

***U-336R/RE***

***User's Guide***

Version 1.0  
(Mar. 1997)

**ZyXEL**

ACCESSING INTERNET & INTRANET

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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:



This product has been approved for connection to the Public Switched Telecommunication Network using interfaces compatible with ITU-TSS recommendation I.420. 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 electromagnetic 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 EXT 252 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.hinet.net outside North America.
  - **Technical support:** support@zyxel.com in North America. support@zyxel.hinet.net 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 and Asian versions and related files, use the address: <ftp.zyxel.co.at>

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

ZyXEL Communications Corporation

6, Innovation Road II, Science-Based Industrial Park

Hsinchu, Taiwan 300, R.O.C.

or

ZyXEL Communications Inc.

4920 E. La Palma Avenue

Anaheim, CA92807, U.S.A.

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# 1 Introduction

## What This Manual Covers

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

## 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 Intelligent features designed to make your data communications faster, easier, and more convenient.

### Standard Features

- Supports V.34 for 28,800bps 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.

- 14 LED indicators (RE/RD).
- 15 LED indicators (R).
- Extended AT command set with V.25bis.
- Operates on 2-wire dial-up or 2-wire leased line (RE).
- Operates on 2-wire dial-up or 2/4-wire leased line (R).

### **Intelligent Features**

- Automatic data, and fax call detection allows you to use a single telephone line to handle both voice and data 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, fax 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.
- Data/Voice toggle switch.
- 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 (RE).
- Line interface: 2-wire dial-up or 2/4-wire leased line (R).
- Call progress monitoring: dial tone, busy, and ring back detection.
- Audio Monitor: programmable volume control.

## **Unpacking Your Modem**

### **Enclosed Equipment**

Before you proceed further, please check all items you received with your modem against this list to make sure nothing is missing. The complete package should include:

- One U-336R/RE universal modem.
- One warranty/registration card.

Contact your dealer or the store where you bought the modem if anything is missing. Check the modem for shipping damages. If you find any damage, contact the shipping agency immediately.

Retain shipping and cushioning materials for future storage or shipping needs.

Please direct any additional questions about damaged or missing materials to your dealer or distributor, or see page vi to contact ZyXEL.

### **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.
- Available AC wall outlet.
- Telephone line from your telephone company (dial-up or leased line).
- Data and fax communication software.

## **Becoming a Registered Owner**

Complete the pre-addressed Warranty Registration Card and place it in the mail. Registered owners will receive future product information and update announcements. Warranty registration is not necessary for product repair or replacement. Also save your **dated invoice** as proof of purchase.

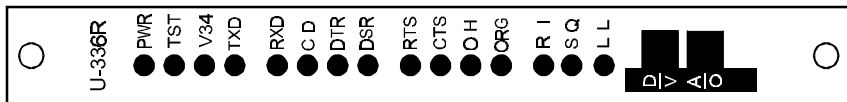


# 2 Installation

This chapter covers the steps required to install your U-336R/RE modem into a ZyXEL RS-1612 rack system. A separate comprehensive manual containing rack system information is included with your modem rack chassis.

## U-336R/RE Modem Card

The U-336R front panel consists of fifteen LED indicators and two switches. The U-336RE front panel consists of fourteen LED indicators and two switches. The LEDs on the front panel, display the current status and configuration of the modem. Refer to the following table for details on the LED status indicators and their meaning.



LED	Name	ON	Blinking
PWR	Power Indicator	The modem is on and operational.	
TST	Test Indicator	The modem is in test mode.	
V34	V.34 Mode Indicator	The modem is operating in V.34 mode.	The modem is in Handshaking state.

<b>LED</b>	<b>Name</b>	<b>ON</b>	<b>Blinking</b>
TXD	Transmit Indicator	The DTE is sending data to modem for transmission.	
RXD	Receive Indicator	The modem is sending received data to the DTE.	
CD	Carrier Detect	The modem senses a valid data carrier on the line.	
DTR	Data Terminal Ready	The attached computer is ready to send or receive data.	
DSR	Data Set Ready	The modem is ready to send or receive data.	
RTS	Request to Send	The DTE requests to send data for transmission.	
CTS	Clear to Send	The modem is able to accept data for transmission.	
OH	Off Hook Indicator	The modem is in Data Mode or Off Hook.	
ORG	Originate Mode Indicator	Modem is in Originate Mode.	
RI	Ring Indicator	Modem is in Auto-Answer mode.	Modem detected an incoming call.

LED	Name	ON	Blinking
SQ	Signal Quality	Modem senses a good quality signal.	Modem senses marginal signal quality.

The following LED is for the U-336R only:

LED	Name	ON	Blinking
LL	Leased Line Mode Indicator	Modem is in Leased Line Mode.	

There are two toggle switches on the U-336R/RE front panel. **VOICE/DATA** Toggles the modem on-line (off-hook, DATA) or off-line (on-hook, VOICE mode, the telephone set is connected to the line). **ANS/ORG** switches the modem between ANSWER and ORIGINATE modes when the modem goes off hook.

