Technical Reference for ZyXEL omni.net series

omni.net LCD
omni.net LCD+M
omni.net Plus
omni.net D

ISDN Terminal Adapters

ZyXEL

ZyXEL Communications Corporation

ZyXEL ISDN Terminal Adapters
omni.net LCD
omni.net LCD +M
omni.net Plus
omni.net D

C E The Declarations of CE Marking

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

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

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

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

4. Council Directive 73/23/EEC and 93/68/EEC of 26 Dec 1996 on the harmonization of the laws of the Member States relation to electrical equipment designed for use within certain voltage limits.

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

Limited Warranty
ZyXEL omni.net series ISDN Terminal Adapters

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

Limitations and exclusions of this warranty:
Repair or replacement, as provided under this warranty, is the exclusive remedy of the purchaser. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular use or purpose.

Limitations of liability:
ZyXEL shall in no event be held liable for indirect or consequential damages of any kind of character to the purchaser.

How to obtain warranty service:
To obtain the services of this warranty, contact ZyXEL's Service Center; refer to the separate Warranty Card for your Return Material Authorization number (RMA). Products must be returned Postage Prepaid. It is recommended that the unit be insured when shipped. Any returned products without proof of purchase or those with an out-dated warranty will be repaired or replaced (at the discretion of ZyXEL) and the customer will be billed for parts and labor. All repaired or replaced products will be shipped by ZyXEL to the corresponding return address, Postage Paid (USA and territories only). If the customer desires some other return destination beyond the U.S. borders, the customer shall bear the cost of the return shipment. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Become a Registered Owner

Complete the pre-addressed registration card and place it in the mail. Registered owners will receive future product information and update announcement. Save your dated invoice as proof of purchase.

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Preface

Thank you for purchasing our ZyXEL omni.net ISDN Terminal Adapter (TA).

About ZyXEL omni.net series ISDN Terminal Adapters

This manual describes the features and provides installation and configuration instructions for the ZyXEL omni.net D, ZyXEL omni.net Plus, ZyXEL omni.net LCD, and ZyXEL omni.net LCD+M.

The data rate of any one of these omni.net series TA can reach 128 kilobits per second (Kbps). With this high-performance speed, plus additional functions, such as LCD display (the ZyXEL omni.net LCD and the ZyXEL omni.net LCD+M) or built-in 56K modem (the ZyXEL omni.net LCD+M model), ZyXEL omni.net TA can help you download text, graphics, music and video faster and easier, as well as make it easy for you to manage the cost of communications- not only for home computer users, but also for SOHO (small-office/home-office) users and corporate telecommuters. The characteristics of each model is as shown below:

ZyXEL omni.net D provides 128Kbps data rate.

ZyXEL omni.net Plus provides 128Kbps date rate, also includes muiltilink and additional functions for phone line connection.

ZyXEL omni.net LCD is the first ISDN terminal adapter in the communication industry to provide a control panel equipped with a 20 x 2 LCD display and four menu keys for easy configuration and detailed status monitoring.

ZyXEL omni.net LCD+M has not only the LCD display and four operation keys, but also includes

an internal fax/modem.

How to Use This Manual

In the following manual, "ZyXEL omni.net ISDN TA" or "ZyXEL omni.net LCD/LCD+M/Plus/D" is used to refer to these four ZyXEL omni.net series devices if the features and the instructions can be applied to all four of them. "ZyXEL omni.net LCD/LCD+M" represents the ZyXEL omni.net LCD and the ZyXEL omni.net LCD+M models. "ZyXEL omni.net Plus/D" represents the "ZyXEL omni.net Plus" and the "ZyXEL omni.net D" models. Otherwise, the model will be described specifically if the features and the instructions of the device can only be applied to that single model.

This technical reference is cataloged into 6 feature oriented parts, namely, Introduction, ISDN Function, Voice Features, Data Function, Internal Fax/Modem Function, Diagnostics & Firmware Update, and Appendices..

Other References

To quickly learn how to install and configure your ZyXEL omni.net LCD/LCD+M, please refer to the *ZyXEL omni.net LCD series Quick Start Guide; and for* ZyXEL omni.net Plus/D, please refer to the *ZyXEL omni.net Plus/D Quick Start Guide*.

Part I

Introduction

Chapter 1
Introduction

This chapter introduces the features and specifications for the ZyXEL omni.net
LCD/LCD+M/Plus/D, and provides instructions for installing your ZyXEL omni.net ISDN TA

Key Features

Speed and Compatibility

■ Plug and Play support for Win95/98/NT environment.

■ Full compatibility with both ISDN and remote PSTN via ISDN.

■ 112Kbps/128Kbps channel bundling: MLP, and Multilink PPP(RFC1990).

■ Multiple signaling protocol compatibility with the following network switches: DSS1
(for Europe), NI-1 and DMS-100 (for USA)

■ Supports X.75, V.110, V.120, and PPP Async-to-Sync Conversion B Channel protocols.

■ B-Channel speeds of 56Kbps (in-band Signaling) and 64Kbps (out-of-band Signaling).

■ High-speed 460.8 Kbps DTE serial port.

■ V.42bis data compression over ISDN using the X.75, V.120, and Bundle protocols.

■ STAC data compression using PPP/MP to provide:

❏ High-speed Web browsing
❏ Fast downloading of video and high-quality graphics

■ Two application program interfaces including ZyXEL ISDN AT Commands and CAPI 2.0.

■ Built-in 56K modem that can communicate with other analog Modem/Fax through an ISDN line (for omni.net LCD+M only).

Intelligent Features

■ Automatic ISDN/analog call detection.

■ Automatic dial-in and dial-out B-channel protocol detection.

■ Supplementary Service for USA NI-1, DMS-100 switches and European DSS1 switch, including call waiting, call hold/retrieve, three-way conferencing, call forwarding, etc.

■ Feature Phone operation, including call back, broker, and three-way conferencing, etc.

■ Two analog telephone ports with metering pulse function.

■ Callback security with password protection.

■ Flash EPROM memory for easy firmware upgrades.

■ Provides FSK/DTMF Caller ID signal on analog ports.

