

U-90 E

V.90 Data/FAX Modem

User's Guide

Version 1.1

Oct 1999

ZyXEL

TOTAL INTERNET ACCESS SOLUTION

U-90E Data/ Fax Modem

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The following Equipment:

Product : Modem
Trade Name : ZyXEL
Model Number : U-90E

The following severity levels have been achieved:

RFI Emission: Generic emission standard according to EN 50081-1:1992
Limit class B according to EN 55022:1994
Limit class A for harmonic current emission according to EN 61000-3-2:1995
Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3:1995

Immunity : Generic immunity standard according to EN 50082-1:1997
Electrostatic Discharge according to EN 61000-4-2:1995
Contact Discharge: 4 kV, Air Discharge: 8 kV
Radio-frequency electromagnetic field according to EN 61000-4-3:1996
80 - 1000MHz with 1KHz AM 80% Modulation: 1V/m
Electromagnetic field from digital telephones according to ENV 50204:1995
900 - 25MHz with 200Hz exp. Frequency Duty Cycle 50%
Electromagnetic field from digital telephones according to EN 61000-4-2:1995
AC/DC power supply: 1kV, Data/Signal lines: 0.5kV
Surge immunity test according to EN 61000-4-5:1995
AC/DC Line to Line: 1kV, AC/DC Line to Earth: 2kV
Immunity to conducted disturbances, induced by radio-frequency fields: EN 61000-4-6:1995
0.15 - 80MHz with 10KHz AM 80% Modulation: 3V/m
Power frequency magnetic field immunity test according to EN 61000-4-8:1993
3A/m at frequency 50Hz
Voltage dips, short interruptions and voltage variations immunity test according to EN 61000-4-11:1994
30% Reduction @ 10ms, 60% Reduction @ 100ms, >95%Reduction @ 5000ms

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Company Name : **ZyXEL Communications Services GmbH.**
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Company Address : A-1160 Wien • AUSTRIA
Tel.: 01 / 494 86 77-0
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Person is responsible for marking this declaration:

Manfred RECLA

Name (Full Name)

October 29, 1999

Date

European Technical Support

Position/ Title

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DECLARATION OF CONFORMITY

Per FCC Part 2 Section 2.1077(a)



The following equipment:

Product Name : Modem

Trade Name : ZyXEL

Model Number : U-90E, U-336E Plus

Is herewith confirmed to comply with the requirements of FCC Part 15 Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

The result of electromagnetic emission has been evaluated by QuisTek EMC laboratory (NVLAP Lab. Code : 200147-0) and showed in the test report.
(Report No. : QTK-998H013-1E)

It is understood that each unit marketed is identical to the device as tested, and
Any changes to the device that could adversely affect the emission
Characteristics will require retest.

The following importer / manufacturer is responsible for this declaration:

Company Name ZyXEL Communications Inc.

Company Address 1650 Miraloma Ave., Placentia, CA 92870

Telephone 714-632-0882 Facsimile: 714-632-0858

Person is responsible for marking this declaration:

Gordon Yang

Name (Full name)

President

Position / Title

09/15/1999

Date


Legal Signature

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Austria	support@zyxel.at sales@zyxel.at	+43-1-4948677-0 +43-1-4948678	www.zyxel.at ftp.zyxel.at	ZyXEL Communications Services GmbH, Thaliastrasse 125a/2/2/4 A-1160 Vienna, Austria
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Preface

About Your Modem

Congratulations on the purchase of your U-90E modem - one of ZyXEL's premier high-performance products. The U-90E modem is world renown for its ability to maintain ultra high speeds and clear, quality connections while communicating around the globe.

About This Manual

This manual describes the use of your U-90E data/fax modem and gives instruction for its installation and operation.

Structure of this Guide

This manual is divided into four sections:

- *Getting Started* (Chapters 1-4) gives a basic overview of your modem's features, explains its installation procedures and introduces you to the basic commands and techniques involved in modem operation.
- *Settings and Commands* (Chapters 5-6) provides an overview of the settings and commands which are available in the U-90E modem.
- *Additional Functions* (Chapters 7-13) describes many special functions and features of the U-90E modem in detail, including error control and data compression, leased-line and synchronous mode operation, remote configuration, caller ID, fax sending and receiving, voice mail and diagnostic features.
- *Upgrading and Troubleshooting* (Chapters 14-15) provides information about upgrading your modem and solving common problems.

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. Save your dated invoice as proof of purchase.

Chapter 1

Getting to Know Your Modem

This chapter describes the key features and applications of your 56/33.6 Kbps Data/Fax modem.

1.1 U-90E Data/Fax Modem

The U- 90E is an analog Data/Fax modem used for data transmission via PSTN line. It connects to both 2-wire dial-up and 2-wire leased line. The synchronous transmission mode can support up to 33.6kbps. For Internet access application, it operates with downstream maximum speed of up to 56Kbps and upstream speed of up to 33.6Kbps. The speed depends on the line quality, and server side configuration.

1.2 Standard Features

- ITU V.90 56Kbps down-stream data transmission.
- V.34bis 33.6Kbps data transmission rate.
- Operates in all system environments including Windows 95, DOS, Windows, Macintosh, OS/2, UNIX, Novell, Amiga, and IBM AS400/RS6000, Linux and other synchronous mode DTE.
- Microsoft Windows 95/98/NT plug and play compatible.
- V.42 and MNP 4/3 error control.
- V.42bis and MNP 5 data compression.
- DTE serial interface with speeds up to 460.8Kbps.
- 12 LED indicators.

- Extended AT command set.
- V.25bis command set..
- Operates on 2-wire dial-up or 2-wire leased line.
- On-line help for easy command reference.

1.3 Intelligent Features

- Automatic data and voice call detection allows you to use a single telephone line to handle both types of calls.
- Asynchronous and synchronous modes for reliable serial data communication. Up to 33.6 Kbps for synchronous transmission.
- Fast retrain with automatic fall-forward and fall-back. Your modem will automatically fall back to lower speeds when communicating with slower modems and when encountering unstable or variable line conditions.
- Call-back security and password protection restricts access to authorized callers only.
- Caller ID identifies incoming calls before you answer (you must subscribe to this service through your telephone company in order for your modem to identify callers).
- Distinctive ring detects data and voice calls (this feature requires communication software that supports distinctive ring, such as ZFAX).
- Remote configuration capability.
- EDR (extended Distinctive Ring).
- Flash EPROM memory lets you easily upload new firmware, providing you with easy access to new features.
- ZyXEL exclusive Kernel Recovery Mode for no hassle recovery from failed flash uploads - no factory repairs needed.

- Reduced voice function. Supports DTMF tone generation and detection only.

1.4 Data Compatibility

The U-90E modem is a high performance universal modem capable of transmission speed up to 56/33.6 Kbps full-duplex on a 2-wire dial-up line. Universal compatibility covers a broad range of ITU-T and BELL standards.

Various operation modes that can be achieved are as follows:

Table 1-1 U-90E Data Operation Modes

Standard	Bit Rate [bps]	Baud Rate [baud]	Modulation	Carrier Frequency [Hz]
V.90	28000-56000	8000	PCM	
V.34bis/V.34	33600-2400	multiple	TCM	multiple
V.32bis	14400	2400	128-TCM	1800
V.32bis	12000	2400	64-TCM	1800
V.32bis	7200	2400	16-TCM	1800
V.32	9600	2400	32-TCM	1800
V.32 uncoded	9600	2400	16-QAM	1800
V.32	4800	2400	4-DPSK	1800
V.23	1200/75	1200/75	FSK	
V.23	600/75	600/75	FSK	
V.22bis	2400	600	16-QAM	1200 Org 2400 Ans
V.22 (BELL 212A)	1200	600	4-DPSK	1200 Org 2400 Ans
V.21	300	300	FSK	
BELL 103	300	300	FSK	

1.5 Fax Compatibility

The U-90E modem supports fax applications and is compatible with many fax transmission standards. It provides the highest fax speed of up to 14400 bps using the fax transmission standard V.17.

Table 1-2 Fax Compatibility

Standard	Bit Rate [bps]	Baud Rate [baud]	Modulation	Carrier Frequency [Hz]
V.17	14400-7200	2400	TCM	1800
V.29	9600-4800	2400	QAM/DPSK	1700
V.27ter	4800-2400	1600/1200	PSK/DPSK	1800
V.21	300	300	FSK	

1.6 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.
- Call progress monitoring dial tone, busy, and ring back detection.
- Audio Monitor: programmable volume control.

1.7 Applications

1.7.1 Data Transfer Via Leased Line

Your U-90E modem provides reliable transmission quality on-line data transfer for users subscribing a leased line. It is useful for networks that have traffic requirements with steady and sustained patterns, such as large file transfers. Your modem is a cost-effective way to handle a high volume of data and/or voice traffic.

Leased lines are very popular method of connecting corporate sites. They are essentially private reserved pathways (or pipelines). The private nature of the leased line networks provides inherent privacy and control benefits. Digital leased lines provide good line quality. For more information please read the chapter **Leased Line Operation**

1.7.2 Synchronous mode DTE

Your U-90E modem provides service on an immediate basis and ensures a steady flow of data. It is very useful for users using synchronous mode DTE like IBM mainframes.

To process large amount of information, you can use the U-90E to transmit data to remote synchronous DTEs with speed of up to 33.6Kbps. For more information please read the chapter **Synchronous Mode Operation**.

1.7.3 Internet Access

Your U-90E modem supporting the V.90 protocol is the ideal choice for high-speed access to the Internet.

V.90 technology is ideal for Internet users, because it enables fast downloading of Web pages with sound, video and other large files.

Your modem is compatible with ISP servers having modem chipsets manufactured by major vendors such as Rockwell, Lucent and U.S Robotics.

For more information on setting up your modem for Internet connection refer to the chapter **Setting up your Internet Connection**

Chapter 2

Modem Installation

This chapter describes the panel function and installation procedure for the U 90E.

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

2.1 Front Panel

The LEDs on the front panel indicate the operational status of the modem. Figure 2.1 shows the front panel of the U-90E. There are 12 LED indicators and two key switches.

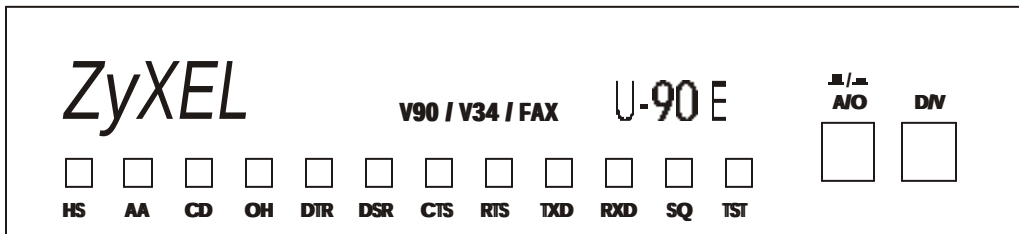


Figure 2-1 Front Panel

2.1.1 Front Panel LEDs

The following table describes the LED indicators.

