compression included. 'SREJ' is appended if a V.42
connection with selective reject is established.

Result Code Field Descriptions

Field Name	Possible Values
Error_Code	NONE, ARQ
Error_Control	LAPM, V42 (This field will not show if no error control is negotiated)
Data_Compression	V42b
DCE_Speed	All possible DCE speeds supported
DTE_Speed	All possible DTE speeds supported

Connect Strings for Error Corrected Connections

To enable the following numerical (ATV0) and verbose (ATV1) result codes when an error corrected connection is made, set S35 bit 7 to 1.(**ATS35.7=1**)

Numerical V0	Verbose V1	Numerical V0	Verbose V1
50	CONNECT	58	CONNECT 16800
51	CONNECT 1200	59	CONNECT 19200
52	CONNECT 2400	60	CONNECT 21600
53	CONNECT 4800	61	CONNECT 24000
54	CONNECT 7200	62	CONNECT 26400
55	CONNECT 9600	63	CONNECT 28800
56	CONNECT 12000	64	CONNECT 31600
57	CONNECT 14400	65	CONNECT 33600

10 **Diagnostics & Troubleshooting**

Diagnostics

The U-336S/SA is equipped with several diagnostic capabilities:

- Power-on Self Test.

- Analog Loop-back Test.

- Analog Loop-back with Self-Test.

- Local Digital Loop-back Test.

- Remote Digital Loop-back Test.

- Remote Digital Loop-back with Self-Test.

The diagnostic tests listed above apply to several modes of operation: asynchronous or synchronous, error controlled or non-error controlled, data compression enabled or disabled data mode. You can use these capabilities to verify the line condition and the modem's functioning and performance, and to locate the source of a communication problem.

Power-On Self Test

At each power-up or upon a reset command from the panel, the modem will test the ROM code checksum, system RAM memory, DSP

code checksum, DSP RAM memory, EEPROM, digital circuits, and the analog circuit calibrations.

Results of the power-on self-test displayed on your terminal:

0	SYSTEM TESTING	Self-test indicator. If no error occurs, this message will last until the end of the test.
1	ROM TEST FIAL....	ROM code checksum error.
2	RAM TEST FAIL....	System RAM fails.
3	LOADING DEFAULTS.	EEPROM checksum error. The factory default settings will be downloaded to the EEPROM and the self-test will be re-initiated. This is not a real error.
4	DSP RAM FIAL...	The testing of DSP RAM fails, condition A.
5	DSP RAM FIAL...	The testing of DSP RAM fails, condition A.
6	VO CALIBRATION FAIL...	Analog circuit calibration error.
7	VR CALIBRATION FAIL...	Analog circuit calibration error.
8	FR CALIBRATION FAIL....	Analog circuit calibration error.

Resetting The Modem

A reset command from the panel will restart the power-on self-test. If an error message is displayed on the screen, turn off the modem, wait for at least 10 seconds, and then turn the power on again. If the error condition persists, call the ZyXEL Service Center for assistance, or follow the return procedure to return the modem to ZyXEL. If the normal IDLE SCREEN shows up, the original failure was due to a

temporary power-on reset problem and will not affect modem operation.

Loopback Tests

The Analog Loopback Test, Local Digital Loopback Test, Remote Digital Loopback Test can all be initiated with AT commands from the terminal. Use the **AT&T0** command to terminate the test.

Analog Loopback (AT&T1)

This test can check almost every part of the modem and the RS-232 cable except the telephone line outgoing interface. During Analog Loopback testing, data from the terminal or computer is sent through an RS-232 cable into the modem's transmitter and is modulated to an analog signal. Then it is looped back to the receiver, demodulated to digital form and sent through the RS-232 cable back to the terminal or computer's screen. You can tell if anything is wrong by looking at the screen. The screen should show the data you have sent to the modem. This test can only be initiated while the modem is off-line.

Analog Loopback with Self-test (AT&T8)

This test generates data from the modem itself instead of input data from the RS-232 interface. The data will go through the same path as it would with the Analog Loopback Test. In asynchronous mode, the pattern consists of printable ASCII characters. You can see the result on the screen. In the synchronous mode, the pattern is made up of scrambled binary 1 and the Throughput Meter will change to a Bit Error Rate Meter. The left reader displays accumulated bit errors while the right reader displays accumulated bits sent.