Specifications

Status Display	Status LED, 20 x 2 LCD panel (LCD/LCD+M only)
Flow Control	Software XON/XOFF or hardware CTS/RTS
Configuration Setting	Software programmable with nonvolatile memory for profile storage
Diagnostics	Self and loopback tests
Line Interface	RJ-45 for S/T interface
DTE Interface	DB-25 connector
Weight	omni.net LCD: 448 g; omni.net LCD+M: 557g omni.net Plus: 379 g; omni.net D: 358 g
Dimensions	omni.net LCD/LCD+M: 192mm (W) x 42.5mm (H) x 145.6mm(L) omni.net Plus/D: 183mm (W) x 36.5mm (H) x 135.0mm(L)

Table 1. Specifications

In the following table, you will find a summary of the key features that apply to your model omni.net LCD/Plus/D new ISDN TA.

Key Features Summary

Feature	omni.net D	omni.net Plus	omni.net LCD	omni.net LCD+M
B-channel Data Rate	64Kbps	64Kbps	64Kbps	64Kbps
B-channel Protocols	PPP, V.120, V.110, X.75	PPP, V.120, V.110, X.75	PPP, V.120, V.110, X.75	PPP, V.120, V.110, X.75
128Kbps B-channel Bundling	PPP-MP, MLP	PPP-MP, MLP	PPP-MP, MLP	PPP-MP, MLP
Status Indicator Type	8 LED	10 LED	8 LED LCD Panel	8 LED LCD Panel
Front Panel Control and Monitoring	—	—	YES 20x2 LCD Panel	YES 20x2 LCD Panel
Hi/fn LZS (Stac) Compression	YES	YES	YES	YES
Muli-Auto for Dial-in and Dial-out	YES	YES	YES	YES
Bandwidth-On-Demand, BACP	YES	YES	YES	YES
Call Bumping	—	YES	YES	YES
Asynchronous Speed on Serial Port	460.8Kbps	460.8Kbps	460.8Kbps	460.8Kbps
Number of Analog (POTS) Ports	—	2	2	2
REN	—	3	3	3
Caller ID on analog port support	—	YES	YES	YES
Feature Phone	—	YES	YES	YES
Supplementary Service	—	YES	YES	YES
Synchronous Mode	—	—	YES	YES
Built-in 56K modem	—	—	—	YES

Table 2. Key Features Summary

Installing Your ZyXEL omni.net ISDN TA

For detailed instructions on how to install and configure your ZyXEL omni.net ISDN TA with the ZyXEL ISDN Configuration Manager (ZyXEL ICM), please refer to the *Quick Start Guide* particular to your device that comes with your omni.net package.

Follow these steps to perform a quick and correct installation, as outlined in the *ZyXEL omni. net LCD series Quick Start Guide or ZyXEL omni.net Plus/D Quick Start Guide.*

Step 1. Connect the omni.net DTE port to your computer's serial port by using the RS232 cable.

Step 2. Connect the omni.net ISDN TA to your ISDN line via the NT-1 ISDN Network Termination device.

Step 3. Perform the setup for Windows 95/98/NT by installing the Windows 95/98/NT driver (INF file.)

Step 4. Install the ZyXEL ISDN Configuration Manager and configure for PPP protocol (Internet access.)

Step 5. Configure Windows 95/98 Dial-Up Networking.

Step 6. Plug analog devices such as telephone, fax, modem, answering machine, into the two analog ports of your omni.net (for omni.net Plus and omni.net LCD/LCD+M only.)

Chapter 2
Using *ZyXEL*® ISDN Configuration Manager

This chapter shows you how to use the ZyXEL ISDN Configuration Manager (ICM).

About ZyXEL ISDN Configuration Manager

The ZyXEL ISDN Configuration Manager is a Graphical User Interface (GUI) program that runs on Windows 95/98/NT operating systems. You can control and set up your ZyXEL omni.net ISDN TA either by using a traditional terminal program where you need to program AT commands, or by running this user friendly ZyXEL ISDN Configuration Manager.

Before starting the ZyXEL ISDN Configuration Manager, you have to:

1. Verify that the power supply to your ZyXEL omni.net LCD/LCD+M/Plus/D is plugged in to a wall power outlet.

2. Make sure that your ZyXEL omni.net LCD/LCD+M/Plus/D is connected to your computer's serial port (COM1 to COM4).

3. Close all communications programs and any DOS Prompts still active in your computer system.

4. Turn on your ZyXEL omni.net LCD/LCD+M/Plus/D.

Start using ZyXEL ISDN Configuration Manager

Follow these steps to use the ZyXEL ISDN Configuration Manager:

Step 1. To display the ZyXEL ISDN Configuration Manager main menu

Double-click on the ZyXEL ISDN Configuration Manager icon to start the Configuration Manager.

Double-click here to execute the ZyXEL ISDN Configuration Manager porgram.

SPID Wizard is installed only if you select "North American" as the item in the installation processing.
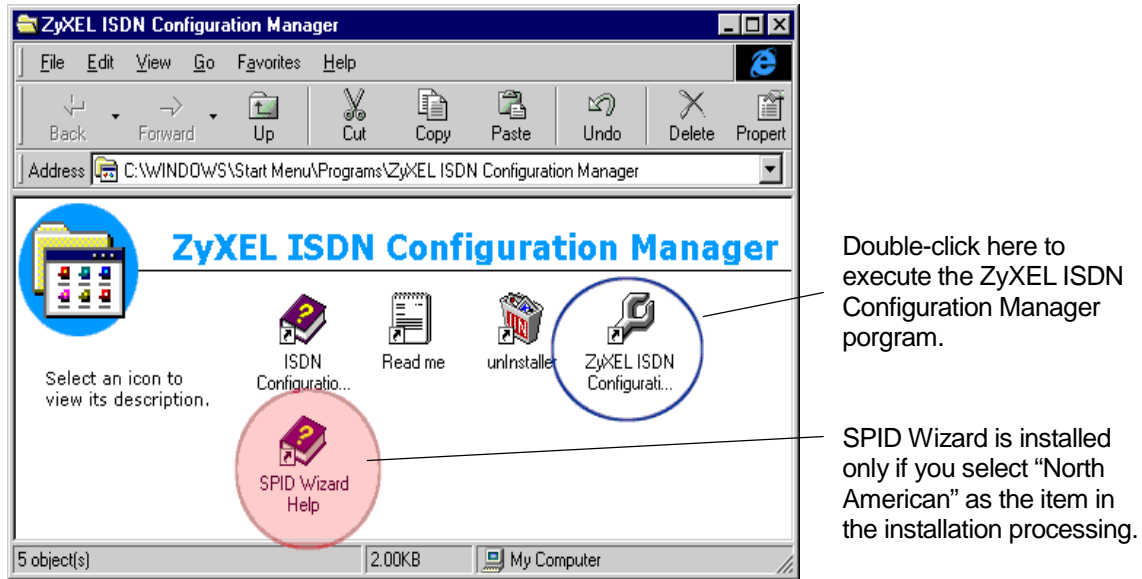
Figure 1. ZyXEL ISDN Configuration Manager icon

Step 2. After checking all active serial communication ports, the ZyXEL ISDN Configuration Manager automatically detects which communication port is connected to your ZyXEL omni.net ISDN TA.