Table 2-1 LED Indicators

LEDs	Description
HS	High Speed mode indicator, lights ON when your modem is operating in V.34 or V.90 mode; flashes when your modem is in Handshaking State.
AA	Auto-Answer indicator lights ON when your modem is in the Auto Answer Mode; and Flashes when modem rings. In error control mode, it flashes when retransmitting.
CD	Carrier Detect indicator, lights ON when a valid carrier is detected present on the line.
OH	Off-Hook indicator lights ON when your modem is in data mode or off-hook and lights OFF when your modem is in talk mode or on-hook.
DTR	Data Terminal Ready indicator, lights ON when your DTE or computer indicates that it is ready to begin communication and lights OFF when DTE is not ready to transmit data.
DSR	DTE mode. Data Set Ready Indicator, lights ON when the modem is ready for communication and lights OFF when the modem is not ready.
CTS	DTE mode. Clear To Send indicator, lights ON when modem can accept data for transmission. It indicates the signal status of RS232 signal CTS.
RTS	DTE mode. Request To Send indicator, indicates the signal status of RS232 signal RTS from DTE. RTS is used for hardware flow control in asynchronous data transmission.
TXD	Transmit indicator, ON when your DTE/computer transmits data on the serial port.
RXD	Receive indicator, ON when your DTE/computer receives data on the serial port.
SQ	Signal Quality Indicator, ON when signal quality is good, OFF when signal quality is bad, and flashes when signal quality is marginal or during power up to indicate an error condition.
TST	Test indicator, ON when modem is in the test mode.

2.1.2 Front Panel Switches

The following table describes the Front Panel Switches:

Table 2-2 Front Panel Switches

Switches	Description
A/O	Pressing the button will set the modem in originate mode and releasing it in answer mode. This switch only determines modem operation if the modem is made to go off-hook manually. Or else the ATD or ATA command will automatically determine the mode.
D/V	Switches the modem into data mode or voice mode. (the telephone is connected to the line).

Warning: If the A/O switch is pressed while the modem is being turned on; the modem will jump into a special kernel program that allows you to upload new firmware into the modem from a computer. If this is not what you intended, turn off the modem and then turn it on again to return to normal operation.

2.2 Rear Panel

The U-90E rear panel is shown below:

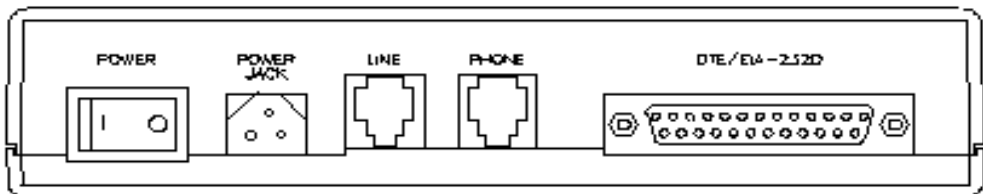
**Figure 2-2 Rear Panel**

Table 2-3 Rear Panel

Printed on U-90E Housing	Description
Power	Power switch, turns the modem ON or OFF.
Power Jack	Input terminal for power adapter.
Line	Dial-up line RJ-11 terminal jack, for connection to a 2-wire dial-up or 2-wire leased line.
Phone	RJ-11 terminal jack, for connection to a telephone set. Pin assignments for RJ-11 phone jacks are listed in the Appendix.
DTE/EIA 232D	Serial port DB25F connector, for connection to the serial port of a DTE (computer terminal). Pin assignments of the DTE are listed in the Appendix.

2.3 Additional Installation Requirements

- 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, and 22).
- Available telephone jack.
- Available AC wall outlet.
- Telephone line from your telephone company (dial-up or leased line).
- Data and fax communication software.

2.4 Connecting the Modem

Connect the power plug from the adapter to the power jack and plug the other end into an electrical outlet. When you connect your modem to the power line, make sure you only use the power

adapter that is supplied with this unit. Use of another adapter may not allow your modem to operate and could result in serious damage to the unit.

This adapter is rated for direct connection to an AC power outlet.

Turn off the power on both the computer and the modem before making connections. Then connect the modem according to the rear panel labels.

Note: Before using RS-232 to connect your modem to your PC, please find the COM port on the back of your PC to determine the pin type of the required connector.

2.5 Modem Configuration

There are no DIP (dual in-line package) switches or configuration settings that you need to worry about. Your modem is factory pre-set. User configurations are also conveniently stored in user selectable non-volatile memories and can be recalled as often as needed by using **ATZn** command.

2.6 Power On

Once your modem's power switch is turned ON, a series of diagnostic tests will be performed. For a more detailed description of these diagnostic tests, please refer to the chapter on **Diagnostics and Troubleshooting**. After performing the diagnostic tests, your modem is ready for use.

Chapter 3

Windows Internet Connection Setup

For accessing Internet, you must install TCP/IP in your computer, configure the TCP/IP, and then create a PPP connection.

3.1 Installing TCP/IP

If TCP/IP is already installed in your computer, you may go to the next section about configuring the TCP/IP; if not, from **Start**, select **Settings/Control Panel**, then click on **Network**. Then click **Add** and you will see the following screen:

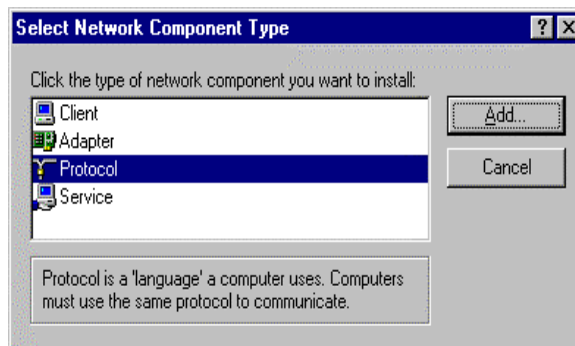


Figure 3-1 Select Network Component Type

Select **Protocol**, then click on **Add**.

You will see Figure 3-2 Select Network Protocol.

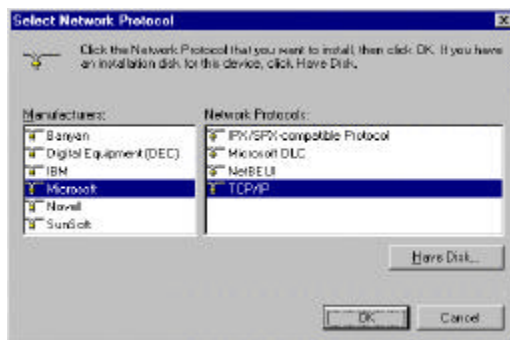


Figure 3-2 Select Network Protocol

Select **Microsoft** and **TCP/IP**, then click on **OK**.

3.2 Configuring TCP/IP

If your TCP/IP is already configured, you may go to the next section to setup a PPP connection; if not, follow the steps below:

From **Start**, select **Settings/Control Panel**, then double-click on **Network**.

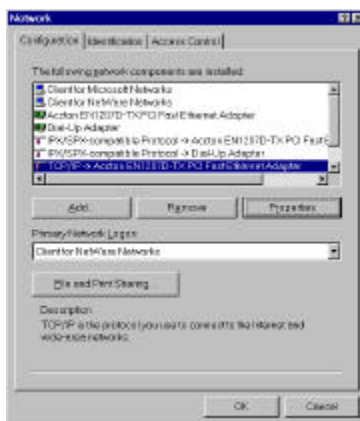


Figure 3-3 Network

Select TCP/IP, then click **Properties**. You will see the following screen.

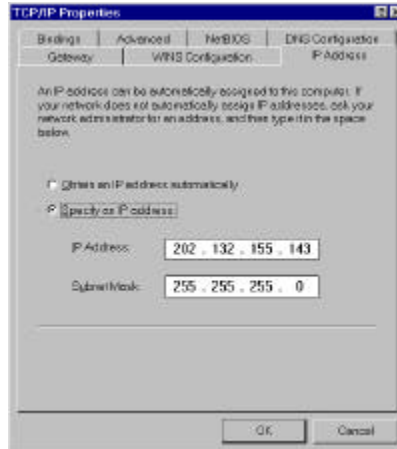


Figure 3-4 IP Address

In most cases, you have to select **Obtain an IP address**. If you have an assigned IP address from your ISP, select **Specify an IP address** then enter your IP address and subnet mask. Then click on **DNS Configuration**.

You will see the following screen. Select **Enable DNS**, enter your **Host** name, **Domain** name, and the **DNS** of your ISP, then click on **OK**.



Figure 3-5 DNS Configuration

3.3 Creating a Dial-up Connection

At this point, you are only one step away from accessing the Internet. Follow the instructions below to create a new dial-up connection.

Click on **My Computer** on your desktop, select **Dial-up Networking**, then click on **Make New Connection**.

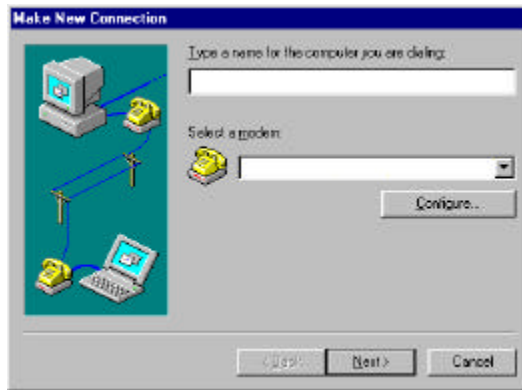


Figure 3-6 Make New Connection

Give a name to this Dial-up Connection. For example, U-90E. Then select your new modem as the device to connect to Internet, and then click **Next**. You will see the following screen.

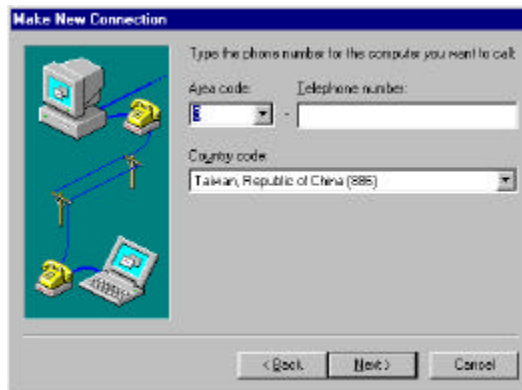


Figure 3-7 Insert ISP's Phone Number

Enter your ISP's phone number, and then click **Next**.

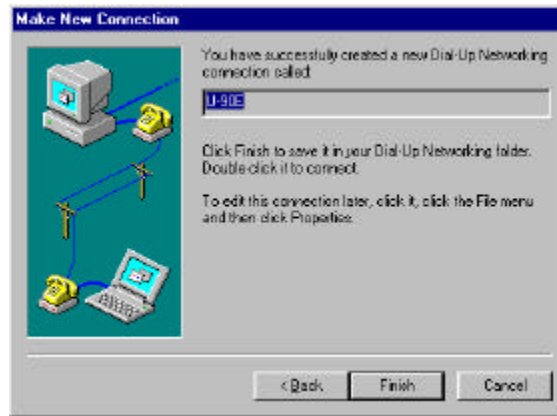


Figure 3-8 Completing Dial-Up Connection

Click **Finish**.

Now, you have completed dial-up setup. From now on, you can access the Internet by your new device.

Chapter 4

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 use the communication software, and to start making connections with your modem.

4.1 Understanding AT Commands

The U-90E 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 for your modem to recognize them. A command statement always begins with the letters **AT** or **at**. One or more commands and the <Enter> key then follow it.

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.

4.1.1 Using the Windows 95 Hyper Terminal Program

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

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

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

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

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

Table 4-1 Modem Settings

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.

4.2 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.

4.2.1 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

4.2.2 Auto-Answer and Hook Controls

Enabling Auto-Answer: **ATS0=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:	ATS0=0
Manually Answering a Call:	ATA
Take modem off-hook:	ATH1
Hang up modem (on-hook):	ATH0

4.3 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 could not coexist.

If you see duplicated characters for each character 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 and “numerical” result codes (i.e. “0”). You can use the ATV command to set it one way or the other as follows.

Table 4-2 AT Result Codes

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. They are as follows:

Table 4-3 Basic Commands

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

The U-90E supports several groups of AT commands:

Table 4-4 AT Command Sets/Types

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

You may browse the lists of available commands for each command set by using the on-line help commands: **AT\$** (for Basic **AT** command set), **AT*\$** (for **AT*** command set), and **AT&\$** (for **AT&** command set) . For more information on **AT** commands refer to chapter **AT Command Set Summaries**.