**NOTE:**

THE ANS/ORG SWITCH ONLY DETERMINES MODEM ON-LINE MODES WHEN THE MODEM IS SET TO OFF-HOOK MANUALLY. IF ATD OR ATA COMMANDS TAKE THE MODEM OFF HOOK, THOSE COMMANDS WILL DETERMINE THE OPERATING MODE FOR THE MODEM TOO.

## Required Steps for U-336R/RE Installation

Setting up the rack system consists of plugging in modem cards, connecting phone lines, connecting to computers, and connecting power. Refer to your rack system User's Guide for details on setting up the rack.

## Installing the modem card

The rack system in which you will install your modem has sixteen available modem slots. You may use any slot for a card without regard to the slot number or sequence. To install a card:

1. Hold the modem card by the front and slide it into an available slot.
2. Push the card gently but firmly until it seats.
3. Screw the modem card holding screws into place to secure the card in its slot.

### NOTE:

THE MODEM CARD WILL NOT SEAT AND THE HOLDING SCREWS WILL NOT TIGHTEN IF YOU INSTALL THE MODEM CARD UPSIDE DOWN.

## Connect to phone lines

Sixteen terminal blocks correspond to the sixteen modem card slots in the rack. Each offers you flexibility with respect to the types of phone lines you may be using. Each terminal block has three sections:

- **U-336RE Section 1** (*terminals 1 & 2*) For standard telephone set connection.
- **U-336R Section 1** (*terminals 1 & 2*) For standard telephone set connection.
- **U-336RE Section 2** (*terminals 3 & 4*) For dial-up line and 2W leased line connection.
- **U-336R Section 2** (*terminals 3 & 4*) For dial-up line.
- **U-336RE Section 3** (*terminals 5 ,6 ,7 & 8*) Not used.

- **U-336R Section 3** (*terminals 5,6,7 & 8*) For leased line connection.

## **Connect to Computers**

Each modem slot has a corresponding 25-pin RS-232 female connector on the rear panel. Connect a cable from the desired computer to the RS-232 connector for the desired modem.

## **Hooking Up Power**

Connecting power should be the last thing you do before using the rack. To connect power follow the instructions below:

1. Plug one end of the power cord to the socket on the back panel.
2. Plug the other end to a properly rated power source.
3. Switch the power source selector to AC or DC according to the type of power supply(s) you are using.
4. Make sure all other hardware installations are complete.
5. Unscrew the front panel and turn on one or both power supply(s).
6. Replace the front panel.
7. Turn on the master power.

## **Fax/Modem Communication Software Installation**

After completing installation of your modem use the following procedures to verify your modem connections:

1. Install and load your communications software. If you need assistance, refer to the manual that came with the software.
2. If your communications software requires you to select a modem, and the your modem is not one of the choices, you can either check our web site for the driver or select the ZyXEL U-

1496 modem. In many cases, the commands for these modems are identical.

Select the following communication settings:

Setting	Value
Baud rate	57,600bps
Data bits	8
Parity	None
Stop bits	1
Flow control	Hardware
Initialization string	AT&F
Port	COM $n$ *

**NOTE:**

WHEN SPECIFYING A PORT ASSIGNMENT, THE 'N' INDICATES THE COMPUTER SERIAL PORT TO WHICH YOUR MODEM IS ATTACHED. FOR EXAMPLE, IF YOUR MODEM IS CONNECTED TO SERIAL PORT 2, YOU WOULD SELECT COM2.

3. Place your communications software in terminal or direct connect mode (your communications software manual will explain how).
4. Look at the modem's front panel and verify the DTR LED is ON. If this LED is OFF, your communications software is not addressing your modem at the correct COM port. Make sure your software is set up for the same COM port to which your modem is connected.
5. Type AT and press the Enter key. You should see the AT characters you typed, followed by an OK result code. If you do not see an OK result code, turn the modem off and on, then repeat this step. If you still cannot see the characters, refer to Chapter 0 for troubleshooting suggestions.
6. Type ATDT number and press Enter, where number is your modem's telephone number. You should see a BUSY result code. If you do not see a BUSY result code, refer to Chapter



10 for troubleshooting suggestions.



# 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-336R/RE 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 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:                    **ATDT** 555 1212

Pulse Dialing:                         **ATDP** 555 1212

Tone and Pulse Dialing:             **ATDP** 555 1212 **WT** 24

Dialing Through a PBX:               **ATDT** 9 **W** 555 1212

#### NOTE:

THE 'W' IN THE DIAL STRING WILL CAUSE THE MODEM TO WAIT FOR A SECOND DIAL TONE BEFORE IT CONTINUES TO DIAL.