If the ZyXEL ISDN Configuration Manager can not find your ZyXEL omni.net ISDN TA, it will prompt you with the Port Setup dialog-box, as shown in the following illustration:

1. In most cases, you only need to change Port selection to reflect the physical connection of your omni.net. Please select the correct COM Port (COM1 to COM4).

2. Click here to open the Configuration Manager's Posrt Setup dialog-box.
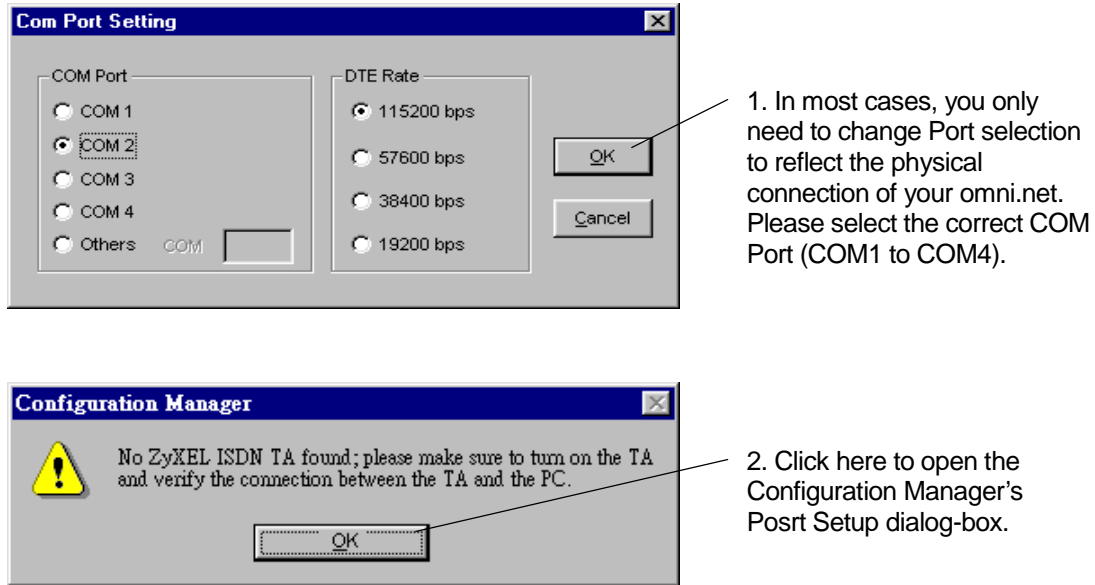
Figure 2. The Com Port Setting of ZyXEL ISDN Configuration Mangaer

Setp 3. ZyXEL ISDN Configuration Manager Main Menu
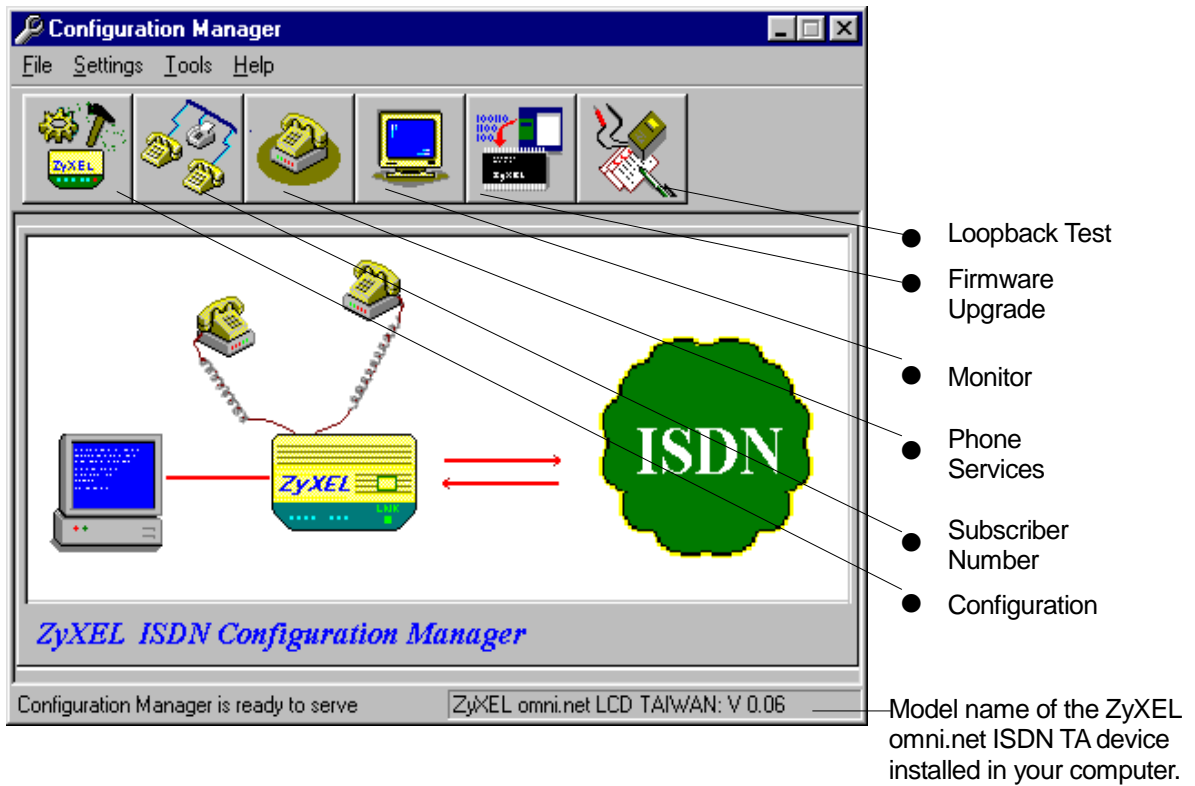
Figure 3. ZyXEL ISDN Configuration Manager Main Menu