4.3.1 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 that the **AT** command you sent was executed. If you receive an **ERROR** code, it means the command was invalid.

The U-90E also provides result codes that show:

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

Whether 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 an incoming ring was detected.

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

For more information on result code options refer to the chapter **AT Command Set Summaries**.

4.3.2 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. For more information on S-registers refer to the chapter **Status Registers**.

4.3.3 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.

4.4 Non-Volatile Memory

The U-90E 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 gives information about storing phone numbers, and saving default settings in the power-on profile.

4.4.1 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 where the phone number **n**’ is the phone number itself.

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

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

You can store up to 50 telephone numbers.

4.4.2 Dialing Stored Phone Numbers

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

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

NOTE: As a general rule, when a letter in an **AT** command definition is shown in italic type, the letter is not to be entered as part of the command, but rather is representative of a number or string expected as input. For example: The letter ‘*S*’ in the **ATDS=*n*** command is actually typed, unlike the ‘*s*’ in the **AT&Z*s*=*n*** command which represents a number.

4.4.3 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 .

Profiles 0 to 3: User profiles.

Profile 4: Factory default profile.

The following table lists the syntax for the commands involved in storing, recalling, and viewing profile settings:

Table 4-5 Profile Setting Commands

Command	Description
AT&V <i>n</i>	Views the settings in profile (<i>n-1</i>); <i>n</i> =0 to 5; <i>n</i> =0 views current settings.
AT&W <i>n</i>	Stores the current settings in user profile ‘ <i>n</i> ’; <i>n</i> =0 to 3.
ATZ <i>n</i>	Resets the current settings with the settings in profile ‘ <i>n</i> ’, <i>n</i> =0 to 4.

4.5 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.

4.5.1 Default Modem Settings for PC's

The U-90E factory settings are configured for operation with PC type computers and communication software. In most cases, no additional settings will be required. The following are some of the default settings that are used for operation with PC computers and software:

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

Table 4-6 Default Settings

4.6 Helpful Hints for Mac Computers

4.6.1 Special AT Command Settings for Mac

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

Type:

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

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

4.6.2 Mac Serial Port

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

4.6.3 Mac Software Tips

All terminal programs that 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 that has found wide acceptance is FaxSTF that 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.

4.7 Helpful Hints for UNIX-Based Computers

4.7.1 Serial Cable

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

4.7.2 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**.

4.7.3 Unix Software Tips

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

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

You should suppress the modem's result code to (**ATQ1**) because they may confuse some applications.

Chapter 5

AT Command Set Summary

An **AT** command is a command issued by the computer/terminal to the modem through the asynchronous computer-modem interface in asynchronous data format. **AT** commands control the modem's behavior and actions. To send an **AT** command from a computer to the modem, you must be running a communication software and the modem must be in command state.

An **AT** command prefix (Attention) precedes each command line, except in the case of **A/**, **A>** and **+++** as mentioned earlier (see Table 3-3). Up to 40 commands can be entered in a command line with a single **AT** prefix. Be sure to either use all capital letters (**AT**) or all small letters (**at**).

5.1 Basic AT Command Set

A list of the basic **AT** commands follows. Each command should be entered after an **AT** prefix. A* sign indicates that it is a default setting.

Table 5-1 Basic AT Command Set

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	Tone 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=0-3	Dial number stored in non-volatile RAM at location 'n'; use "+" to dial two consecutive numbers for bundling.	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 'ATT'	
	I1	Display product information and ROM checksum	
	I2	Display modem link status report	
	I12	Display physical layer status	
	I13	Display Channel response for V.34	

Command	Options	Function & Description	Ref.
	I14	V 90 capability report	
	I15	V 90 power management report	
Ln	n=0-7 4 *	Speaker volume control. The higher the value, the higher the volume	S24.5-7
Mn		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	
Nn	n=0-7 5 *	Ring volume control.'N0' will disable the audio ring function	S24.1-3
O		Return to on-line state	
O1		Force modem to request a retrain	
Qn		Result code displayed	S23.7
	Q0 *	Modem returns result code	
	Q1	Modem does not return result code	
	Q2	Modem returns result code but quiet after answering on a RING (see also S42.2)	S40.1
Sr.b=n		Set bit 'b' of S-register 'r' to value 'n'. 'n' is a binary digit '0' or '1'	
Sr.b?		Display value of bit 'b' of S-register 'r'	
Sr=n		Set S-register 'r' to value 'n'. 'n' must be a decimal number between 0 and 255	
Sr?		Display value stored in S-register 'r'	
UPX		Download firmware to the Flash EPROM by using Xmodem protocol	
Vn		Sets display type for Result Codes	S23.6

Command	Options	Function & Description	Ref.
	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.	
Xn	n=0-7 5 *	Result code options, see the Options Table below.	S23.3-5
Zn	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	

5.1.1 Result Code Options

The result codes are the command responses. When you issue a command to the modem, the modem sends a response to you via the screen. That is called the result code. The format of the result code is dependent on Xn and Vn command. The are eight result code sets. The default result code set is ATX5. The result codes can be displayed in verbose or numerical form using ATVn command. They are listed in the following table:

Table 5-2 Result Code Options

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
0	OK	.	.	.	.	.	.	.	.
1	CONNECT	.	.	.	.	.	.	.	.
2	RING	.	.	.	.	.	.	.	.
3	NO CARRIER	.	.	.	.	.	.	.	.
4	ERROR	.	.	.	.	.	.	.	.
5	CONNECT 1200		.	.	.	.	.	.	.
6	NO DIAL TONE			.		.	.	.	.
7	BUSY				.	.	.	.	.

8	NO ANSWER				.	.	.	.	.
9	RINGING				.	.	.	.	.
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		.	.	.	.	.		
20	CONNECT 57600		.	.	.	.	.		
21	CONNECT 76800		.	.	.	.	.		
22	CONNECT 115200		.	.	.	.	.		
23	CONNECT 230400		.	.	.	.	.		
24	CONNECT 460800		.	.	.	.	.		
27	CONNECT 921600		.	.	.	.	.		
28	CONNECT 307200		.	.	.	.	.		
29	CONNECT 153600		.	.	.	.	.		
30	CONNECT 102400		.	.	.	.	.		
31	CONNECT 61440		.	.	.	.	.		
32	CONNECT 51200		.	.	.	.	.		
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		.	.	.	.	.	.	.
100	CONNECT 56000		.	.	.	.	.	.	.
101	CONNECT 54666		.	.	.	.	.	.	.
102	CONNECT 53333		.	.	.	.	.	.	.
103	CONNECT 52000		.	.	.	.	.	.	.
104	CONNECT 50666		.	.	.	.	.	.	.
105	CONNECT 49333		.	.	.	.	.	.	.
106	CONNECT 48000		.	.	.	.	.	.	.
107	CONNECT 46666		.	.	.	.	.	.	.
108	CONNECT 45333		.	.	.	.	.	.	.
109	CONNECT 44000		.	.	.	.	.	.	.
110	CONNECT 42666		.	.	.	.	.	.	.
111	CONNECT 41333		.	.	.	.	.	.	.
112	CONNECT 40000		.	.	.	.	.	.	.
113	CONNECT 38666		.	.	.	.	.	.	.
114	CONNECT 37333		.	.	.	.	.	.	.
115	CONNECT 36000		.	.	.	.	.	.	.
116	CONNECT 34666		.	.	.	.	.	.	.
117	CONNECT 33333		.	.	.	.	.	.	.
118	CONNECT 32000		.	.	.	.	.	.	.
119	CONNECT 30666		.	.	.	.	.	.	.
120	CONNECT 29333		.	.	.	.	.	.	.
121	CONNECT 28000		.	.	.	.	.	.	.

Note: If error control result codes are enabled (X4,X5,X6,X7),the resulting message will be formatted as:

X4: **CARRIER** Rx Rate.

PROTOCOL: Error Control Level

COMPRESSION: Compression Level

CONNECT DTE Speed

X5: **CONNECT** DTE Speed/Protocol Rx Rate/Error control level

X6: **CONNECT** Rx Rate/ARQ

X7: **CONNECT** Rx Rate/ARQ/Error control level

ARQ denotes that Automatic Retransmission reQuest type of error control is enabled.

5.2 Extended AT& Command Set

Table 5-3 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.	
&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	
&Mn		Synchronous/asynchronous mode selection	S14.6-7
	&M0 *	Asynchronous mode with data buffering	
	&M1	Asynchronous command, synchronous data	
	&M2	Direct asynchronous mode, no data buffering	
	&M3	Synchronous mode	
&Nn		Modem link mode options (DCE/DCE). (See also S43.7, S48.1)	S19

Command	Options	Function & Description	Ref.
	&N0 *	Multi-Auto, auto negotiate highest possible link rate: V.34, V.32bis, V.32, V.22bis, V.22 and Bell 212A, G3 Fax V.17/V.29/V.27ter .	
	&N3	V.32 9600T/9600/7200T/4800	
	&N4	V.32 9600/7200/4800	
	&N5	V.32 4800	
	&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	
	&N60	V.34 33600	
	&N61	V.34 31200	
	&N62	V.34 28800	
	&N63	V.34 26400	
	&N64	V.34 24000	
	&N65	V.34 21600	
	&N66	V.34 19200	
	&N67	V.34 16800	
	&N68	V.34 14400	
	&N69	V.34 12000	
	&N70	V.34 9600	
	&N71	V.34 7200	

Command	Options	Function & Description	Ref.
	&N72	V.34 4800	
	&N73	V.34 2400	
	&N78	V.90 56000	
	&N79	V.90 54666	
	&N80	V.90 53333	
	&N81	V.90 52000	
	&N82	V.90 50666	
	&N83	V.90 49333	
	&N84	V.90 48000	
	&N85	V.90 46666	
	&N86	V.90 45333	
	&N87	V.90 44000	
	&N88	V.90 42666	
	&N89	V.90 41333	
	&N90	V.90 40000	
	&N91	V.90 38666	
	&N92	V.90 37333	
	&N93	V.90 36000	
	&N94	V.90 34666	
	&N95	V.90 33333	
	&N96	V.90 32000	
	&N97	V.90 30666	
	&N98	V.90 29333	
	&N99	V.90 28000	
&Pn		Pulse dial make/break ratio	S23.2
	&P0 *	make / break, 39% / 61%	
	&P1	make / break, 33% / 67%	

Command	Options	Function & Description	Ref.
&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
	&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)	

Command	Options	Function & Description	Ref.
&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.	
	&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 summary help	

5.3 Extended AT* Command Set

Table 5-4 Extended AT* Command Set

Command	Options	Function & Description	Ref.
*Cn		Character length, including start, stop and parity bit.	S15.3-4
	*C0 *	10-bit character length.	
	*C1	11-bit character length.	
	*C2	9-bit character length.	
	*C3	8-bit character length.	
*Dn	n=0-49	Set default dial pointer at telephone 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).	
*Fn		Remote Configuration.	S36.0
	*F0 *	Denies Remote Configuration.	
	*F1	Accepts Remote Configuration. (Also the Remote Digital Loopback must be granted- AT&T4)	
*Gn		Security Function	S36.7-5
	*G0	Disables security function.	
	*G1	Enables type 1 security, with password check.	
	*G2	Enables type 1 security, with password check and call back.	
	*G3	Enables type 2 security, with password check.	
	*G4	Enables type 2 security, with password check and call back.	