Pausing During Dialing: ATDT 9,,555 1212

**NOTE:** THE PAUSE TIME FOR EACH COMMA IS DEFINED BY S REGISTER S8. DEFAULT IS 2 SECONDS PER COMMA.

Dialing Without Waiting for Dial Tone: ATX0D, 555 1212

Originating a call using an Answer Tone: ATDT 555 1212,,,,,R

Redialing the Last Number Called: ATDL

Waiting for Five Seconds of Silence: ATDT 800 555 1212 @  
123456,1 714 555 1212

Transferring a Call (using flash hook): ATDT! 2468

### **Auto-Answer and Hook Controls**

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

**NOTE:** IN THIS EXAMPLE, N IS A NUMBER FROM 1 TO 255 THAT CORRESPONDS TO THE NUMBER OF RINGS AFTER WHICH YOUR MODEM ANSWERS AN INCOMING CALL.

Disabling Auto-Answer: AT**S0=0**

Manually Answering a Call: **ATA**

Take modem off-hook: **ATH1**

Hang up modem (on-hook): **ATH0**

Manually Disconnecting a Call: **+++ATH**

## **Making Your First Connection**

For this example, we will use the connection you created in the Hyper Terminal program to dial the ZyXEL BBS. If you are using a different terminal program, run the program according to the instructions provided with it.

Start the terminal program by double-clicking the **Test Connection** icon. When the terminal window appears, enter the dial command with ZyXEL's BBS as the phone number.

Type:

```
ATDT17146930762<enter> (Omit the '1714' if  
you are in this area code)
```

The modem will go off-hook, dial the number, and after a few seconds of negotiation tones you should be connected to our BBS.

You will receive a login message asking for your name. For the purposes of this example you need not continue. Just click the “disconnect” icon on the toolbar.

## 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.

Your modem 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



<b>AT Command Set/Type</b>	<b>Example</b>
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 AT\$\$\$. 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.

Your modem 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 **ATXn** 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 **Sr?** 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 **Sr.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

Your modem 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&Zs=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 ‘1-816-555-1212’ 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&ZS=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&Vn	Views the settings in profile ( <i>n-1</i> ); <i>n=0</i> to 5; <i>n=0</i> views current settings.
AT&Wn	Stores the current settings in user profile ' <i>n</i> '; <i>n=0</i> to 3
ATZn	Resets the current settings with the settings in profile ' <i>n</i> ', <i>n=0</i> 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**

Your modem's 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.

<b>AT Command</b>	<b>Description</b>
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 receive FIFO to increase communication program efficiency.

## Helpful Hints for Macintosh Computers

### Special AT Command Settings for Macintosh

For operation with Macintosh 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*)

### Macintosh 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**

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. Refer to Chapter 12 Terminal 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 screen 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 Synchronous Mode Operation

This chapter introduces you to the use of the U-336R/RE 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. 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 sending modem.
2. The **slave clock** is used when in remote digital loopback mode.
3. The **external clock** is a signal generated by the sending 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).



# 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. The U-336R supports 2 and 4-wire leased lines while the U-336RE supports 2-wire leased lines.

## Connecting to a Leased Line

Your modem default line is a dial-up type (DL) which includes a separate leased-line jack. The leased line must be connected to the jack labeled LEASED LINE (located at the rear of the modem). You can set your modem for leased-line operation by typing commands from the terminal or by selecting it from the front panel. The leased-line phone jack pin assignments are shown in Chapter 12 Terminal Pinouts.

### Line Type Setting

AT-Command	Description
AT&L1	The modem is connected to a 2-wire leased line; the line plug should be plugged into the jack assigned DIALUP for RE model or leased line for R model on the rear panel.
AT&L2	The modem is connected to a 4-wire leased line. Plug the line into the LEASED LINE jack.

## 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	The default is -9dBm. The adjustable range is from 0 to -15dBm, effective in leased-line operation only. If bit 3 of S35 is 8set, this range will change to -12 to -27dBm.
...	
AT*P15	

## 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 O on the RS1612 control panel for originating mode and then press A for answer mode. 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. 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.

<b>AT-Command</b>	<b>Description</b>
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.

## Leased-Line Dial Backup

When a leased-line connection fails, the following actions may be taken by the modem:

- Reattempt to connect on the leased line indefinitely if the dial backup option is disabled.
- If the dial backup is enabled, the originating modem attempts to dial a pre-stored telephone number to backup the connection; the answering modem will reattempt to connect to the leased line and monitor the dial-up line for rings. Incoming dial-backup calls will be answered.

## Dial Backup

The dial backup option can be set by issuing an asynchronous AT command from the terminal, or by using the RS-1612 LCD control panel.

<b>AT-Command</b>	<b>Description</b>
AT*B0	Leased-line dial backup disabled (Default).
AT*B1-50	When the leased-line cannot continue operation, the originate mode modem will automatically dial the number stored in the memory address selected. The answer mode modem will monitor the dial-up line for rings.

The originating modem will try to dial the number up to nine times or until a 3-minute time-out is activated. If the dial backup attempt fails, the originating modem will go back to try the leased line connection. If this fails, it will try the dial-up line again.

It will try these two alternatives indefinitely. If the dial backup attempt succeeds, the value of S-register S34 determines the interval of the dial backup connection before going back to check the leased line.