Step 4. Configuration Settings
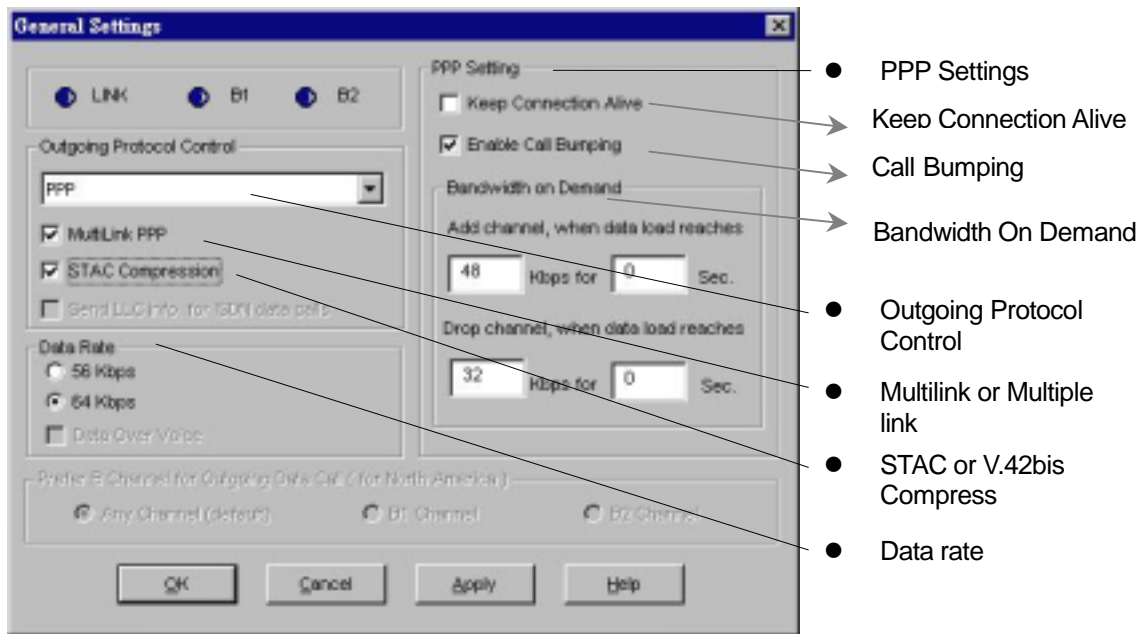
Figure 4. Configuration Settings

Follow the guidelines in the table below designed to assist you in configuring the ISDN parameters of your ZyXEL omni.net ISDN TA.

Configuring ISDN Parameters

ISDN Parameter	Description
Outgoing Protocol Control	Sets the calling protocol for the your ZyXEL omni.net ISDN TA. The protocol selected should match the protocol in use by the device or network your ISDN TA is calling. Selections are [X.75/V.110/V.120/PPP]. Note: PPP is the most widely used protocol for Internet Access.
Multilink **Multiple Link**	☒ Check the selection box if you want to combine 2 x B-channels to increase the data transfer rate. This is called multilink. ☐ Multiple Link with two independent B-Channels.
STAC or V.42bis Compression	You can enable or disable data compression by checking or unchecking the check box.
Data Rate	Click the 56Kbps or 64Kbps option button.
Call Bumping	Call Bumping configures your ISDN device to allow outgoing or incoming analog calls while a Multilink connection is established. If this box is checked when a handset is picked up on a POTS port, or an incoming analog call is detected, the B-channel associated with this call will disconnect from the ISDN data call and allow the analog call to proceed.
Keep Connection Alive	Keep Connection Alive sets a timer that will send a dummy PPP packet every 59 seconds to maintain the connection with the remote device. This is useful during long periods when there is no data transfer, but you do not wish to be automatically disconnected by the remote device. Note: Do not set this option if you are charged by time usage, as this can maintain the connection indefinitely until it is manually disconnected.
Bandwidth-On- Demand	Bandwidth-On-Demand settings are used to control the adding and removing of the 2nd link of a Multilink connection.

Table 3. Configuring ISDN Parameters

Chapter 3
LCD Panel Operation (for ZyXEL omni.net LCD/LCD+M)

This chapter explains LCD panel readings and provides a detailed description on how to operate the menu-tree for the ZyXEL omni.net LCD and the ZyXEL omni.net LCD+M models.

LCD panel

ZyXEL omni.net LCD is the first ISDN TA in the industry to provide a control panel equipped with a 20 x 2 LCD display and four menu keys for easy configuration and detailed status monitoring. ZyXEL omni.net LCD+M has not only a LCD display and four operation keys, but also has included a built-in 56K modem.

The four arrow keys allow intuitive menu-tree operation and the LCD panel displays the status of your ZyXEL omni.net LCD/LCD+M.

Control Panel Description

The ZyXEL omni.net LCD/LCD+M control panel allows you to check at any time the status of your ISDN TA, record the dial-in/dial-out call history, and have access to your list of stored phone numbers. It can display advice on charges and help you manage your ISDN communication fees.

Moreover to help filter undesired phone calls, your omni.net LCD supports Caller ID when connected to a caller ID box. The LCD panel displays the calling party's phone number.

The LCD on ZyXEL omni.net LCD/LCD+M is as below:

LCD Panel Idle Screen   **Arrow Keys**
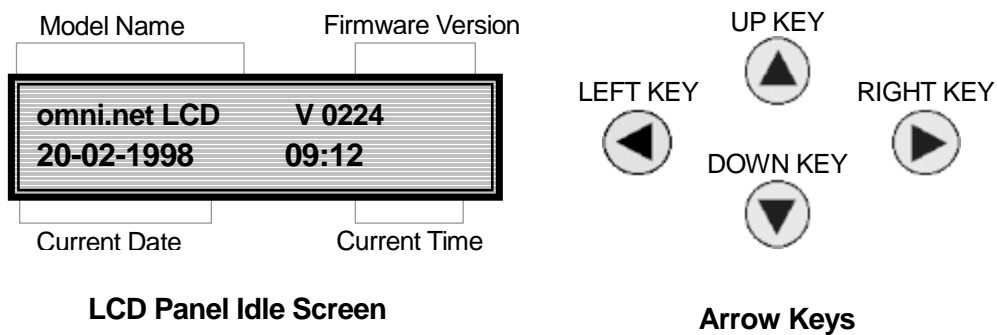
Figure 5. LCD Front Panel

LCD Panel Functions

The menu tree options are listed in the following table:

Menu˙ree Options	Function
Idle Screen	Display model name, firmware version, current date, and current time.
Clock Options	Set the date and time. Set the display mode.
Dial In Log	Display the type of call (Tel1, Tel2, X.75, T.70, V.110, V.120, and PPP…), connection time, and caller ID for up to 20 incoming calls. (Incoming call history)
Stored Phone List	Display the stored phone number for up to 40 records.
Dial Out Log	Display the type of call (Tel1, Tel2, X.75, T.70, V.110, V.120, and PPP…), connection time, dial out number, and charge information for up to 20 outgoing calls. (Call out history)

Table 4. Menu Tree Functions

LCD Panel Operation Keys

▶ Right key:	Next menu option selection Next item selection (shift right one digit)
◀ Left key:	Previous menu option selection Previous item selection (shift left one digit)
▲ Up key:	Cancel Return to previous menu Quit
▼ Down key:	Enter new setting Save new setting Shift down to next sub-menu

Table 5. LCD Panel Operation Keys

LCD Panel Display

<<	Indicates more menu items on the left. Press ◀ to access the menu option to the left.
>>	Indicates more menu items on the right. Press ▶ to access the menu option to the right.
↓	Indicates sub-menu item(s). Press ▼ to access the sub-menu(s).

Table 6. LCD Panel Display

The following screens represent the LCD display as seen on your ZyXEL omni.net LCD/LCD+M front panel, for various status of ISDN TA.

Idle Screen

LCD Display	Description	
Omni.net LCD V 1.00 **02-03-1998 08:12**	omni.net LCD	: **model name**
	V 1.00	: **firmware version**
	02-03-1998	: **current date**
	08:12	: **current time**

Table 7. Idle Screen

Set Clock sub-menu

LCD Display	Description	
Set Clock **Year 1998**	Set Clock	: **update the date and time**
	Year 1998	: **current Year (or Month, Day, Hour, Minute, Sec) setting**

Table 8. Set Clock sub-menu

Set Display Mode sub-menu

LCD Display	Description	
Set Display Mode **= 24Hr**	Set Display Mode	: **update the display mode**
	=24Hr	: **display mode (24 hr mode or 12 hr mode [PM/AM])**

Table 9. Set Display Mode sub-menu

Dial In Log

LCD Display	Description	
<< Dial In Log >> ↓	Dial In Log sub-menu	
▼		
#01: TEL1 00:01:02 **Fm:035783942**	*nn	**: the last number of incoming call**
	#*nn*	**: record number nn (nn=01-20) of an incoming call**
	TEL1	**: active device or protocol (TEL1, TEL2, X.75, T.70, V.110, V.120, PPP,…). If the call is not answered, the log will record "Analog" for a phone call or "Data" for ISDN data call.**
	00:01:02	**: connection period**
	035783942	**: Caller ID containing up to 16 digits**
▼		
#01: TEL1 00:01:02 **02-03-1998 09:32**	02-03-1998 09:32	**: connection time**

Table 10. Dial In Log

Stored Phone List

LCD Display	Description	
<<Stored Phone List>> ↓	Stored Phone List sub-menu	
▼		
Stored Phone List **#00=035774848**	#*mm*	**: record number mm (mm=00-39) of a stored phone number**

Table 11. Stored Phone List

Dial Out Log

LCD Display	Description	
<< Dial Out Log >> ↓	Dial Out Log sub-menu	
#01: TEL1 $102 **To:5783942**	*#nn*	**: record number nn (nn=01-20) of an outgoing call**
	TEL1	**: active device or protocol (TEL1, TEL2, X.75, T.70, V.110, V.120, PPP,…).**
	$102	**: charge information**
	5783942	**: dial-out number containing up to 16 digits**
OR **#01: TEL1 00:02:06** **To:5783942**	00:02:06	**: connection period if the charge information is not supported by the ISDN network.**
#01: TEL1 00:01:02 **02-02-1998 09:32**	02-02-1998 09:32	**: connection time**

Table 12. Dial Out Log

Active Status

When the omni.net LCD is idle, an incoming call or outgoing call will cause it to auto-change the screen to active status, as shown in the examples below:

B1 detail information:

| **B1 TEL2 Fm:035783942** **B2 Idle** | One incoming call has been answered. (One B-channel active) | ▶ | **B1 TEL2 00:00:05** **Fm:035783942** |

| **B1 Analog Fm:5783942** **B2 Idle** | One incoming call has NOT been answered. (One B-channel active) | ▶ | **B2 Idle** |

▶

| **B1 TEL2 To:035774848** **B2 Idle** | One outgoing call has been answered. (One B-channel active) |

| **B1 TEL2 Fm:035783942** **B2 V.120 Fm:035712121** | Two incoming calls have been answered. (Two B-channels active) |

| **B1 TEL2 Fm:035783942** **B2 TEL1 To:035774848** | One incoming call has been answered. One outgoing call. (Two B-channels active) |

| **B1 TEL2 To:035781234** **B2 TEL1 To:035774848** | Two outgoing calls. (Two B-channels active) |

| **B1 DISC $102** **B2 Idle** | One incoming/outgoing call disconnected. |

Table 13. Active Status

Clock Options

Display Clock

Operation	LCD Display	Description
	Omni.net LCD V 1.00 **02-02-1998 08:12**	Idle screen.
1. press ◀ button.	**<< Clock Options >>** ↓	Enter "Clock Options" menu.
2. press ▼ button.	**<< Set Clock >>** ↓	Enter "Set Clock" sub-menu.
3. press ▼ button.	**Set Clock** **Year 1998**	Display current year.
4. press ▶ button.	**Set Clock** **Month 02**	Display next set clock sub-menu (the sequence is Month, Day,…, Sec, Year).
5. OR from step 3, press ◀ button.	**Set Clock** **Sec 27**	Display previous set clock sub-menu (the sequence is Sec, Min,…, Month, Year).

Table 14. Display Clock

Update Clock

Operation	LCD Display	Description
	Set Clock **Year 1998**	Display original clock parameter.
1. press ▼ button.	**Set Clock** **Year _**	Set clock parameter.
2. press ► or ◄ button.	**Set Clock** **Year _**	Select the new digit that you want to input (the sequence is <0123456789^).
3. press ▼ button.	**Set Clock** **Year 1_**	Confirm your selection and shift right one space for the next input.
4. repeat steps 2 and 3.	**Set Clock** **Year 1998**	Until the last digit is set.
5. press ▲ button.	**<< Clock Options >>** ↓	Return to "Clock Options."