Command	Options	Function & Description	Ref.
	*G5	Enables type 2 security, with password check and call back; remote side enters the call back number.	
Note: The command *Gn requires supervisor password checking. 1. In security type 1, the remote site must be a ZyXEL modem. 2. In security type 2, the remote site can be any other type of modem. 3. The modem can store 50 (0-49) telephone numbers. If call back security is disabled, the modem will search the password table to check the remote modem's password. If they match, the modem will keep the connection, otherwise the modem will hang up. If call back security is enabled, the modem will complete the password checking. If there is no match, the modem will disconnect the line, find the corresponding phone number and call back immediately. The remote modem should be set to auto-answer the call and response.			
*Hn		Modifies the user password table at location n (0 < n < 49)	
*HS		Modifies supervisor password. The default supervisor password is ZyXEL .	
Note: • The commands *Hn and *HS require the supervisor password before execution. Any character can be entered in the password (0-255). Maximum password length is eight.			
*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.	S14.0-1
	*M0 *	Leased line auto-handshake on originate mode.	
	*M1	Leased line auto-handshake on answer mode.	
*Pn	n=0-31 *P11 *	Set leased line transmission power level; ranges from 0 dBm to -31dBm (default: -11 dBm depends on the country code) (see also S35.3)	S17.1-4

Command	Options	Function & Description	Ref.
*Qn		Action taken when line quality changes.	S27.6-7
	*Q0	No action to poor signal quality.	
	*Q1	Retrain action taken if signal quality is poor. (See also S41.2)	
	*Q2 *	Adaptive rate, automatic fall-back or forward.	
	*Q3	Disconnect if signal quality is poor.	
*Rab		Reads from remote profile a to local profile b a= 0-3, local user profile number b= 0-3 remote user profile number. 4, remote active configuration 5, remote factory default	S36.2
*T		Recall the last CND (Caller ID) information.	S40.2
*V		View password table.	
Note:			
*V command requires the supervisor password before execution.			
*Wab		Writes the local configuration profile a to remote user profile b and resets the remote modem from that profile: a= 0-3, local user profile number 4, local active configuration 5, local factory default settings b= 0-3 remote user profile number.	S36.1
Note:			
The above command only works when the modem is on-line independent of the type of connection involved.			
*\$		Extended *AT Command summary help.	

5.4 Extended AT# Command Set

Table 5-5 Extended AT# Command Set

Command	Options	Function & Description	Ref.
#En		Modem status in escape state	
	#E0	Disable the report of modem status in escape state	
	#E1	Enable the report of modem status in escape state	

5.5 AT Fax Command Set

For **AT+F** commands see the chapter **Fax Operation**.

5.6 AT Voice Command Set

For **AT** Voice commands see the chapter **Voice Capability**.

Chapter 6

Status Registers

This chapter provides an overview of S-Registers (status registers) available in your U-90E data/fax modem.

6.1 S-Register Descriptions

The descriptions for each S-register are given below. In most bit-mapped S-registers, the default bit value is 0. An asterisk marks non-0 default values. 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.

6.1.1 Basic S-Registers "ATS_n=x"

NOTE: The default values of S-Registers may change in different countries.

Table 6-1 Basic S-Registers

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 "W" dial modifier to wait for the dial	+003

Command	Function & Description	+Ref.
	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

6.1.2 Extended S-Registers "ATSn=x"

Table 6-2 Extended S-Registers

Command	bit	dec	hex	Function and description	Ref.
S13=	bit	dec	hex	Bit-mapped register	+000
	1	2	2	Capture modem manufacturer information during V.42 handshake, can be displayed at AT12 <Last Speed/Protocol> line if available ('Flash' or 'ZyXEL' stands for ZyXEL connection)	
S14=	bit	dec	hex	Bit-mapped register:	+002
	0	0	0*	Originate mode auto handshake in leased line mode.	*M0
		1	1	Answer mode auto handshake in leased line mode.(Default)	*M1
	1	0	0	Grant Remote Digital Loop-back test request	&T4
		2	2*	Deny Remote Digital Loop-back test.(Default)	&T5

Command	bit	dec	hex	Function and description	Ref.
	3,2	0	0*	Dial-up line (Default)	&L0
		4	4	2-wire leased line	&L1
	5,4	0	0*	Internal clock (Default)	&X0
		16	10	External clock (from DTE)	&X1
	7,6	32	20	Remote clock (slave mode)	&X2
		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	Analog 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	+022
	4-1	0-30	0-1E	Set leased line transmission power level from 0 to -15 dBm. (See also S35b3) (Default *P11)	*Pn
		5	0	Normal dial	D
		32	20	Reverse dial, go on-line in answer mode.	DR
		7,6	0	AT Commands set	*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 value settings (n) the same as S20	

Command	bit	dec	hex	Function and description	Ref.
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	+001
		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	

Command	bit	dec	hex	Function and description	Ref.
		22	16	624000 bps	
		24	18	124800 bps	
		25	19	62400 bps	
		26	1A	41600 bps	
		27	1B	31200 bps	
		28	1C	24960 bps	
		29	1D	20800 bps	
		46	2E	921600 bps	

Note: Only the speeds up to S20=15 are supported by auto speed detection.

S21=	bit	dec	Hex	Bit mapped register	+178
	0	0	0*	Maintain non-error control connection when modem error control handshake fails	*E0
		1	1	Drop connection when modem error control handshake fails (default)	*E1
	1-2	0	0	Speaker is always OFF	M0
		2	2*	Speaker is ON until carrier is detected (default)	M1*
		4	4	Speaker is always ON	M2
		6	6	Speaker is ON after last digit is dialed out until carrier detected	M3
	3	0	0*	DSR is always ON (default)	&S0
		8	8	According to CCITT (see also S44.4, S41.5)	&S1
	4	0	0	CD is always ON	&C0
		16	10*	CD tracks presence of data carrier (see also S38.3) (default)	&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 (default)	&D2
		192	C0	108.2+RST, 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 (default)	E1
	1	0	0*	Tone dial. (Default)	T
		2	2	Pulse dial.	P
	2	0	0*	Pulse dial make/break ratio = 39% / 61% (default)	&P0
		4	4	Pulse dial make/break ratio = 33% / 67%	&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 is enabled (Default)	X5
		48	30	ATX6, error control result code is enabled	X6

Command	bit	dec	hex	Function and description	Ref.
		56	38	ATX7, error control result code is 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	+067
	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	+156
	0-2			Modem error control	
		0	0	No error control	&K0
		1	1	MNP4 + MNP3 (see also S41.0)	&K1
		2	2	MNP4 + MNP5 (see also S38.5, S41.0)	&K2
		3	3	V.42+MNP4	&K3
		4	4*	V.42 + V.42bis (compatible with &K2) (default)	&K4
	3-5	0	0	Flow control disabled	&H0
		24	18*	Hardware (RTS/CTS) flow control (default)	&H3

Command	bit	dec	hex	Function and description	Ref.
		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 is poor	*Q1
		128	80*	Adaptive rate (auto fall-back /forward) when signal quality changes.(Defaults)	*Q2 S41.2
		192	C0	Disconnect when signal quality is poor	*Q3
S28=	bit	dec	Hex	Bit mapped register	+068
	2-3	0	0	Destructive, expedited break	&Y0
		4	4*	Non-destructive, expedited break (default)	&Y1
		8	8	Non-destructive, un-expedited break	&Y2
	4-5	0	0*	No guard tone (default)	&G0
		16	10	Reserved	&G1
		32	20	1800 Hz guard tone	&G2
	6	0	0	DTE/DCE rate follows link rate (See also S18, S44b6)	&B0
		64	40*	DTE/DCE rate is fixed at the DTE setting, range from 300-460.8 Kbps (default, also see S18, S44b6)	&B1
	7	0	0 *	Select V.22 for 1200 bps communication	B0
		128	80	Select Bell 212A for 1200 bps communication	B1
S29=		0-49	0-31	Set default dial phone number pointer, use AT&Zn=s to store phone numbers in EEPROM.	+000 *D

Command	bit	dec	hex	Function and description	Ref.
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	+32
	1	2	2	Disable aborting from terminal during modem handshaking	
	3	8	8	Add 16dB attenuation to the leased line transmission power	
	4	16	10	When Data/Voice switch is pressed, modem will dial the default number.	*Dn S29
	5	32	2*0	Enable Selective Reject in V.42 (Default)	
	6	64	40	Enable password protection to profile saving. When 'AT&W0' is issued, and profile 0 in the NVRAM has this bit set, the supervisory password will be requested. This bit in profile 0 also protects the supervisory password from a hardware reset.	*W0
	7	128	80	Enable extended numerical result codes from 50-65 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

Command	bit	dec	hex	Function and description	Ref.
	7-5			Security function control	
		0	0*	Disable security function (Default)	*G0
		32	20	Enable type 1 security with password check. (ZyXEL to ZyXEL only)	*G1
		64	40	Enable type 1 security with password check and call-back (ZyXEL to ZyXEL only)	*G2
		96	60	Enable type 2 security with password check	*G3
		128	80	Enable type 2 security with password check and call-back	*G4
		160	A0	Enable type 2 security with password check and call-back, remote site enters the call-back number	*G5
S37=	bit	dec	Hex	Bit-mapped register for remote configuration using panel menu control	+000
	3-0	0-5	0-5	Remote profile number	
	7-4	0-80	0-50	Local profile number	
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 ON before connect message is sent, DCD off after last DCE response is sent	&C1 S21.4
	4	16	10	Auto-mode fax receiving disabled.,hang up if a fax call is received	&N0
	5	32	20	Disable MNP5 negotiation.	&Kn

Command	bit	dec	hex	Function and description	Ref.
S39=	bit	Dec	hex	Bit mapped register	+032
	2	4	4	Reverse the answers. Answer in originating mode	ATA
S40=	bit	dec	Hex	Bit mapped register	+000
	1	2	2	No result code is 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
	1				
	2	4	4	Disable retrain abort, up to 5 min. for special satellite line	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 after DCD on-off transition	&Sn
	6	64	40	Force S0>=2; doesn't answer on the first ring.	S0
	7	128	80	Ignore calling tone, not to be used as fax detection	
S42=	bit	dec	hex	Bit mapped register	+000

Command	bit	dec	hex	Function and description	Ref.
	1	2	2	Enables throughput averaging	
	2	4	4	CND message will be forced on even if ATQ2 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 mod	
	5	32	20	Disable Data/Voice button switch.	
	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	+008
	6	64	40	Enable 1.5 sec, pause between off-hook and modem answering	
	7	128	80	Modem hang-up if the line condition does not permit modem to run at the 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 .(cyclic dial).	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

Command	bit	dec	hex	Function and description	Ref.
S45=	7	128	80	Enable UK (Australian, Singapore, Indian, etc.,) type short-to-short (discontinuous) ring-back detection.	
		dec 0-255	Hex 0-FF	Delay during which the CND silence detection is disabled, in 20 ms units. (See also S46)	+100
S46=		dec	Hex	CND silence detection interval	+028
		0-255	0-FF	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	
	2	4	4	Enable data calling tone (CNG) sending	
	3	8	8	Reverse the V.23 channel speed. Originate mode modem speed (Send/Receive) 1200/75; Answer mode modem speed (Send/Receive) 75/1200	&N12
	4	16	10	(Work with &D1 command) DTR ON will have the modem dial the default number and DTR OFF will have the modem hang-up and reset to profile 0. When the modem is idle (waiting for command), it will not dial any number when DTR changes from ON to OFF	
S50=		dec	hex	In active timer, in 100 second units	+000

Command	bit	dec	hex	Function and description	Ref.
		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	+000
	1-0	0	0	Disables EDR	
		1	1	Reports RING twice	
		2	2	Reports RING four times	
		3	3	Reports RING six times	
	3-2	0	0	Disables DTMF tone	
		4	4	Reports RING for a DTMF tone	
		8	8	Reports RING 'DTMF' for a DTMF tone	
		12	0C	Reserved	
	5-4	0	0	Disables fax-CNG tone detection (Default)	
		16	10	Reports RING for fax CNG tone	
		32	20	Reports RING 1 for fax CNG tone	
		48	30	Reports RING 2 for fax CNG tone	
	7-6	0	0	Disables data CNG tone detection	
		64	40	Reports RING for data CNG tone	
		128	80	Reports RING 1 for data CNG tone	
		192	B2	Reports RING 3 for data CNG tone	
S52=	bit	dec	hex	Bit-mapped register	+000
	3-4	0-24	0-18	Receive level adjustment	
		0	0	-43 dBm (Default)	
		8	8	-33 dBm	

Command	bit	dec	hex	Function and description	Ref.
		16	10	-26 dBm	
		24	18	-26 dBm	
	7	0	0	Select 'Mark' as the first signal of the V.23 handshaking sequence (Default)	&N12
		128	80	Select 'Space' as the first signal of the V.23 handshaking sequence	&N12
S56=		dec	hex		+000
		0-255	0-FF	Hook flash detect time, in units of 10ms, country specific	
S57=	bit	dec	hex	Bit-mapped register	+016
	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		
	2	0	0	Select AT as the attention prefix	
		4	4	Select ATTSRQP as the attention prefix.	