<b>AT-Command</b>	<b>Description</b>
ATS34=0	The dial backup line continues to be used indefinitely.
ATS34=n; (1 ≤ n ≤ 255; default:30)	Retries leased line after n minutes. If the leased line has still not been recovered, the modem will continue to use the dial backup line.

### **Aborting from Leased-Line Operation**

If the leased line has not been connected, pressing any key on the RS-1612 LCD control panel will abort the attempt to connect to the leased line. If dial backup is enabled, backup action will be taken. Pressing any key again will abort the backup action and revert to the IDLE SCREEN display.

## **Terminating a Leased Line Connection**

Disconnecting the leased line manually will force your modem to switch to the IDLE SCREEN. Either going on-line manually or, if you have set the leased line as the power-on default, turning the power OFF and ON, will make the modem try the leased line again.

# 6 Special Functions

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

## Security Functions

Your modem provides security 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.
- With **level 2 security**, redial 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** for your modem 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 for 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 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: Jordan Chu

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.

**NOTE:** PLEASE REFER TO THE BELLCORE TECHNICAL ADVISORY DOCUMENT TR-NWT-000030 FOR THE EXACT DATA FORMAT. THE ABOVE CALLER ID SCHEME APPLIES TO THE NORTH AMERICA ONLY. DIFFERENT COUNTRIES MAY EMPLOY DIFFERENT CALLER ID SCHEMES, MAKE SURE THE SCHEME USED IN YOUR COUNTRY IS SUPPORTED BEFORE USING THE CALLER ID FEATURE. FOR MOST OTHER CALLER ID SCHEMES, ONLY THE CALLER TELEPHONE NUMBER IS PROVIDED.

## 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 on; 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

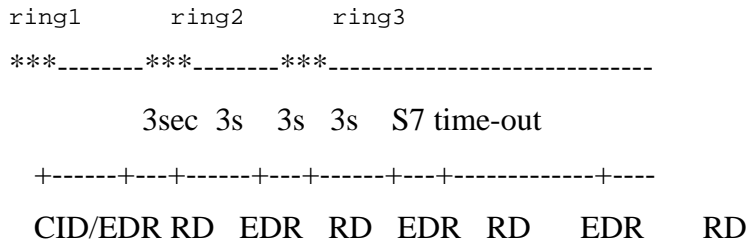
The new EDR can be used at home where multiple phones are installed in parallel. Once this function is enabled, the modem will go into EDR mode after the ring disappears, and it will be able to detect the data/fax CNG tone and DTMF tones, and report them as different types of rings. The EDR settings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



**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

In the sections below, we will describe how the U336R/RE 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.

## 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.

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 U-336R/RE takes full control of the ITU-T T.30 fax protocol, also known as G3 fax handshaking signals and procedures. Your modem initiates and terminates fax calls, manages communications sessions, and transports image data relieving the computer fax software of the T.30 protocol handling.

Your 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 if poor line conditions are encountered. 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**

Your modem 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

Command	Value	Description
		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:

Value	Modulation	Speed	Requirements
3	V.21 ch. 2	300	Required for FTH & FRH.
<i>+FTH and +FRH support value 3 (V.21 ch. 2 / 300 bps) only.</i>			
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= <i>n</i>		Auto-answer mode parameter:
	n=0	Answer as set by +FCLASS.
	n=1	DCE answers and auto-determines type.
+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= <i>n</i>		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=" <i>string</i> "		Local fax station ID string, for polling Rx.
+FCLASS= <i>n</i>		Service class selection: Refer to +FCLASS Class 1 command in previous section.
+FCON		DCE responds fax connection .
+FCQ= <i>n</i>		Copy quality check capability

Command	Value	Description
		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= <i>n</i>		"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= <i>vr,br,wd,ln,df,ec,bf,st</i>		DCE capabilities parameters.
	vr=0	Vertical resolution: Normal; 98 lpi.
	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.

<b>Command</b>	<b>Value</b>	<b>Description</b>
	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.
+FDCS= <i>vr,br,wd,ln,df,ec,bf,st</i>		Current session parameter; refer to +FDCC command.
+FDIS= <i>vr,br,wd,ln,df,ec,bf,st</i>		Current session negotiation parameter; refer to +FDCC command.
+FDR		Receive phase C data command; initiates document reception.
+FDT= <i>df,vr,wd,ln</i>		Transmit phase C data command: release the DCE to proceed with negotiation.
+FET= <i>n</i>		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.

Command	Value	Description
+FK		Regular fax abort command.
+FLID="string"		Local ID string parameter.
+FLO= <i>n</i>		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= <i>n</i>		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.
+FMFR?		Request DCE manufacturer .
+FMINSP= <i>n</i>		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= <i>n</i>		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.