Table 15. Update Clock

Follow a procedure similar to the one described above to update other clock parameters such as Month, Day, Hour, Minute, and Second.

Set Display Mode

Operation	LCD Display	Description
	<< Clock Options >> ↓	
1. press ▼ button.	**Set Clock** **Year 1998**	Display set clock sub-menu.
2. press ▶ or ◀ button.	**Set Display Mode** **[24Hr]**	Enter the "Set Display Mode" sub-menu. Show current display mode.
3. press ▼ button.	**Set Display Mode** **= 24Hr**	Enter "mode selection" sub-menu.
4. press ▶ or ◀ button.	**Set Display Mode** **= PM/AM**	Select the new display mode (24Hr or 12Hr [PM/AM]) for the system clock.
5. press ▼ button.	**Set Display Mode** **[PM/AM]**	Confirm your selection.
6. press ▲ button.	**<< Clock Options >>** ↓	Return to "Clock Options."

Table 16. Set Display Mode

Dial In Log Options

Dial In Log Records

Operation	LCD Display	Description
	Omni.net LCD V 1.00 **02-03-1998 08:12**	Idle screen.
1. press ▶ button.	**<< Dial In Log >>** ↓	Enter "Dial In Log" menu.
2. press ▼ button.	**#01: TEL1 00:01:02** **Fm:035783942**	Show dial-in record #01 (the dial in log contains up to 20 records of incoming calls #01-#20.)
3. press ▶ or ◀ button.	**#02: V120 00:02:06** **Fm:035774848**	Display the next or previous dial-in record.
4. press ▲ button.	**<< Dial In Log >>** ↓	Return to "Dial In Log."

Table 17. Dial In Log Records

Stored Phone List Options

Stored Phone List Records

Operation	LCD Display	Description
	omni.net LCD V 1.00 **02-03-1998 08:12**	Idle screen.
1. Press ▶ ▶ button.	**<<Stored Phone List>>** ↓	Enter "Stored Phone List" menu.
2. press ▼ button.	**Stored Phone List** **#00=035712121**	Show stored phone record #00 (the stored phone list contains up to 40 phone records #00-#39.)
3. press ▶ or ◀ button.	**Stored Phone List** **#01=035783942**	Display the next or previous stored phone number record.
4. press ▲ button.	**<<Stored Phone List>>** ↓	Return to "Stored Phone List."

Figure 6. Stored Phone List Records

Dial Out Log Options

Records of Outgoing Calls

Operation	LCD Display	Description
	omni.net LCD V 1.00 **02-03-1998 08:12**	Idle screen.
1. Press ◀ ◀ button.	**<< Dial Out Log >>** ↓	Enter "Dial Out Log" menu.
2. press ▼ button.	**#01: TEL1 $102** **To:5783942**	Show record of outgoing call #01 (the dial-out log contains up to 20 records of outgoing calls #01-#20.)
3. press ▶ or ◀ button.	**#02: V120 00:02:06** **To:5712121**	Display the next or previous record of outgoing call.
4. press ▲ button.	**<< Dial Out Log >>** ↓	Return to "Dial Out Log."

Table 18. Records of Outgoing Calls

Part II

ISDN Function

Chapter 4
ISDN Communication Basics

This chapter covers how to initiate and receive calls over digital lines using your ZyXEL omni.net ISDN TA.

Understanding AT Commands

AT commands are used to configure and control the omni.net by typing the command statements at the computer or terminal keyboard. Command statements must be written in a specific form in order for the omni.net to recognize them. A command statement begins with the letters string [AT] or [at], followed by one or more alphanumeric commands (a set of letters and numbers) and then ended by pressing <Enter>, as shown in the following examples.

Examples of AT Commands

Type AT Command	Operation	omni.net Response
AT<Enter>	To verify that the omni.net is online with your terminal or computer.	OK
ATCL?<Enter>	To inquire about the current setting of the packet length or frame size.	Maximum user data length in packet:

Table 19. Examples of AT Commands

AT commands can only be issued when the omni.net is in command or off-line mode.

Once the omni.net has established a connection with the remote device, it goes into on-line mode,

and the characters sent from your computer (through the TA) are transmitted to the remote device.

In order to issue an AT command statement, you first need to run your communications software and configure it to the port connected to your omni.net. (*Refer to your communications software manual.*)

Additional AT Command Set for Internal Fax/Modem (for ZyXEL omni.net LCD+M only)

Beside the AT commands supported by omni.net LCD, there are additional AT commands for internal fax/modem usage to control speaker (ATMn and ATLn), data compression (AT&Kn), modem dial out (ATDMs), fax command set (EIA Class 1 fax commands), etc.

Supported AT Command Types

Type of AT Command S pported	Example
Basic AT (Hayes compatible)	`ATA`
Basic AT$ (on line help)	`AT$` *(Browse the list of AT commands)*
Extended AT&	`AT&F`
Extended AT* command	`AT*D0`
S-Register command	`ATS0=1`
S-Register bit-mapped command	`ATS13.1=1` *(Set S-Register 13 bit-1 equal to 1)*
S-Register inquiry command	`ATS0?` or `ATS13.1?`

Table 20. Supported AT Command Types

Quick Tips when Issuing AT Commands

■ To execute an AT command, press the <ENTER> or <RETURN> key.

■ Multiple AT commands can be combined into one line by using the [AT&] function. For example, [AT&O2] and [ATB02] can be combined into one line [AT&O2B02].

■ The TA executes commands from left to right. The AT command that appears to the right might over-write the command to the left. For example, [ATB13B14] will result in [ATB14] since both [B13] and [B14] can not co-exist.

■ If you see duplicated characters for each one you type, your omni.net and software both have their echo feature turned on (the omni.net default setting enables command *echo*). To eliminate the double characters, turn off software command *echo*.

■ To repeat the last command, type [A/]. *(No AT prefix is needed for this command.)*

■ The omni.net supports either verbose result code (i.e. OK) or numerical result code (i.e. 0). You can use [ATVn] command to set it one way or the other:

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

Table 21. At Commands for numberical/verbose result code

Outgoing Calls

After you have connected your omni.net to the ISDN line, your computer, and analog phone (omi.net LCD/Plus only), then you are able to place outgoing data and voice calls.

Dialing Data Calls

You can use the command [ATDI] to instruct your omni.net to make an ISDN data call.