Bit S-register bit number, 'b', used in 'ATSr . b=n' and 'ATSr . b=?'

dec Decimal value, 'x', used in 'ATSn=x'

hex Equivalent Hexadecimal value.

Note: 'AT' is omitted when an AT command is referred to in the 'Reference' column.

Chapter 7

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. U-90E supports only 2-wire leased lines. Two-wire leased lines transmit and receive on the same pair of wires.

7.1 Connecting to a Leased Line

The leased line jack of U-90E is the same as dial-up line. You can connect leased line to the dial-up line jack. The leased line phone jack pin assignments are shown in the Appendix.

7.1.1 Line Type Setting

Table 7-1 AT Command to Set Line Type

AT-Command	Description
AT&L0	The modem is connected to a dial-up line.
AT&L1	The modem is connected to a 2-wire leased line.

7.1.2 Power Level Setting

Your modem's leased line mode transmission power level can be adjusted from **0 dBm** to **-31 dBm** in **1 dBm** increments.

Table 7-2 AT Command to Set Power Level

AT-Command	Description
AT*P0	The default is -11dBm. The adjustable range is from 0 to -31dBm, effective in leased-line operation only.
...	
AT*P31	

7.2 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 answer. You can set this manually or automatically.

7.2.1 Manual Connect

You can set the modem to leased line mode. Type the asynchronous command **ATD** to the originating modem and **ATA** to the answering modem, or press D/V button on the front panel with A/O button (See the Table 2-2 Front Panel Switches).

7.2.2 Auto Handshake

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

Table 7-3 AT Command for Auto Handshake

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

7.3 Terminating a Leased Line Connection

Disconnecting the leased line manually will only force your modem to drop the line temporary. Later it will try to re-establish the connection again. If you want to terminate the leased line connection, you must set the line type back to dial-up line by using the AT command **AT&L0**.

Chapter 8

Synchronous Mode Operation

This chapter introduces you to the use of U-90E modem for synchronous operation. Use the modem as a synchronous modem when it is connected to a synchronous computer or terminal. Make sure that the remote modem and system are also set to synchronous. Synchronous mode applies to the entire non-FSK mode except V.90 supplied with the modem.

8.1 Mode options

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

Table 8-1 Synchronous Mode Options

AT-Command	Description	Function
AT&M1	SYNC DATA	The modem accepts asynchronous command at command state, but exchanges data synchronously at data state
AT&M3	SYNC	The mode accepts synchronous command (V.25bis) at command state, and also exchanges data synchronously at data state.

8.2 Clock Options

Synchronous data must be transmitted and received with a clock. You can choose from three types of transmission clock sources: internal clock, external clock and slave clock. The internal clock is the one suitable for most applications and is the default. In this case, the clock signal is generated by the modem itself and sent to the DTE. The external clock is the one in which the clock signal is provided by the DTE and sent to the modem. The slave clock is used when in remote digital loopback mode. Here the recovered clock signal from the received carrier serves as the transmission clock.

Table 8-2 Clock Options

AT-Command	Description
AT&X0 *	Modem provides synchronous transmit clock signal (Internal clock to pin 15 of EIA-232D)
AT&X1	Terminal provides synchronous transmit clock signal (External clock from pin 24 of EIA-232D)
AT&X2	Received carrier provides synchronous transmit clock signal (Remote or Slave clock to pin 15 of EIA-232D)

In some special application (such as DNN), the received clock must be the same as external transmission clock. In this case, you must set **s58.5** to 1 to let the received clock lock with external clock.

8.3 Half-Duplex operation

For a half-duplex modem, the carrier only exists in one direction at any specific time. There are two kinds of half-duplex mode provided by U-90E.

8.3.1 Pseudo CD

Set **s12.7** to 1 can enable this function. When **s12.7** is set, CD (Carrier Detect) signal will light up only when there is received data present. This function is often used together with RTS option set to **&R0**. (CTS track RTS). Please take note that it would drop the line when CD signal is on for more than 20 second unless **s12.6** is set to 1.

8.3.2 V.13

Set **s44.5** to 1 can enable this function. The communication software packages written for half-duplex mode rely on RTS, CTS and CD signals. The V.13 protocol is provided where the local CD follows the remote modem's RTS signal.

Chapter 9

Error Control and Data Compression

In Synchronous data communication, data is checked and corrected in the host by the so-called “link layer protocols” to ensure data integrity. Normally, no data checking is provided in the host for the asynchronous data communication. However, file transfer protocols that include error checking are available with asynchronous hosts.

Nowadays, intelligent modems incorporate error control protocols inside the modems for asynchronous data communication. Your data/fax modem U-90E also provides error control, data compression and flow control features.

9.1 Error Control

Error control keeps the modem data link error-free by detecting and re-transmitting erroneous data. The U-90E modems support both MNP and V.42 error control protocols.

MNP (Microcom Network Protocol) is a set of protocols developed and licensed by Microcom, Inc., and later used by many modem manufacturers. V.42 is an error control standard developed by CCITT (now called ITU-T) - the international telecommunications standard making organization.

The U-90E modems support level 4 and 3 error control MNP protocols, commonly denoted as MNP4 and MNP3. V.42 supports both LAPM (Link Access Procedure for Modems) and MNP4. A V.42 handshaking will try an LAPM connection first, and if not successful, it will try MNP4. The maximum data block size used in the U-90E modem is 256 bytes.

9.2 Data Compression

In the modems, data compression is activated between asynchronous to synchronous conversion in an attempt to reduce the number of bits actually sent. The receiving modem applies these techniques in reverse to recover the actual data from the compressed data stream.

The U-90E modems support both V.42bis and MNP5 data compression protocols. Data compression needs an error-free data link to work correctly, otherwise the corrupted compressed

data stream will ruin the decompression process. Hence MNP5 is used with MNP4 error control and V.42bis is used with V.42 error control.

The compression efficiency of V.42bis is generally higher than that of MNP5. In some cases it can be 50 % to 100% higher and in other cases it is just slightly higher. In general, it is about 50 % more efficient.

You can issue AT commands to the modem to enable its error control and data compression option as shown in the following table.

Table 9-1 Error Control and Data Compression

Control Level	AT Command	Error Control	Data Compression
NONE	AT&K0	None	None
MNP3/MNP4	AT&K1	MNP3/MNP4	None
MNP4, MNP5	AT&K2	MNP4	MNP5
V.42, MNP3/MNP4	AT&K3	Auto detection	none
V.42bis, MNP4/MNP5	AT&K4 (default)	Auto detection	Auto detection

9.3 Flow Control

This feature refers to stopping and restarting the flow of data into and out of the modem’s transmission and receiving data buffers. Flow control is necessary so that a device does not receive more data than it can handle. The U90E provide two kinds of flow control methods.

9.3.1 Hardware CTS/RTS Flow Control

This is a bi-directional flow control. CTS and RTS are RS232 signals which are available on your computer. When the modem’s transmission buffer is almost full, The modem will drop CTS to signal the DTE that it cannot accept any more data. Turn On the CTS to notify the DTE that it can keep sending data to the modem. On the computer software side, when the receiving buffer of the software is almost full,it will drop RTS to signal the modem to stop sending data to the DTE. Turn ON the RTS and the modem will start sending data again to DTE.

9.3.2 Software XON/XOFF Flow Control

This is a bi-directional flow control. XON and XOFF character defaults are decimals 17 and 19. These can be changed by modifying the S-Registers 31 and 32. Both the modem and the DTE will treat XOFF as a signal to stop transmitting data and will treat XON as a signal to restart sending data. Modems will not send these characters received from the local DTE to the remote modem.

Chapter 10

Special Functions

This chapter describes special features of the U-90E, and offers instructions on how to use them.

10.1 Security Functions

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

- Type 1 security is used when the remote modem is also a ZyXEL modem.
- Type 2 security is used when the remote modem is a modem of another brand.

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

In 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.

10.1.1 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 will be disconnected.
- With **level 2 security**, the local modem will dial back the phone number corresponding to the dial-in password. The line will simply disconnect if the password does not match.

10.1.2 User Passwords

The user may define fifty passwords. The corresponding 50 dial-back numbers will be 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 prompted to re-enter the new password for verification. For example:

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

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

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.

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 commands below will enable different types and levels of security:

Table 10-1 Security Function Commands

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.

Command	Function
*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 entries 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.

10.2 Remote Configuration

Remote configuration on the U-90E is provided as a profile by profile batch mode.

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.

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. You can then disconnect the modem and modify the profile locally.

Local profile modification is done by loading the remote 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**

Table 10-2 AT*Rab Command

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

Uploading (writing) the local profile to the remote modem's profile and making the remote modem reset its profile from the new profile is achieved with the command: **AT*Wab**

Table 10-3 AT*Wab Command

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.

Before doing remote configuration the remote modem must be set to accept remote configuration by executing the **AT*F1** command. Also as the modem uses the remote digital loopback mode to request remote configuration information, the remote digital loopback request (**AT&T4**) must also be granted on the remote modem to accept the remote configuration request. The **AT*F0** command will set the modem to deny remote configuration requests.

10.3 Caller Number Delivery (Caller ID)

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

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

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

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

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

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

Note: The Caller ID message may cause some confusion to a communication software that is not expecting it. If you plan to use the Caller ID feature, be sure you are using software that supports it (such as ZFAX).

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

RING

TIME: <MM-DD hh:mm>

CALLER NUMBER: <CALLER_ID> or CALLER NAME:<CALLER_NM>

RING

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

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

RING

TIME: 04-28 12:30

CALLER NUMBER: 7135551414 or CALLER NAME: Brent Harper

RING

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

RING

TIME: MM-DD hh:mm

CALLER NUMBER: <Caller_ID>

CALLER NAME: <Caller_Name>

RING

Here is an example:

RING

TIME: 04-28 12:30

CALLER NUMBER: 7135551414

CALLER NAME: Tracy Huang

RING

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

RING

TIME: 04-28 12:30

REASON FOR NO NUMBER: OUT_OF_AREA

REASON FOR NO NAME: PRIVACY

RING

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

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

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 area. For most Caller ID schemes, only the Caller telephone number is provided.

Different countries may employ different Caller ID schemes. Hence check the scheme used in your country before using the Caller ID feature.

10.4 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:

Table 10-4 Ring Control

Type	Bit (on)	Ring Sequence
1	3	1.2s on; 2s 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.