Command	Value	Description
	n=5	Page good; procedure interrupt requested.
+FREL= <i>n</i>		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= <i>n</i>		"Enable polling" command:
	n=0	Disable polling.
	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.
+FDCCS:vr,br, wd,ln,df,ec,bf,s t		Report session parameters response; refer to +FDCC=.... command.
+FDIS:vr,br,w d,ln,df,ec,bf,st		Report session negotiation parameters response; refer to +FDCC=.... command.
+FDTC:vr,br, wd,ln,df,ec,bf,s		Report remote capabilities response; refer to +FDCC=.... command.

<b>Response</b>	<b>Value</b>	<b>Function and Description</b>
t		
+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.
+FN SF:"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= <i>n</i>		Auto-answer mode parameter:
	n=0	DCE answers as set by +FCLASS.
	n=1	DCE answers and auto-determines call type.
+FBO= <i>n</i>		Phase C data bit order:
	n=0	Select direct bit order.
	n=1	Select reversed bit order in receiving mode for phase C data.
+FBS?		Buffer size parameter; read only.
+FCC= <i>vr,br,w d,ln,df,ec,bf,st</i>		DCE capability parameter. Refer to +FDCC command in Class 2 for parameter settings.
+FCLASS= <i>n</i>		Service class selection. Refer to +FCLASS Class 1 command in previous section.
+FCO		DCE response fax connection made.
+FCQ=< <i>rq</i> >, < <i>tq</i> >		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.

Command	Value	Description
	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= <i>n</i>		"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= <i>n</i>	0-255	DTE phase C time-out parameter. n=0-255, 1s units.
+FDR		Receive phase C data command initiates document reception
+FDT		Transmit phase C data command: releases the DCE to proceed with negotiation
+FEA= <i>n</i>		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= <i>n</i>		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

Command	Value	Description
		and reported using the +FVO response.
+FIP		Initialize facsimile parameters to factory default.
+FIS= <i>vr,br,wd,ln,df,ec,bf,st</i>		Current session parameter. refer to +FDCC Class 2 command in previous section parameter settings.
+FKS		Session termination command.
+FLI=" <i>string</i> "		Local ID string parameter.
+FLO= <i>n</i>		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= <i>n</i>		Document for polling command:
	n=0	The DTE has no document for polling.
	n=1	Indicated document available for polling.
+FMI?		Request DCE manufacturer identification.
+FMM?		Request DCE model identification.
+FMR?		Request DCE revision identification.
+FMS= <i>n</i>		Minimum phase C speed parameter. refer to +FMINSP Class 2 command in previous section for parameter settings.
+FNR= <i>rpr, tpr,idr,nsr</i>		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.

Command	Value	Description
		(+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.
+FNS="string"		Non-standard byte string parameter. "string": string of hexadecimal coded octets.
+FPI="string"		Local fax station ID string, for polling Rx.
+FPR= <i>n</i>		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= <i>n</i>		Page transfer status: refer to the +FPTS Class 2 command in previous sections for settings.
+FRQ= <i>pgl, cbl</i>		Receiving quality threshold parameters:
	pgl=	Specify the percentage of good lines (e.g.

Command	Value	Description
	0-64 (HEX value)	with negotiated number of pixels) required for a page considered acceptable. The percentage of good lines would be computed by the equation: $100 \times (\langle lc \rangle - \langle bl \rangle) / \langle lc \rangle$ 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= <i>n</i>		Enable polling command:
	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,w d, 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,

<b>Response</b>	<b>Value</b>	<b>Function and Description</b>
		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.
	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.



<b>Response</b>	<b>Value</b>	<b>Function and Description</b>
+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,b lc,cblc,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 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,w d,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 Settings*

<b>Command</b>	<b>Function</b>
#F	Set the modem into V.17G3 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 the 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

<b>Command</b>	<b>Function</b>
	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*

<b>Command</b>	<b>Function</b>
#V0	Set to normal vertical resolution.
#V1	Set to high vertical resolution.
#T0	Set to one dimensional coding scheme.
#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).

<b>Command</b>	<b>Function</b>
#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 your modem is in fax mode, each ATD or ATA command will 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
<i>Snnnn</i>	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.
<i>Vn</i>	Vertical resolution; n = 0 or 1.
<i>Tn</i>	Coding scheme; n = 0 or 1.
<i>Rn</i>	Recording width; n = 0, 1, or 2.
<i>Ln</i>	Recording length; n = 0, 1, or 2.
<i>Cn</i>	Scan line time; n = 0 to 7.
<i>P&lt;string&gt;</i>	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.
<i>P&lt;string&gt;</i>	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, your modem 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 each page. 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

Your modem 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 Front Door 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
--------	-------------

<b>String</b>	<b>Error Level</b>
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.	

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.	
Ds		Dial s (numbers and options) that follow (see also S38.0, S35.4). The options of s are listed as follows:	
	0-9, #, *	Digits for dialing.	
	P	Pulse dialing.	S23.1
	T	Ton dialing.	S23.1

Command	Options	Function & Description	Ref.
	,	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.	
DSn	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
En		Command mode local echo of keyboard commands.	S23.0
	E0	Echo off.	
	E1 *	Echo on.	
Hn		On/off hook control	
	H0 *	Hang up (on-hook) the modem or ISDN, same as 'ATH'.	
	H1	Off hook the modem.	
In		Display inquired information.	
	I0	Display numerical product code, same as 'ATI'.	
	I1	Display product information and ROM checksum.	
	I2	Display modem link status report.	