➢ Type: `ATDI17142630398<enter>` *(Make a Data call)*

Dial Out Voice Calls (for ZyXEL omni.net LCD/LCD+M//Plus)

You can use your analog phone connected to Phone port 1 and 2 to dial out directly, or choose to type the command [ATDA], [ATDB] to instruct your omni.net that you wish to place an ISDN voice call. Command [ATDA] switches the call to analog port 1, while [ATDB] assigns the call to analog port 2.

➢ Type: `ATDA17146930762<enter>` *(Make a voice call on analog port 1)*

Dialing Out using internal Fax/modem (for ZyXEL omni.net LCD+M)

Using the "M" command following the "ATD" will tell your omni.net LCD+M to automatically switch calls to the internal fax/modem once dialing is complete.

➢ Type: ATDM17146930762<enter> *(Make a voice call on analog port 2)*

Dialing Out Using ISDN Mode Optional Speech Bearer Service

Your omni.net supports ISDN data utilizing Speech Bearer Service. To enable this function, you need to set S-register S83 bit 7 to 1 (ATS83.7=1). This function is useful in areas where ISDN service providers' charge lower usage rate for voice (speech) calls.

➢ To enable Speech Bearer Service, type: `ATS83.7=1<enter>`

➢ To disable this function, type: `ATS83.7=0 <enter>`

Manually Switching Communication Mode (for ZyXEL omni.net LCD/LCD+M/Plus)

The manual switching functions will only be necessary if your communication software does not allow you to change your dial-up string.

Conventional dialing commands [ATD], [ATDT] and [ATDP], used by much existing communication software, can be mapped onto one of the new dialing commands according to the [AT&O] setting, as follows:

For ZyXEL omni.net LCD/Plus:

Manual Switch AT Command	Dial string it will map to
AT&O0	ATD, ATDT, ATDP are the same as [ATDB]
AT&O2	ATD, ATDT, ATDP are the same as [ATDI]
AT&O3	ATD, ATDT, ATDP are the same as [ATDA]

Table 22. Manual Switch AT Command For ZyXEL omni.net LCD/Plus

For ZyXEL omni.net LCD+M:

Manual Switch AT Command	Dial string it will map to
AT&O0	ATD, ATDT and ATDP are the same as ATDM
AT&O1	Auto-selection of 64kbps and 3.1 kHz on outgoing calls
AT&O2	ATD, ATDT and ATDP are the same as ATDI
AT&O3	ATD, ATDT and ATDP are the same as ATDA

Table 23. Manual Switch AT Command For ZyXEL omni.net LCD+M

(For more information on ZyXEL omni.net LCD+M, please refer to *Chapter 9 Internal Fax/Modem Function*)

The factory default setting is [AT&O2] that instructs the omni.net to select ISDN data mode when you do not otherwise specify which communication mode to use (i.e. ATD or ATDT).

Placing a Data Call

While placing a voice call can be as simple as dialing out with your analog phone, initiating a data call requires prior selection of a proper B-channel protocol. Here are some simple commands that will be useful when placing a call. The omni.net has the capability to automatically detect the B-channel protocol (V.120, X.75, or PPP) used by the answer site.

AT Command	Description
ATBnn	Changes ISDN B channel protocol setting.
ATDL	Re-dials the last dialed telephone number.

Table 24. AT Command for Placing a Data Call

Multi-Auto Dial Out (MDO) for Outgoing Data Calls

With the Multi-Auto Dial Out function, your omni.net automatically tries the outgoing data protocol with the predefined protocol sequence set by the commands [ATB90-97], as listed in the following table.

AT Command	MDO Protocol Trial Sequence
ATB90	PPP+X.75
ATB91	PPP+X.75+T.70+ISO8208+T.90+BTX
ATB92	X.75+T.70+ISO8208+T.90+BTX+PPP
ATB93	PPP+V.120
ATB94	V.120+PPP
ATB95	PPP+X.75+V.120 (* default for DSS1)
ATB96	PPP+V.120+X.75 (* default for U.S.A.)
ATB97	X.75+V.120+PPP
Note: Bundle call is not supported in MDO X.75+V.120+PPP	

Table 25. MDO AT Command

Incoming Calls

This chapter provides guidelines for setting up the your omni.net to answer calls.

The ZyXEL Multi-Auto feature allows your omni.net to automatically detect calls, to identify calls as analog or digital and to route them accordingly.

When an analog call comes in, the omni.net sends the call to the analog port as the factory default, Phone 1 and then Phone 2 (for omni.net LCD/ LCD+M/Plus).

When a data call comes in, the omni.net automatically detects the PPP, V.110, V.120, and X.75 protocols, and negotiates a connection using the proper B-channel protocol, thereby freeing users from manual protocol configuration.

Answering a Call Using MSN

When answering an incoming call, the omni.net will first be identified if the calling number matches the MSN settings.

The Multiple Subscriber Number (MSN) supplementary service enables multiple ISDN numbers to be assigned to a single ISDN BRI line. It allows the caller to select, via the public network, one or more distinct terminals from a variety of terminal choices. Since the omni.net supports many different communication protocols and two analog adapters, each of these ports can individually be assigned to a different ISDN number using the following [AT&ZIn=s] AT command:

AT&Zin=s (where 's' is the MSN)	
&ZI0=s	Assigns MSN 's', phone number for X.75
&ZI1=s	Assigns MSN 's', phone number for V.110
&ZI2=s	Assigns MSN 's', phone number for V.120
&ZI3=s	Assigns MSN 's', phone number for PPP, MPPP
&ZI4=s	Assigns MSN 's' for ISDN data, protocol auto-detection
&ZI6=s	Assigns MSN 's', phone number for Phone 2 (for omni.net LCD/Plus) and modem (for omni.net LCD+M only)
&ZI7=s	Assigns MSN 's', phone number for Phone 1 (for omni.net LCD/ LCD+M/Plus)

Table 26. AT Command for answering a call using MSN

[AT&ZI?] can be used to display the MSN numbers. The factory default for these numbers are UNASSIGNED.

If an incoming SETUP message is offered with addressing information (i.e. the appropriate part of the called_party_number), this address will be compared with the MSN numbers assigned by the [AT&ZIn=s] commands. The call will be accepted using the specific protocol, if the assigned number of this protocol matches the received called party number.

> **NOTE:** You are not required to enter the complete number string for the [AT&Zin] command. The last few distinguishable digits will be enough for the Omni.net to make the decision. Two phone number strings are said to be matched if their least significant 'n' digit(s) are identical, where 'n' is the number of digits in the shorter string.