This test can only be initiated when the modem is off-line. The following Bit Error Rate Meter example shows 11120 Kbits sent, 22 bits in error. When the number exceeds 99999 Kbits, it will reset itself back to zero.

Local Digital Loopback Test (AT&T3)

This test will loopback the digital form data demodulated from the receiver to the input of the transmitter. During testing, all data received from the remote modem will be returned to the remote modem. This test is applicable when the remote modem does not provide V.54 Remote Digital Loopback capability. This test can be initiated by the local modem when the modems are on-line.

Remote Digital Loopback Test (AT&T6)

This test will request the remote modem to do a digital loopback. During testing, the local modem will send a remote digital loopback request to the remote modem according to V.54. If the remote modem supports V.54 and is programmed to grant this kind of request, it will resend all of the received data back to the local modem. The local terminal or computer will receive all of the data it sends out. This test is applicable when the remote modem and local modem both provide V.54 Remote Digital Loopback capability. This test can be initiated by either modem when the modems are on-line.

Remote Digital Loopback with Self-test (AT&T7)

This test generates data from the modem itself instead of input data from the RS-232 interface. The data will go through the same path as it would with the Remote Digital Loopback Test. In asynchronous mode, the pattern consists of printable ASCII characters. You can see the results on the screen. In the synchronous mode, the pattern is made up of scrambled binary 1, and the Throughput Meter of the initiated modem will change to a Bit Error Rate Meter. The left reader displays accumulated bit errors and the right reader displays accumulated bits sent. This test can be initiated by either modem when the modems are on-line.

Indicator Lights

Retransmission Indicator

In the error control mode, an error occurring in the link will cause the data to be re-transmitted. At the same time, the AA LED will flash. This also indicates the quality of the line.

Dialing Indicator

The V34 LED will flash on and off for 1/2 second each to indicate that the modem is dialing. This flash will continue after dialing until a carrier is detected. Therefore, the V34 LED will also flash in leased-line modem connections when one modem is trying to handshake but the other modem is not turned on.

Handshaking And Retrain Indicator

The V34 LED will flash on and off in 1/2 second intervals to indicate that the modem is handshaking or retraining.

Line Condition Status Display

Regarding data being transmitted over telephone line circuits, there are many kinds of line impairments that can affect the data being received by the remote modem.

Your modem can measure four major line impairments. From the impairment readings, you can understand the current line condition. Your modem also logs line events over a long period, so you know what the line condition has been. We will describe these readings and logs as follows:

⊞ NOTE: THE READINGS DISPLAYED ARE NOT MEASUREMENTS AND SHOULD ONLY BE USED AS A REFERENCE.

Signal to Noise Ratio (S/N)

This reading is expressed in 0.1 dB resolution. The higher the speed, the higher the S/N ratio required. The modem measures the S/N ratio by

measuring the distance between the demodulated signal point and the ideal signal point. For V.32/V.32bis, the modem-measured S/N ratio is generally about 2 dB higher than what is actually on the line because the modem rejects some of the out-of-band noise. For V.22/22bis, the difference can be as high as 8 dB because the modem only uses part of the 3 KHz bandwidth and rejects more than half of the voice band noise.

Received Signal Power Level (RX)

This reading is expressed in 0.1 dBm resolution. The modem measured receiving signal power is generally within 1-2 dBm of the actual value with relative accuracy. The receiver sensitivity specification for your modem is -43 dBm. Strong signal power could cause signal saturation in the channel and degrade the data validity. To avoid this situation, decrease the transmission power of the remote modem. For increased line operability, your modem's transmission power level on a leased-line operation could be adjusted from 0 dBm to -27 dBm. The default value is -9 dBm.

Phase Jitter (PJ)

This reading is expressed in peak-to-peak degrees for phase jitter in the 20 to 300 Hz frequency range in 0.1 degree resolution.

Frequency Offset (FO)

Frequency offset is expressed in 0.1 Hz resolution. It is the difference between the transmitted carrier frequency and the received carrier frequency.

In the ON-LINE SCREEN 3 there are four counters recording the action or reaction the modem took when the line condition changed.

Retrain Granted (RTG)

The count of the granting of the remote modem's retrain requests. Each request is an indicator of bad receiving conditions.

Retrain Requested (RTR)

The count of the local modem's requests for the remote modem to retrain when the signal quality is poor.

Round Trip Echo Delay (RTD)

Measured in T (1/2400 sec.). Will be re-measured in every retrain action.