<b>Command</b>	<b>Options</b>	<b>Function &amp; Description</b>	<b>Ref.</b>
	I12	Display physical layer status.	
<i>Ln</i>	n=0-7 4 *	Speaker volume control. The higher the value, the higher the volume.	S24.4-6
<i>Mn</i>		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.	
<i>Nn</i>	n=0-7 5 *	Ring volume control.'N0' will disable the audio ring function.	S24.0-2
<i>O</i>		Return to on-line state.	
<i>O1</i>		Force modem to request a retrain.	
<i>Qn</i>		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
<i>Sr.b=n</i>		Set bit 'b' of S-register 'r' to value 'n'. 'n' is a binary digit '0' or '1'.	
<i>Sr.b?</i>		Display value of bit 'b' of S-register 'r'.	
<i>Sr=n</i>		Set S-register 'r' to value 'n'. 'n' must be a decimal number between 0 and 255.	
<i>Sr?</i>		Display value stored in S-register 'r'.	
<i>T</i>		Ton dial.	S23.1
<i>UPX</i>		Download firmware to the Flash EPROM by using Xmodem protocol.	

Command	Options	Function & Description	Ref.
<i>Vn</i>		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.	
<i>Xn</i>	n=0-7 5 *	Result code options, see the Options Table.	S23.3-5
<i>Zn</i>	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 AT12 Output:

The Link Status Report output appears as follows:

```
ZyXEL U-MODEM LINK STATUS REPORT
Chars Sent                2420
Chars Received            2420
Octets Sent               950
Octets Received          950
Blocks Sent               13
Blocks Received           13
Blocks Resent             0
```

```

Max Outstanding          8
Max Block Size          256
Retrain Requested       0
Link Duration           1
Retrain Granted         0
T401 Timeouts           0
T402 Timeouts           0
FCS Errors              0
Round Trip Delay        10
Xmitter Underrun        0
Receiver Overrun        0
Last Speed/Protocol     Connect
14400/ARQ/V42b
Disconnect Reason Local Hangup

```

<b>Data Type</b>	<b>Description</b>
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.)

<b>Output Parameter</b>	<b>Output Value Description</b>
Chars Sent	Number of characters DTE has sent to modem.

<b>Output Parameter</b>	<b>Output Value Description</b>	
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.	
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

Output Parameter	Output Value Description	
	Carrier Lost	On-Line (Not disconnected)
	Resent Expiration	Protocol Error
	Break Time-out	DTR Dropped
	Carrier Lost 1 (No handshaking response) Security check ATH command D/V hang up.	Carrier Lost 2 (Remote hang-up, busy tone) 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, RJ11.	
	&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 selection.	S14.6-7
	&M0 *	Asynchronous mode with data	



Command	Options	Function & Description	Ref.
		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 line only)	
	&N2	V.33 12000 (models with 4-wire leased line 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 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)	

<b>Command</b>	<b>Options</b>	<b>Function &amp; Description</b>	<b>Ref.</b>
	&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	
	&N44	CELL 9600	
	&N45	CELL 7200	
	&N46	CELL 4800T	
	&N62	V.34 28800	
	&N63	V.34 26400	
	&N64	V.34 24000	
	&N65	V.34 21600	

Command	Options	Function & Description	Ref.
	&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-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

<b>Command</b>	<b>Options</b>	<b>Function &amp; Description</b>	<b>Ref.</b>
	&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).	
	&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.	

Command	Options	Function & Description	Ref.
	&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.
*Bn		Dial-backup selection.	S30
	*B0 *	Disable dial-backup.	
	*Bn	Enable dial-backup and set dial-backup pointer at telephone directory location (n-1). See also S34, S44b2)	
*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 directory location n.	S29
	*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).	

<b>Command</b>	<b>Options</b>	<b>Function &amp; Description</b>	<b>Ref.</b>
*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")	
*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.	

			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.	
*T		Recall the last CND (Caller ID) information..	S40.2
*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.

# 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 register also sets the time-out interval for the	+003



<b>Command</b>	<b>Function &amp; Description</b>	<b>+Ref.</b>
	“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 "ATS<sub>n</sub>=x"

<b>Command</b>	<b>bit</b>	<b>dec</b>	<b>hex</b>	<b>Function and description</b>	<b>Ref.</b>
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
	1	0	0	Grant Remote Digital Loop-	&T4

Command	bit	dec	hex	Function and description	Ref.	
				back test request.		
		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 power on.	Z1	
		64	40	Profile 2 as active settings after power on.	Z2	

Command	bit	dec	hex	Function and description	Ref.
		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
	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 accepted).	*I2
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	