10.5 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 absence of the ring signal, 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 answering machine will ask the caller to press any DTMF key if he or she wants to send a fax. This will activate the modem to report and subsequently be ordered to answer the fax call.

10.5.1 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)

Table 10-5 EDR Settings

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. S51 bits 0-1 control the number of rings that the modem will answer to once the CNG or DTMF tone is detected.

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

ring1 ring2 ring3

__***_-----

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

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

CID/EDR RD EDR RD EDR RD EDR RD

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

Note: During the EDR period, any **AT** command will disable the EDR function.

10.5.2 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:

- Set ZFAX to answer on 2 rings.
- 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.
- Set **S51.4=1** to enable fax CNG tone detection. It is reported as RING.
- 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**.

10.6 On-line Help

Your modem provides on-line help to understand **AT** command sets. You can see the "AT command quick manual" in command state or data state if you enter **AT\$**, **AT&\$** or **AT*\$**.

AT\$ command helps you to view basic **AT** commands and **AT&\$** and **AT*\$** commands enable you to view **AT&** and **AT*** commands respectively.

10.7 V.25bis Command Set

U-90E supports V.25bis command set. V.25bis is a dialing command set standard defined by the ITU-T. It supports both asynchronous and synchronous dialing. Use **AT*I1** to enable V.25 commands.

The following table lists V.25bis commands and their formats.

Table 10-6 V.25 Command Set

Syntax	Command with parameters	Descriptions
CRN	CRN <dial string>	Call request with number provided
CRS	CRS n	Call request with number from memory location “n”. 0. n . 49
PRN	PRN n; <number>	Save <number> to address n. 0 .n. 49
RLN	RLN	Requests list of all stored number.
DIC	DIC	Ignore 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 number. (response to RLN)
RST	RST	Change to the asynchronous AT command mode.

Chapter 11

Fax Operation

The U-90E can be used as a fax machine. In the sections below, we will describe how the modem works as a fax machine, the ITU-T T.30 fax protocol, and the Class 1, Class 2 and 2.0 fax commands. Also covered are the status report result codes. The instructions for using the included data/Fax modem 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.

11.1 Fax Basics

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

Fax Branding: The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device to send any message via a telephone or fax machine unless such message clearly contains in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business or other entity, or individual sending the message and the telephone number of the sending machine or such business, or entity, or individual. In order to program this information into the fax function of your modem, please refer to the documentation of the fax software you will be using.

11.2 Modem as Fax Machine

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

Your modem supports Group 3 send and receive facsimile functions. For normal fax operation, you must connect the modem to a computer, usually a PC. The computer serves as the input/output device for the fax function. The RS-232 serial connection or the ZyXEL serial port interface connects your 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.

11.2.1 ITU-T T.30 Fax Protocol

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

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

11.3 Fax Command sets

The U-90E supports three command sets for fax operation:

- Class 1 command set
- TIA PN-2388 Class 2 command set
- TIA 592 Class 2.0 command set

11.3.1 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 connected computer handles the complete organizational overhead for this protocol. The Class 1 command set is also called the EIA/TIA-578 standard.

Several revisions of the Class 2 standard exist. Implementations conforming to different revisions may not work together. Class 2.0 command set is a formally approved version of the class 2 standard and is also called the EIA/TIA-592 standard. The class 2 commands allow the modem to do many negotiations simultaneously.

11.3.2 Service Class 1 Commands

Table 11-1 Service Class 1 Commands

Command	Description	Value
+FCLASS=n	Service Class Identification and Control	n=0:Sets to modem mode n=1:Sets to Class 1 mode n=2.0:Sets to Class 2.0 mode n=8:Sets to Voice mode
+FTS=n	Stop Transmission and pauses	n=0-255 in 10 ms units.
+FRS=n	Wait for Silence	n=0-255 in 10 ms units.
+FTM=<MOD>	Transmit Data with <MOD> Carrier	See table 10.2
+FRM=<MOD>	Receive Data with <MOD> Carrier	See table 10.2
+FTH=n	Transmit HDLC Data with <MOD>=3 Carrier	n=3
+FRH=n	Receive HDLC Data with <MOD>=3 Carrier	n=3

The value of <MOD> parameter:

Table 11-2 MOD Parameters

Value	Modulation	Speed
3	V.21 ch 2	300

Value	Modulation	Speed
24	V.27 ter	2400
48	V.27 ter	4800
72	V.29	7200
73	V.17	7200
74	V.17 short train	7200
96	V.29	9600
97	V.17	9600
98	V.17 short train	9600
121	V.17	12000
122	V.17 short train	12000
145	V.17	14400
146	V.17 short train	14400

11.3.3 Class 2 Command Set

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

Table 11-3 Command Syntax

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

Table 11-4 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.

Command	Value	Description
+FBADLIN= <value>	0-255	Bad line threshold (number of consecutive bad lines for a bad page parameter): Determine if Copy Quality OK on the T.30 flow chart . <value>=0 to 255; a value of 0 implies that error checking is disabled.
+FBOR= <i>n</i>		Phase C data bit order:
	<i>n</i> =0	Select direct bit order.
	<i>n</i> =1	Select reversed bit order in receiving mode for phase C data.
+FBUF?		Buffer size; read only parameter: Allow DTE to determine the characteristics of the DCE's buffer size.
+FCIG="string"		Local fax station ID string, for polling Rx.
+FCLASS= <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 parameter
	<i>n</i> =0	No copy quality check capability.
	<i>n</i> =1	Only check 1D phase C data.
	<i>n</i> =2	Check both 1D and 2D phase C data.
+FCR= <i>n</i>		"Capability to receive" parameter
	<i>n</i> =0	DCE will not receive message data or poll a remote device.
	<i>n</i> =1	DCE receives message data or polls a remote device.
+FDCC= <i>vr,br,wd,ln,df,e</i> <i>c,bf,st</i>		DCE capabilities parameters.
	<i>vr</i> =0	Vertical resolution: Normal; 98 lpi.
	<i>vr</i> =1	Vertical resolution: Fine; 196 lpi.
	<i>br</i> =0	Bit rate: 2400 bit/s; V.27ter.
	<i>br</i> =1	Bit rate: 4800 bit/s; V.27ter.

Command	Value	Description
	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.
	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.

Command	Value	Description
+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.
+FK		Regular fax abort command.
+FLID=" <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.
+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.

Command	Value	Description
+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.
	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."

Table 11-5 Class 2 Command Responses

Response	Value	Function and Description
+FCFR		Confirmation .
+FCIG:"string"		Report remote ID response CIG.
+FCON		Facsimile connection response.
+FCSI:"string"		Report remote ID response CSI.
+FDCS:vr,br,wd,ln,df,		Report session parameters response; refer to

Response	Value	Function and Description
ec,bf,st		+FDCC=.... command.
+FDIS:vr,br,wd,ln,df, ec,bf,st		Report session negotiation parameters response; refer to +FDCC=.... command.
+FDTC:vr,br,wd,ln,df, ec,bf,st		Report remote capabilities response; refer to +FDCC=.... command.
+FET:n		Post page message response; refer to the +FET=n command.
+FHNG:n		Call termination status response.
	n=00	Normal and proper end of connection.
	n=10	Transmit error on phase A hang up code.
	n=20	Transmit error on phase B hang up code.
	n=40	Transmit error on phase C hang up code.
	n=50	Transmit error on phase D hang up code.
	n=70	Receive error on phase B hang up code.
	n=90	Receive error on phase C hang up code.
	n=100	Receive error on phase D hang up code.
+FNSC:"HEX string"		Report the non-standard facilities command frame.
+FNSF:"HEX string"		Report the non-standard facilities frame response.
+FNSS:"HEX string"		Report the non-standard setup frame response.
+FPOLL		Remote polling indication.
+FPTS:n		Receive page transfer status response; refer to +FPTS=n command.
+FTSI:"string"		Report remote ID response TSI.
+FVOICE		Transition to Voice response.

Class 2 Flow Control

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

11.3.4 Service Class 2.0 Commands**Table 11-6 Service Class 2.0 Commands**

Command	Description	Value
+FDT	Transmit phase C data command: releases the DCE to proceed with the negotiation	
+FDR	Receive phase C data command: initiates document reception	
+FKS	Terminate a Session , orderly fax abort	
+FIP	Initialize Service Class 2.0 Parameters	
+FCLASS=n	Service Class Identification and Control	n=0,1,2,0,8;refer to the +FCLASS Class 1 command
+FMI?	Identify DCE Manufacturer	ZyXEL
+FMM?	Identify DCE	U-90E
+FMR?	Identify DCE Revision	Vx.x
+FCC=vr,br,wd,ln,df,ec,bf,st	Establish DCE Capabilities	
	Vertical Resolution	vr=0:Normal;98 lpi Vr=1:Fine;196 lpi

Command	Description	Value
	Bit Rate	br=0:2400 bps br=1:4800 bps br=2:7200 bps br=3:9600 bps br=4:12000 bps br=5:14400 bps
	Page Width	wd=0:1728 pixels in 215mm wd=1:2048 pixels in 255mm wd=2:2432 pixels in 303mm
	Page Length	ln=0:A4;297mm ln=1:B4;364mm ln=2:unlimited length
	Data Compression Format	df=0:1-D df=1:2-D
	Error Correction	ec=0:Disable
	Binary File Transfer	bf=0:Disable
	Minimum Scan Time/Line	st=0:0 ms st=1:5 ms st=2:10 ms (normal); 5 ms (fine) st=3:10 ms st=4:20 ms (normal); 10 ms (fine) st=5:20 ms st=6:40 ms (normal); 20 ms (fine) st=7:40 ms

Command	Description	Value
+FIS=vr,br,wd,ln,df,ec,bf,st	Current Session negotiating parameters	The same as above
+FCS=vr,br,wd,ln,df,ec,bf,st	Current Session Parameters	The same as above
+FLI="string"	Local Facsimile station ID String, TSI/CSI	
+FPI="string"	Local Facsimile station ID String, CIG	
+FLP=n	Indicate Document available for polling	n=0:No document n=1:A document is available
+FSP=n	Enable/Disable polling	n=0:Disable n=1:Enable
+FNR=rpr,tpr,idr,nsr	Negotiation Reporting Enable	rpr= 0:Receiver parameters are not reported rpr=1:Receiver parameters are reported tpr= 0:Transmitter parameters are not reported tpr=1:Transmitter parameters are reported idr= 0: ID Strings are not reported idr=1: ID Strings are reported nsr= 0:Non-standard frames are not reported nsr= 1:Non-standard frames are reported
+FIE=n	Procedure Interrupt parameter	n=0:Disable n=1:Enable
+FPS=n	Page Transfer Status	n=1:Received page is good n=2:Page is bad; retrain is requested

Command	Description	Value
		n=3:Page is good; retrain is requested n=4:Page is bad; procedure interrupt is requested n=5:Page is good; procedure interrupt is requested
+FLO=n	Flow Control Select	n=0:No flow control n=1:Sets XON/ XOFF software flow control n=2:Sets CTS/RTS hardware flow control
+FPR=n	Serial Port Rate Control	n=0:Automatic DTE rate detection by the DCE n>0:Serial rate is fixed at the value multiplied by 2400 bps
+FBO=n	Phase C Data Bit Order	n=0:Selects direct bit order n=1:Selects reversed bit order
+FEA=n	Phase C Received EOL alignment	n=0:EOL patterns are as received
+FCR=n	Capability to Receive	n=0:Not receive message data or poll a remote device n=1: Receives message data or poll a remote device
+FCQ=<rq>,<tq>	Copy Quality disable/enable	rq= 0:Receive copy quality check is disable rq=1:Receive copy quality check is enable tq= 0:Transmit copy quality check is disable tq=1:Transmit copy quality check is enable
+FRQ=pql,cbl	Receive Quality Thresholds	pql= 0-64h:Specifies the

Command	Description	Value
		percentage of good lines cbl= 0-ffh: Specifies the maximum tolerable number of consecutive bad lines
+FAA=n	Adaptive Answer Mode	n=0: Answers as set by +FCLASS n=1: Answers and auto-determines the call type
+FCT=n	Phase C Timeout	n=0-ffh, 1 sec units
+FMS=n	Minimum Phase C Speed	n=0: 2400 bps n=1: 4800 bps n=2: 7200 bps n=3: 9600 bps n=4: 12000 bps n=5: 14400 bps
+FBS?	Buffer Size	512,256

11.4 Status Report Result Codes

When the U-90E is in fax mode, each ATD or ATA command will make the modem try to establish a fax connection. Your modem will send a status report result code back to the DTE (computer).