Carrier Loss Counter (CLC)

When operated over a leased line, it is the count of the carrier's temporary drop-out, if there is any.

ON-LINE SCREEN 4 also has four counters recording the modem's actions and reactions.

FRN (Fast Rate Negotiation) Granted (FRG)

The count of the granting of the remote modem's change rate (FRN) requests. Each request is an indicator of a changed receiving condition.

FRN Request (FRR)

The count of the local modem's requests to change the rate.

Block Retransmitted (BLR)

The count of the blocks retransmitted (bad reception on the remote modem).

FCS (Frame Check Sum) Errors (FRE)

The count of the FCS errors received (block errors) (bad reception on the local modem).

Trouble Shooting

Your modem is designed to provide years of ultra high speed satisfaction. In the unlikely event you encounter problems using your modem, the tips in this section will help you to identify and resolve them. Most modem problems are a result of incorrect cabling or settings within your communications or fax software. This section provides a list of more common problems that you may encounter, followed by likely solutions.

AT Command Set Problems

Problem

Your modem does not respond to AT commands.

Solutions

1. Make sure the DTR LED is ON. If it is OFF, make sure your communications software is using the same COM port as your modem.

2. Check to see that your modem's COM port is not already assigned to another installed serial device, such as a mouse or laser printer.

Problem

Your modem fails to execute AT commands.

Solutions

1. Make sure the DTR LED is ON. If it is OFF, make sure your communications software is using the same COM port as your modem.

2. You may have omitted the characters AT from the beginning of the command line. These characters must appear at the beginning of each command line.

3. You may have typed the commands when your modem was in data state instead of the command state. To switch from data state to command state, type the escape sequence code +++. To return to the data state, type ATO and press Enter.

Problem

You typed an AT command, but did not receive an OK or 0 result code.

Solutions

1. Your communications software may be using a different COM port than your modem. Be sure both the software and your modem are addressing the same COM port.

2. The E0 and Q1 commands may be in effect, disabling echo and result codes. To verify this in terminal mode, type AT&V0 and press Enter with the modem in command state to view the currently active settings. To enable echo and result codes, type AT E1 Q0 and press Enter.

3. You may have typed the commands when your modem was in the data state instead of the command state. To switch from data state to command state, type the escape sequence code +++. To return to data state, type ATO and press Enter.

Problem

You receive the ERROR result code after typing an AT command.

Solution

You may have typed a command that is not recognized by your modem or communications software.

Command Echo Problems

Problem

You do not see any typed characters on your computer screen.

Solutions

1. Make sure the DTR LED is ON. If it is OFF, make sure your communications software is using the same COM port as your modem.

2. Neither your modem nor your communications software is configured to echo characters. Use the E1 command to enable modem echo, or turn on your software program's Echo (or duplex) feature.

Problem

Each character you type appears twice on your computer screen.

Solution

Both your modem and your communications software are echoing characters to your screen. Use the E0 command to disable modem echo, or turn off your software program's echo (or duplex) feature.

Answer Problems

Problem

Your modem does not auto-answer incoming calls.

Solutions

1. Make sure the supplied telephone cable is connected to your modem's LINE jack and not the PHONE jack.

2. Your modem may not be set up for auto-answer. With the modem in command state, type ATS0=1 and press Enter to have the modem answer on the first incoming ring To auto-answer after a specific number of rings, replace 1 with a value up to 255. Do not assign a value of 0, which turns off auto-answer, unless your software can respond to the modem's RING result codes.

3. Check that the DTR LED is ON, and that the AA LED flickers with each incoming ring. If the LEDs do not respond in this way, refer to your ZyXEL Modem Reference Manual.

4. Set &Dϕ and auto answer, if your modem is not connected to RS232 or DTR is not ready.

Problem

When you receive a phone call, your modem immediately seizes control of the telephone line.

Solution

Your modem may be configured for auto-answering. To disable auto-answer, type ATS0=0 and press Enter with the modem in command state.

Dialing Problems

Problem
Your modem does not dial calls.

Solutions

- Make sure the supplied telephone cable is connected to your modem's LINE jack and not the PHONE jack.

- You are using touch-tone dialing on a line that requires pulse dialing. Change your communications software to use pulse dialing.

Data Transfer Problems

Problem
You can make a data connection with a remote modem, but encounter frequent errors during data transfers.