Command	bit	dec	hex	Function and description	Ref.
				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	
		17	11	153600 bps	
		18	12	102400 bps	
		20	14	61440 bps	
		21	15	51200 bps	
		22	16	624000 bps	
		24	18	124800 bps	

Command	bit	dec	hex	Function and description	Ref.
		25	19	62400 bps	
		26	1A	41600 bps	
		27	1B	31200 bps	
		28	1C	24960 bps	
		29	1D	20800 bps	
		46	2E	921600 bps	
<b>Note: Only the speeds up to S20=15 are supported by auto speed detection.</b>					
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
		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

Command	bit	dec	hex	Function and description	Ref.
		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
		24	18	ATX3	X3
		32	20	ATX4	X4
		40	28	ATX5, error control result code enabled (Default).	X5

Command	bit	dec	hex	Function and description	Ref.
		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' command).	&Rn
S27=	bit	dec	hex	Bit mapped register.	
	0-2			Modem error control.	

Command	bit	dec	hex	Function and description	Ref.
		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.
0		0	0	Reserved	
4-5		0	0	No guard tone.	&G0
		16	10	Reserved	&G1
		32	20	1800 Hz guard tone.	&G2
7		0	0	* Select V.22 for 1200 bps communication.	B0
		128	80	Select Bell 212A for 1200	B1



Command	bit	dec	hex	Function and description	Ref.
				bps communication.	
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.	
	0	1	1	Use CELL 4800T trellis 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	*W0

Command	bit	dec	hex	Function and description	Ref.
				password will be requested. This bit in profile 0 also protects the supervisory password from a hardware reset.	
	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
		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

Command	bit	dec	hex	Function and description	Ref.
		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 number.	*Dn 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:	

Command	bit	dec	hex	Function and description	Ref.
				+FCON at current DTE, shift to 19,200 when entering into the next phase.	
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.	
	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

Command	bit	dec	hex	Function and description	Ref.
	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 0.5 seconds at carrier loss.	&C0
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	

Command	bit	dec	hex	Function and description	Ref.
				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 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)	&Bn
	7	128	80	Enable UK (Australian, Singapore, Indian, etc.,) type short-to-short	

Command	bit	dec	hex	Function and description	Ref.
				(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.	+003
				To process the CND, silence must be detected for the specified interval, in 20 ms units.	
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 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

<b>Command</b>	<b>bit</b>	<b>dec</b>	<b>hex</b>	<b>Function and description</b>	<b>Ref.</b>
	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 reaches the preset value. Set value '0' to disable this function.	
S51=	bit	dec	hex	Bit-mapped register.	
	1-0	0	0	Disables EDR.	



Command	bit	dec	hex	Function and description	Ref.	
		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.	
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	&N12	

Command	bit	dec	hex	Function and description	Ref.
				signal of the V.23 handshaking sequence (Default).	
		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	1	Force the modem to use the old values of S18 (compatible with 1496 series modem) to fix the baud rate when answering.	

<b>Bit</b>	S-register bit number, 'b', used in 'ATSr.b=n' and 'ATSr.b=?'
<b>dec</b>	Decimal value, 'x', used in 'ATSn=x'

<b>hex</b>	Equivalent Hexadecimal value.
<b>+nnn</b>	Factory default when listed in 'Reference' column.
<b>Note:</b>	'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
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		%	%	%	%	@	\$	#
16	CONNECT 12000		%	%	%	%	@	\$	#
17	CONNECT 14400		%	%	%	%	@	\$	#
18	CONNECT 16800		%	%	%	%	@	\$	#
19	CONNECT 38400		%	%	%	%	@		

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
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:**

<b>V</b>	<b>Supported</b>
%	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

<b>Numerical V0</b>	<b>Verbose V1</b>	<b>Numerical V0</b>	<b>Verbose V1</b>
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-336R/RE 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
- \* Line Condition Status Display
- \* Re-Transmission Indicator
- \* Throughput Display
- \* Link Status Report

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.



**NOTE:**

\* ITEMS APPLICABLE EXCLUSIVELY TO U-336R INSTALLED IN RS-1612 RACK SYSTEM.

### 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.

If successful, the TST LED will be on during, and off after the test. If the test fails the SQ LED will flash. The number of flashes will indicate the error as specified by the table below:

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	The factory default settings will be downloaded to the RAM 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.
---	----------------------------	-----------------------------------

## 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.

### *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. 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 RI 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 intervals 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 during 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 for 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:**

READINGS ARE ONLY AVAILABLE WHEN USING THE U-336R/RE INSTALLED IN RS-1612 RACK SYSTEM. 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 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 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 -11 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 1 degree resolution.

***Frequency Offset (FO)***

Frequency offset is expressed in 1 Hz resolution. It is the difference between the transmitted carrier frequency and the received carrier frequency.