Table 11-7 Status Report Result Codes

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.

Chapter 12

Voice Capability

Voice capability stands for the modem’s ability to digititalize incoming voice messages, which the computer stores and forwards. Only a limited voice function that supports DTMF (Dual Tone Multi Frequency) detection and generation is provided by U-90E modem.

12.1 The voice AT command specification

The following is a summary of the supported AT commands:

Table 12-1 Voice AT Commands

Command	Function	Option	Default	Description
+FCLASS	Voice/data/fax selection	0,1,2,0,8	0	0: DATA. 1: CLASS 1 FAX. 2.0: CLASS 2.0 FAX. 8: VOICE.
+FMI	Manufacturer ID.	N/A	U90E	
+FMM?	Model ID	N/A	ZyXEL	
+FMR?	Revision	N/A	V1.x	
+VLS	Select a voice I/O device.	0,1,2,8,16	0	0: The DCE is on hook. Local phone connected to Telco line. 2: The DCE is off-hook and is connected to the Telco line. The local phone is provided with power.
+VTS	Tone Generation	[x,y,z],{x,z},x -----	NA	[x,y,z],{x,z} -----

Command	Function	Option	Default	Description
		[x,y,z]: x: 0-3000 Hz y: 0-3000 Hz z: 0- 1000 {x,y} x:0-9,A-D,*,# y:0-1000 x:0-9,A-D,*,#		[x,y,z]: x: first frequency y: second frequency z: duration in 0.1 sec. {x,y} x: DTMF y: duration in 0.1 sec. x: Default duration:+VTD setting.
+VTD	Default DTMF tone generation duration.	0-255	50	Unit: 0.01 second.

12.2 Voice Shield DTE command

The voice shield DTE commands describe DTMF tone detection and generation. The following table provides a summary of voice shield DTE commands:

Table 12-2 Voice Shield DTE Command

Response Code	Description
<DLE>0 - <DLE>9 <DLE>*,<DLE># <DLE>A-<DLE>D	DTMF
<DLE>a	Answer Tone
<DLE>b	Busy
<DLE>c	Calling Tone
<DLE>d	Dial tone
<DLE>e	European Data Modem Calling Tone
<DLE>f	Bell Answer Tone
<DLE><ETX>	End of stream

Chapter 13

Diagnostics

The U-90E modems provide several diagnostic capabilities:

- Power-on Self-Test
- Analog Loopback Test
- Analog Loopback with Self-Test
- Local Digital Loopback Test
- Remote Digital Loopback Test
- Remote Digital Loopback with Self-Test
- Line Condition Report
- Link Status Report
- Indicators

The diagnostic capabilities 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.

13.1 Power-on Self-test

At each power-on upon a reset command from the panel the modem will test the ROM code checksum, Internal SRAM, External SRAM and FLASH.

13.2 Loopback Tests

The Analog Loopback Test, Local Digital Loopback Test, Remote Digital Loopback Test, Analog Loopback with Self-Test, and Remote Digital Loopback with Self-Test can all be selected from the terminal. Use the `AT&T0` command to terminate the test.

13.2.1 Analog Loopback Test (AT&T1)

This test can check almost every part of the modem and 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 loopbacked 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.

The U-90E will have the **TST** LED On during the test. This test can only be initiated while the modem is off-line

13.2.2 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 be with the Analog Loopback Test. In the asynchronous mode, the pattern consists of printable ASCII characters.

This test can only be initiated when the modem is off-line. The U-90E modem's **TST** LED flashes for any bit error.

13.2.3 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

The U-90E will have the **TST** LED On during the test. This test can be initiated by the local modem when the modems are on-line.

13.2.4 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 the received data back to the local modem, and the local terminal or computer will receive all the data it sends out. This test is applicable when the remote modem and local modem both provide V.54 Remote Digital Loopback capability.

The U-90E will have the **TST** LED indicator ON during the test. This test can be initiated by either modem when the modems are on-line.

13.2.5 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.

The U-90E will have the **TST** LED On during the test. This test is applicable when the remote and the local modem both provide V.54 Remote Digital Loopback capability. This test can be initiated by either modem when the modems are on-line.

13.3 Line Condition Report (AT#E1)

You can monitor the line conditions: Signal to noise ratio (SNR), Received power Level (RXL), Retrans Granted (RTG), Retrans Requested (RTR), FRN (Fast Retrain) Granted (FTG) and Fast Retrain Requested (FTR), when the modem is on-line (in the command state), by using the **AT#E1** command.

13.4 Link Status Report (ATI2)

During a connection, the modem will record information about link operations. You can use the **AT** command **ATI2** to view the link status report. The V.90/V.34 Link Status Report output appears as follows:

Chars Sent	0	Chars Received	0
Octets Sent	0	Octets Received	0
Blocks Sent	0	Blocks Received	0
Blocks Resent	0	Max Outstanding	0
Max Block Size	0	Retrans Requested	0
Link Duration	0	Retrans Granted	0
FRN Requested	0	FRN Granted	0
FCS Errors	0	Round Trip Delay	0
Xmitter Underrun	0	Receiver Overrun	0
Last Speed/Protocol	TTxRate/RRxRate/Protocol/Error control		

Disconnect Reason

Local hang up

Table 13-1 Data Type Description

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

Table 13-2 Output Value Description

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

Output Parameter	Output Value Description
Retrains Granted	The number of times remote modem requested retrain.
FCS Errors	Errors in frame (block) checksum. (If there were many FCS Errors, you may have experienced problems on the line.)
Round Trip Delay	Baud.
Xmitter Underrun	For modem's processor power measurement.
Receiver Overrun	For modem's processor power measurement.
Disconnect Reason	Local hang up Remote hang up Resent expiration Carrier lost On-line Protocol error S7 Timer timeout DTR dropped Carrier lost 1 Carrier lost 2 Speed no match Security check EC negotiation failure Keyboard abort ATH command Inactivity FRMR received Local clear down Remote clear down V.8 answer failure (V.8 8.2.1) V.8 negotiation failure (v.8 8.2.3) Fax disabled Retrain failure Fax hang up D/V hang up DM received DISC received LD received

13.5 Indicator Lights

13.5.1 Retransmission Indicator

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

13.5.2 Dialing Indicator

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

13.5.3 Handshaking And Retrain Indicator

The HS LED will alternatively flash on and off for 1/2 second each to indicate that the modem is handshaking or retraining.

Chapter 14

Upgrading Your Modem

14.1 Upgrading by Flash EPROM

1. Obtain the new firmware by downloading from the ZyXEL WWW or FTP site. See **Customer Support** for the FTP address.
2. Turn on your computer.
3. Turn on your modem.
4. Start any communications program that supports the XModem protocol.
5. Type **ATUPX**.
6. Press Enter and wait for the following prompt characters:

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

Are you sure (Y/N)?

7. Press **Y**. The following message then appears:
Start programming, please upload....
8. After the “S” prompt, use the XModem protocol to upload the U-90E file to your modem. This step updates the modem’s flash EPROM with the latest firmware.
9. When the installation is complete, the modem restarts automatically.

14.2 Kernel Recovery Mode

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

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

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

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

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

Chapter 15

Troubleshooting

Your modem is designed to provide years of ultra high speed satisfaction. In the unlikely event of you encountering 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.

15.1 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.

15.2 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.

15.3 Auto-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 ATSO=1 and press Enter to have the modem answer on the first incoming ring. To auto-answer after a specific number of rings, replace 1 with a value up to 255. Do not assign a value of 0, which turns off auto-answer, unless your software can respond to the modem's RING result codes.
3. Check that the DTR LED is ON, and that the AA LED flickers with each incoming ring. If the LEDs do not respond in this way, refer to your ZyXEL User's Guide.
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 ATSO=0 and press Enter with the modem in command state.

15.4 Dialing Problems

Problem

Your modem does not dial calls.

Solutions

1. Make sure the supplied telephone cable is connected to your modem's LINE jack and not the PHONE jack.
2. You are using touchtone dialing on a line that requires pulse dialing. Change your communications software to use pulse dialing.
3. Unplug the telephone line cable from the computer and connect it directly to a telephone handset. Check for dial tone. If there is none, the problem is in the telephone line. Call the service provider.

15.5 Data Transfer Problems

Problem

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

Solutions

1. Re-dial the call. (The telephone connection may be poor.)
2. 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.
3. 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.

15.6 Connection Problems

Problem

Your modem disconnects while communicating with a remote system.

Solutions

1. The remote system may have hung up. Type ATl2 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 User's Guide.
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.

Appendix A

Glossary

Analog: Not digital. Analog quantities may have any value.

Analog loopback test: Testing method in which the modem's analog output signal is connected to the analog input.

Answer: In a connection between two modems, one modem works as the recipient (in answer mode) and the second modem as the initiator (originate mode).

ARQ: Automatic Retransmission reQuest - Standardized method in error control protocols.

ASCII: American Standard Code for Information Interchange. This code assigns a 7-bit numerical value to characters, digits and control characters. An ASCII character is a 7-bit character with a decimal value ranging from 0 to 127.

Asynchronous: Data transfer method in which a character's data bits are framed by additional bits (start bit, parity bit and stop bit). There are variable idle times between characters.

AT command: The commands used with an intelligent modem. Every command line is started with the **AT** prefix (ATtention). To send an **AT** command to a modem, you must have communications software running.

Auto-answer: Modem's ability to automatically answer a call after a set number of rings.

Baud: Unit of modem transmission speed. Characters per second. Named after Baudot, a French engineer who developed the Baudot code - the precursor of today's ASCII code.

bis: Old French word for two.

Bit: Smallest unit of information. A bit can have one of two states: ON (1; set) and OFF (0; not set). By combining a number of bits, a computer can code any information. A byte consists of 8 bits. Therefore a byte can have any one of 256 (2⁸) states.

Bit rate: Count of data bits transmitted per time unit. The framing bits needed for asynchronous transfer are also counted in the calculation of the bit rate. In general, the bit rate is ten times the character rate.

bps: Unit of measurement. Bits per second.

Carrier: The carrier is a modulated tone and is used by the modem to transfer the data.

CCITT: Comité Consultatif International Thonique et Traphique; former name for the ITU-TSS (ITU-T), the international standard making organization for telecommunications.

CD: See DCD.

Class 2: A standard for fax transfers using a fax modem. Currently several drafts exist which are incompatible with each other. ZyXEL modems support the draft PN-2388 of Aug. 20th 1990, and the final 2.0 standard.

CNG: Call negotiation tone. A calling fax machine sends this tone before connecting to quickly establish a fax connection. A data modem may also have a data calling tone.

Command mode: In command mode, a modem accepts commands from the local DTE. Data transfer is suspended while the modem is in command mode.

Compatibility: If components are compatible, they work with each other.

COM port: Another name for the serial port on a PC.