Solutions

1. Your modem and communications software may be configured for different flow control methods. Be sure your modem and software are both using hardware (RTS/CTS) flow control or software (XON/XOFF) flow control.

2. To verify that your modem and communications software are using the same flow control method, type AT&T8 and press the Enter key with your modem in the command state. You should see a smooth "stair-stepping" ASCII test pattern flowing diagonally across your screen.

Connection Problems

Problem

Your modem disconnects while communicating with a remote system.

Solutions

1. The remote system may have hung up. Type ATI2 and press Enter to view the link status report, which will include the reason for the disconnect. For information on understanding this report, refer to your ZyXEL Modem Reference Manual.

2. You may have subscribed to Call Waiting and received an incoming call that interrupted your data connection. See your telephone directory for information on disabling Call Waiting.

11 **Upgrading Your Modem**

Upgrading by Flash EPROM

1. Obtain the new firmware by downloading from the ZyXEL BBS, WWW or FTP site. See Contacting ZyXEL on page vi for the FTP address.

2. Turn on your computer.

3. Turn on your modem.

4. Start any communications program that supports the XModem protocol.

5. Type **ATUPX**.

6. Press Enter and wait for the following prompt characters:

   ```
   You have chosen XMODEM (128 bytes data
   with checksum) protocol to update your
   modem. Data in Flash ROM will be
   erased!!!
   ```

   ```
   Are you sure (Y/N)?
   ```

7. Press **Y**. The following message then appears:

   ```
   Start programming, please upload....
   ```

8. After the "§" prompt, use the XModem protocol to upload the file **U336S/SAvv.vvv** to your modem. This step updates the modem's flash EPROM with the latest firmware.

9. When the installation is complete, the modem restarts automatically.

Kernel Recovery Mode

Your modem is equipped with ZyXEL's exclusive **Kernel Recovery Mode.** This unique feature enables quick recovery from failed flash uploads. With other modems, a failed flash upload usually results in the user having to return the modem to the factory for repair.

In the unlikely event that your modem fails to respond to AT commands after upgrading the flash EPROM:

1. Turn off the modem.

2. Press the D/V button while turning on the modem, then release the button after 5 seconds.

   A Kernel Program responsible for the update process takes control of the modem. It accepts a limited set of AT commands, including the ATUPX command.

3. Repeat steps 1 through 9 from the previous directions above to upload a file that contains the valid firmware for your modem.

12 **Connector Pinouts**

Phone Jack Pinouts

The ZyXEL U-336S/SA modem features two RJ-11 phone jacks, one for 2-wire dial-up and 2-wire leased line connection (LINE) and one for an optional connection to a telephone set (PHONE). The signals on these pins are:

1	A
2	RING
3	TIP
4	A1

PC Serial Port Pinouts

Signal Pin	ITU-TSS Signal Name	EIA Signal Name	Pin/Signal Description	Direction DTE-DCE
1	101	AA	Protective Ground (GND).	
2	103	BA	Transmitted Data (TXD).	→
3	104	BB	Received Data (RXD).	←
4	105	CA	Request To Send (RTS).	→
5	106	CB	Clear To Send	←

Signal Pin	ITU-TSS Signal Name	EIA Signal Name	Pin/Signal Description	Direction DTE-DCE
			(CTS).	
6	107	CC	Data Set Ready (DSR).	←
7	102	AB	Signal Ground (GND).	
8	109	CF	Data Carrier Detected (DCD).	←
15	114	DB	Transmit Clock Signal (source: DCE).	←
17	115	DD	Synchronous Receive Clock.	←
18	141		Local Analog Loopback Test.	→
20	108/2 108/1	CD	Data Terminal Ready (DTR). Connect DCE to line	→
21	140		Remote Digital Loop Test.	→
22	125	CE	Ring Indicator(RI).	←
24	113	DA	Transmit Clock Signal (source: DTE).	→
25	142		Test Indicator.	←

Macintosh Serial Port Pinouts

The following table shows the wiring of a modem Macintosh hardware handshaking cable:

Mac Din 8	Modem DB 25	Description
1	4 & 20	DTR to RTS and DTR, Hardware Handshaking Out
2	5	CTS to CTS, Hardware Handshaking In
3	2	TX- to TXD, Data sent
4	7	GND, Ground
5	3	RX- to RXD, Data received
6	-	not connected
7	8	GPI to CD, Carrier detected
8	7	GND, Ground, needed for RS-232 connections

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