***Retrain Granted (RG)***

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

***Retrain Requested (RT)***

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

***Round Trip Echo Delay (ED)***

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

***Carrier Loss Counter (CL)***

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

***FRN (Fast Rate Negotiation) Granted (FG)***

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 (FR)***

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

***Block Retransmitted (BR)***

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

***FCS (Frame Check Sum) Errors (FE)***

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

**Link Status Report (ATI2)**

During a connection, the modem will record information about link operations. You can use the AT command **ATI2** to see the summary, as show in the sample below:

```
ZyXEL U-MODEM LINK STATUS REPORT
ZyXEL U-MODEM LINK STATUS REPORT
Chars Sent                2420
Chars Received            2420
Octets Sent               950
Octets Received           950
Blocks Sent               13
Blocks Received           13
Blocks Resent              0
Max Outstanding           8
Max Block Size            256
```

Retrain Requested	0
Link Duration	1
Retrain Granted	0
T401 Timeouts	0
T402 Timeouts	0
FCS Errors	0
Round Trip Delay	10
Xmitter Underrun	0
Receiver Overrun	0
Last Speed/Protocol	Connect
14400/ARQ/V42b	
Disconnect Reason	Local Hangup

This Link Status Report is very helpful in finding the link condition and identifying problems with the link. Following are explanations for each item and the terminology used above.

***Chars***

Data characters transmitted between the DTE (computer/terminal) and the modem.

***Octets***

Data bytes transmitted between the modems, handled by error control protocol, may be compressed data. Data compression efficiency may be seen from the ratio of chars count to octets count.

***Block***

Framed octets transmitted between error control protocols of the two modems.

***Chars Sent***

Characters sent from the DTE to the modem for transmission.

***Chars Received***

Characters received by the modem from the line and sent to the DTE.

***Octets Sent***

Data bytes sent to the remote modem.

***Octets Received***

Data bytes received from the remote modem.

***Blocks Sent***

Blocks sent to the remote modem.

***Blocks Received***

Blocks received from the remote modem.

***Blocks Resent***

Number of blocks resent because of error. If there are too many resends, it may be a bad line or protocol incompatibility.

***Max Outstanding***

Error control protocol parameter. The maximum allowable number of blocks sent or received without acknowledgment.

***Max Block Size***

Error control protocol parameter. The maximum allowable number of octets in a block. Actual block size can be smaller.

***Retrans Requested***

Number of times the local modem has requested a retrain. Each request is an indicator of bad receiving conditions.

***Retrans Granted***

Number of times retrans requested by the remote modem were granted.

***Link Duration***

Connection time in minutes.



### ***T401 Timeouts and T402 Timeouts***

These are for the manufacturer checking link layer operation. T401 and T402 are timers used in MNP4 or V.42. T402 will count when the modem is connected in the idle state with no data to transmit or receive.

### ***FCS Errors***

Frame CheckSum Errors/number of block errors. A lot of FCS errors indicate a bad line.

### ***Round Trip Delay***

Round trip delay between modems in T (1/2400 sec) units. Normally should be in the range of 0-100. A satellite link will introduce a delay of about 1300 T.

### ***Xmitter Underrun***

Number of times the modem fails to provide data octet in time for transmission.

### ***Receiver Overrun***

Number of times the modem fails to take data octet in time from receiver.

### ***Last speed/protocol***

The speed and protocol of the link before hang-up. It may be different from the initial speed because of retrain and speed fall-back or fall-forward. Speed change is a clue to changing line conditions.

### ***Disconnect Reason***

- Local Hang-up
- Remote Hang-up
- Carrier Lost
- On Line

- Resent Expiration
- Protocol Error
- Break Timeout
- DTR Dropped
- Carrier Lost 1 (No handshaking response)
- Carrier Lost 2 (Remote hang-up, busy tone heard)

## **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 RI LED flickers with each incoming ring. If the LEDs do not respond in this way, refer to your ZyXEL Modem Reference Manual.
4. Set `&D0` 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.

## **Connect 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 instructions.
2. Turn on your computer.
3. Turn on your modem.
4. Start any communications program that supports the XModem protocol.
5. Type **ATUPX<enter>**.
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. Wait for the following prompt characters:  
§§§...
9. Use the XModem protocol to upload the file to your modem. This step updates the modem's flash EPROM with the latest firmware.

10. 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 and hold down the A/O button while turning on the modem, then release the button after 5 seconds.
3. 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.

Repeat steps 1 through 6 from the directions above to upload a file that contains valid firmware for your modem.



# 12 Terminal Pinouts

## Terminal Blocks

Each terminal block has eight terminal pins for connecting phone lines to the corresponding modem in the rack. A description and function of each of the eight pins is given below:

Pin	Assignment	Purpose
1	TIP	Connect to your telephone
2	RING	Connect to your telephone
3	TIP	Connect to dial up line
4	RING	Connect to dial up line
5	RX	For use with four wire leased line systems receive line
6	RX	For use with four wire leased line systems receive line
7	TX	For use with two or four wire leased line systems transmit line
8	TX	For use with two or four wire leased line systems transmit line

## 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 (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	→

Signal Pin	ITU-TSS Signal Name	EIA Signal Name	Pin/Signal Description	Direction DTE-DCE
			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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