Compression: *See data compression.*

CRC: Cyclic redundancy check; an error checking protocol.

CTS/RTS: Control signal lines on an RS-232C serial interface. These lines are needed to use hardware flow control.

Cursor: A special marker on a display.

Data bit: In asynchronous transfers, a character is composed of data bits (the actual information) and framing bits (start bit, stop bit/s, parity bit). The framing bits are needed to recognize whether a character has been successfully transmitted and where a new character starts.

Data compression: Recoding of information. The same information is represented by less data bits. ZyXEL modems use MNP4 and V.42 compression schemes.

Data packet: Block of data which is framed by error control groups. A block consists of up to 256 8-bit groups. Data packets are used in synchronous transfer.

Data pump: The important module doing modulation and demodulation for a modem. The data pump is decisive for the quality and the speed of a modem's transfer capabilities.

DCD: Data Carrier Detected - a control signal line of the RS-232C interface.

DCE: Data Circuit Terminating Equipment or Communications Equipment - a modem is a DCE.

Demodulation: Transferring analog signals into digital data bits.

Digital: Digital data consists of a series of bits. A bit may have only one of two states. Analog data may have any value.

Digital loopback test: A modem test procedure which transfers the received digital data back to the modulator and transmits them out.

DIP switch: Dual inline package switch. DIP switches are abundant in the world of electronic equipment. They are used to set certain parameters on a printer, modem or other peripheral devices. You will not find any DIP switches in ZyXEL modems. ZyXEL modems let you perform all settings from the front panel or through command sequences.

DLE: The ASCII code that is used in voice data mode to separate data segments from command segments.

DSP: Digital signal processor. ZyXEL modems are equipped with this/these device(s). DSPs generate, process and analyze all signals.

DSR: Data Set Ready - a control signal line of the RS-232C standard.

DTE: Data Terminal Equipment - a computer or a terminal.

DTMF: Dual Tone Multi-Frequency. The technology used in pushbutton telephones, commonly known as touchtone, of generating audible notes to represent numbers.

DTR: Data Terminal Ready - a control signal line of the RS-232C standard interface. Some computers set this signal when they are turned on, even if they are not able to receive data.

Echo: For a modem user, echo has two meanings: A modem can return all received characters to its local terminal/computer so they can be seen on-screen. The other meaning of the term "echo" is that part of the analog signal the modem sent out is bounced back by the telephone network to the modem's receiver, mixing there with the remote modem's signal.

EDR: Extended Distinctive Ring - A feature of ZyXEL modems which helps to distinguish between data, fax and voice calls.

EEPROM: An Electronically Erasable and Programmable Read Only Memory. Such a device is used in ZyXEL modems to store settings and profiles. An EEPROM does not lose data when the modem is turned off.

EIA: Electronic Industry Association (of North America); this organization was the first to draft a standard serial port (RS-232C).

EPROM: Electrically Programmable Read Only Memory. A memory chip which may be programmed electronically, but must be exposed to ultraviolet radiation to be erased.

Error correction: A method to compensate for errors which occurred in the transmission path. Error correction is done by the modems and is transparent to the DTEs. The most familiar correction methods are MNP5 and V.42bis.

Fax: Long distance copy; facsimile - transfer of graphical data between two fax units. The graphical data is compressed during transfer (G3).

FIFO-Buffer: First-in-first-out buffer. A buffer of this type is used in the 16550 type UARTs which allow higher data throughput rates on PCs.

Firmware: The ZyXEL modems' system software is located in flash EPROMs. Depending on the size of the EPROM(s), some features may or may not be available.

Flash: Memory designed for multi-purposes.

Flow control: Method to stop and start the data flow to avoid loss of data.

Front panel: The front panel on the ZyXEL modems consists of LED indicators and key switches.

Full-duplex: Transmission link where transmission can take place in both directions simultaneously.

FSK: Frequency Shift Keying - a frequency modulation scheme.

G3 fax: Several fax standards exist. Most available fax machines use the group 3 (G3) standard. This standard defines the compression of graphic data and a transmission speed of up to 14400 bps with an automatic fallback to 2400 bps if the telephone line is bad.

Handshake: At the beginning of a connection, the modems must negotiate and initialize the protocols to be used and the speed at which the connection is to be established. This negotiation phase and the following initialization phase is called handshake.

HDLC: High-level Data Link Control - protocol for synchronous transfer.

High-speed modem: A modem that works at bit rates higher than 9600 bps.

Hook-Flash: The hook-flash is a signal used in a dial sequence. This signal may be used for call transfers or to request an outside line on certain PABX.

Hz: Hertz. A unit of measurement for frequency. Cycles per second.

Internet: The worldwide collection of networks and computers, linked together to create a global community for information exchange.

Interrupt: In a computer, some tasks must be performed regularly and without delay. This is possible because the CPUs provide special interrupt vectors. These vectors each point to some short program sequence. An interrupt stops the currently running program and the segment to which the vector points is executed.

ITU-TSS: International Telecommunications Union - Telecommunication Standards Sector. New name for the standard making organization CCITT. See CCITT.

ISP: Internet Service Provider. A company that provides subscribers with access to the Internet, usually through telephone lines via modems.

LAPM: Link Access Procedure for Modems - a protocol which controls the handshake between two modems.

Layer protocol: A standard of the ISO (International Standards Organization) which defines everything regarding data communications from the hardware to the screen display in seven levels.

LED: Light Emitting Diode - a display element.

LINE: The jack on the rear panel which is connected to the wall phone outlet.

Mailer: A program which works with a remote BBS and requests and distributes messages automatically.

Memory: A fast storage component of a computer where data can be saved and from where it can be retrieved.

MNP: Protocols for error correction and data compression from Microcom, Inc.

Modem: An artificial word concatenated from **mod**ulator and **dem**odulator. A modem translates the digital signals received from its local DTE to analog signals which are transmitted via a telephone line. At the other end, the analog signals are demodulated and sent to the DTE as digital signals again.

Modulation: Translating digital states to analog waveforms.

Off-line: A modem which is not connected to another modem is off-line.

On-line: A modem which is engaged in a connection with another modem is on-line.

Originate : In a modem connection, one modem must work in the originate mode, the other in the answer mode.

Packed data: Data from which redundant information has been removed. Some file extensions denote packed files. Standard extensions are .ZIP, .ARC, .LZH, .TAR, .ZOO and others. If you transfer packed data don't use MNP5 compression.

Parity: A method to check whether a character has been correctly transmitted in asynchronous transfer. Usual settings are even parity and odd parity. In a connection, the modems at both ends must use the same parity settings.

Parity bit: The parity bit is sent as additional information with the data bits in asynchronous transfers. It controls the integrity of the transferred data. If parity is even, the parity bit is set if an uneven number of data bits is sent in the character, resulting in an even number of set bits.

PC: Personal Computer - acronym for computers which are compatible with the IBM PC or **AT** computers.

PHONE: Jack to which a telephone set may be connected.

Processing unit: A computer's brain. Here all the necessary calculations are performed.

Protocol, file transfer: Many protocols have been developed to ensure reliable data transfer at maximum speed, among them Xmodem, Ymodem, Zmodem and Kermit. With modern modems, the use of integrated hardware protocols (MNP4 and V.42) is recommended. The G-flavors of the above mentioned Ymodem and Zmodem allow transfers of multiple files with no additional error correction.

PSTN: The public network that delivers telephone services worldwide.

Public Domain: A special form of distributing software. Public domain software authors make no claim to commercialize their rights.

QUIET: A state in the voice mode of ZyXEL modems. Quiet is detected after a long pause in voice data.

RAM: Random Access Memory - working memory. The modem uses it among many other uses to store information on sent, but not yet acknowledged data.

Redundancy: Extra data that does not generate additional information.

Remote location: The modem at the other end of the line (the one you are calling or that is calling).

Reset: Return a device into a defined base status.

Retrain: The re-initialization process a modem is doing with the remote modem when the receiving condition becomes bad.

ROM: Read Only Memory. The ROM holds the system software and the profiles and settings of the modem (refer to EEPROM).

RS: Abbreviation of recommended standard.

RTS/CTS: *See CTS/RTS.*

RXD: Line for the received data on a serial port following RS-232C.

Security function: Features of the ZyXEL modems which help deny illegitimate contacts to your computer system through telephone lines.

Self-test: Ability of the modem to check its components and operations for faults.

Serial port: Communication path through which data is transferred bitwise. Only one wire each is available for transmitted and received data.

Shareware: A distribution method for software. The author lets the user try out the fully functional software for a certain amount of time at no charge. If the customer wants to keep and use the product after the period, he must pay the requested fees. This method depends heavily on the honesty of the user.

Signal to noise ratio: A measure for the signal quality of a connection.

SILENCE: Status detected in voice mode. If the modem returns a silence message, no voice energy was detected after a connection was established.

Speech digitalization: Changing spoken sound into digital data which can be pro-cessed and saved by a computer.

SRAM: Static Random Access Memory. A memory device used to store both program and data.

S-register: Abbreviation of status-register. The currently used parameters are stored in the status registers. S-registers are a part of the modem's internal memory.

SREJ: Selective Reject - extension of the V.42 protocol which allows the more efficient handling of retransmission of erroneous data blocks.

Start bit: In asynchronous transfers, a new character is introduced by the start bit.

Symbol speed: Speed at which a signaling unit is transferred. In modern modem modulation, a signaling unit is no longer a single bit. Thus, the bit speed is different from the symbol speed.

Stop bit: In asynchronous transfers, every character is terminated by one or two stop bits which show where a character ends.

Synchronous : In synchronous transfer, a dedicated control signal line transmits a clock signal which paces the transmitted data. In highspeed connections, the transfer between two modems is always synchronous, even if the DCE to DTE connection is asynchronous.

T.30: A standard for fax transfers.

TAE6: A standard for a telephone wall outlet used in some countries, particularly in Germany.

ter: Old French word for three.

Terminal equipment: A computer running terminal software is used as terminal equipment in modem connections.

Terminal program: A program which emulates the operation of a hardware terminal on a computer's screen and keyboard.

Token: A token is a reencoding of information in less bits; basically an abbreviation.

Transfer mode: Data can be transferred either synchronously or asynchronously.

Transfer rate: The speed at which the data bits are effectively transferred.

UART: Universal Asynchronous Receiver and Transmitter; a special IC chip which controls the serial port. Different models are available for PCs. Models with an internal buffer usually allow higher transfer rates.

V.: The ITU-TSS V. - standards describe data transfer via telephone lines.

Western jack: Telephone wall outlet connector used in the USA and other countries.

X.: The ITU-TSS X.-standards describe data transfer in public data networks.

XModem: A widely used, though somewhat aged, file transfer protocol. The use of 128 byte data blocks severely limits the achievable throughput.

XON/XOFF: Software flow control. The data flow is stopped by sending ASCII character Control-Q (dec. 17; hex \$11) and restarted by Control-S (dec. 19; hex \$13).

YModem: A file transfer protocol which uses data blocks of 1 Kbyte and transfers filenames and more than one file in one transfer.

ZModem: A file transfer protocol with variable block size, reinitiation of aborted transfers and transfer of several files in one transfer along with file (and path) names.

Appendix B

EIA-232D Interface

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 Loop Test.	→
22	125	CE	Ring Indicator(RI).	←
24	113	DA	Transmit Clock Signal (source: DTE).	→
25	142		Test Indicator.	←

Appendix C

Phone Jack Pin Assignments

The ZyXEL U 90E modem features two RJ-11 phone jacks, one for 2-wire dial-up and 2-wire leased line connection (LINE) and one for an optional connection to a telephone set (PHONE). The signals on these pins are:

1	A
2	RING
3	TIP
4	A1

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