Called_Party_Subaddress information within the incoming SETUP message can also be used to select the protocols and/or analog ports. In normal conditions Called_Party_Subaddress information is not used by the omni.net to select the protocols or services, but only indicates the subaddress (if any) to the DTE.

Data Over Speech Channel (for ZyXEL omni.net LCD/LCD+M/Plus)

If you are expecting ISDN data calls through the Speech (Voice) channel, you need to setup MSN for that purpose. To the omni.net, if no MSN entries are found in MSN ISDN data lists, all Speech (Voice) calls will be sent to either Phone 1 or Phone 2. Which entry to use would depend on the type of data call that you are expecting. If you only expect PPP calls, you should enter the number that the remote user will use to dial in: entry #3 [AT&ZI3=xxx]. Once this is set, the omni.net will attempt to use PPP protocol to handshake with the remote site whenever a caller dials into this number.

Best-effort Call Answering (for ZyXEL omni.net LCD/LCD+M/Plus)

If some numbers have been set using the &ZIn command (this can be seen by issuing the [AT&ZI? Command] and they are not matched with the address of the incoming call, the omni.net will, by default, ignore the call as it may be intended for other devices that share the same S/T interface (S/T bus) with the ISDN TA.

If you want the omni.net to answer inbound calls using all possible protocols, you can set the best-effort call answering bit as follows:

Command	Description
ATS119.3=0	Answer call only when number matched (default)
ATS119.3=1	Best effort call answering

Table 27. AT Commands for Best-effort Call Answering

Ambiguity Resolution Switch for Voice Calls (for omni.net LCD/LCD+M/Plus)

Voice calls are routed to one or both of the POTS ports (Phone 1 or/and Phone 2) when they are received. /and Phone 2) when they are received. You can choose the POTS port you want to receive calls by setting the MSN (command [AT&Zi*n*=s], as described in a previous table) to a specific

phone number 's'.

In cases when the omni.net is unable to distinguish which POTS port to route the incoming voice call to, your ISDN TA will alert both POTS ports by default [`ATS120.2=0`], until the first available port answers. Otherwise [`ATS120.2=0`], an ambiguity resolution bit (Bit 5 of S84, or `&Ln`) can be used to determine the path.

Ambiguity Resolution AT Command	Description
AT&L0	Phone 1 has the higher priority.
AT&L1	Phone 2 and modem (for omni.net LCD+M only) has the higher priority.

Table 28. Ambiguity Resolution AT Command

Scenarios of an Incoming Voice Call					Outcome		
Phone 1 MSN Matched	Phone 2 MSN Matched	Global Call (No Called Party No.)	S120.2 (Default=0)	AT&Ln (Default n=0)	Phone 1	Phone 2	Modem able to answer
✓	✗	✗	-	-	Ring	-	✗
✗	✓	✗	-	-	-	Ring	✓ &L1 ✗ &L0
Unassigned	Unassigned	✗	0	-	Ring	Ring	✓ &L1 ✗ &L0
Unassigned	Unassigned	✗	1	n=0	Ring	-	✗
Unassigned	Unassigned	✗	1	n=1	-	Ring	✓
✓	✓	✗	0	-	Ring	Ring	✓ &L1 ✗ &L0
✓	✓	✗	1	n=0	Ring	-	✗
✓	✓	✗	1	n=1	-	Ring	✓
✗	✗	✗	-	-	-	-	✗
-	-	✓	0	-	Ring	Ring	✓ &L1 ✗ &L0
-	-	✓	1	n=0	Ring	-	✗
-	-	✓	1	n=1	-	Ring	✓

Table 29. Scenarios of an Incoming Voice Call

The default MSN sub-address (or EAZ) for 1TR6 (Old German ISDN) of the a/b adapters are as follows:

➢ Phone 1: EAZ = 4 (&ZI7=4)

➢ Phone 2: EAZ = 3 (&ZI6=3)

A global call is an inbound voice call with no destination phone number (Called-Party-Number) which may happen on some switches when the calling site is on the PSTN (analog telephone). By default, the omni.net will route the global call to both the POTS ports (making them alert). The phone port that picks up the phone earlier answers the call.

Global Call AT Command	Description
ATS87.0=0	Enable POTS port 1 to accept global calls (default)
ATS87.0=1	Disable POTS port 1 to accept global calls
ATS87.1=0	Enable POTS port 2 to accept global calls (default)
	&L1 : Allow modem to accept global calls &L0 : Not allow modem to accept global calls (default)
ATS87.1=1	Disable POTS port 2 to accept global calls

Table 30. Global Call AT Command

German ZyXEL customers: The inner two pins of the RJ-11 are used for the Tip and Ring (or 'a' and 'b' signals in Germany, the two signals that connect to a telephone set). This is the standard pin assignment, but some BZT-approved telephones use the outer two pins for a and b. If this is the case, use the attached TAE adapter which has a unique interface definition or use an RJ-11 cable that connects the inner pins on one end and the outer pins on the other end.

Part III

Voice Features

Chapter 5
Supplementary Service
(for ZyXEL omni.net LCD/LCD+M/Plus)

Supplementary services such as call waiting, caller ID, … are generally available from your telecommunications provider. The omni.net LCD/LCD+M/Plus supports all of the following services:

- Caller ID
- Call Waiting
- Call Hold/Retrieve
- 3-Way Conference
- Multiple Subscriber Number (MSN) Sub-address
- Advice of Charge

- Calling Line Identification Presentation
- Calling Line Identification Restriction
- Call Forwarding
- Call Transfer
- Terminal Portability

Supplementary services can be ordered from your local telecommunications provider. The omni.net LCD/LCD+M/Plus provides good compatibility with DSS1 switches in Europe, and NI-1 and DMS 100 in North America.

To operate the supplementary service phone features that you have subscribed, please refer to the instructions provided in this chapter.

To Implement the Supplementary Services

After you have subscribed the services that you need from your telecommunications provider, you

can invoke all the supplementary services by using a single key on your telephone keypad: the Flash key.

To assign the flash key to enable supplementary service, issue the command [ATS120.7=1&W0Z0].

Call Waiting

Call waiting allows you to put a call on hold while you answer another incoming call on the same phone (directory) number.

The command register S79 controls the operations of call waiting. By default, call waiting is enabled on both phone ports. You can use the S79 settings to enable/disable call waiting, as follows:

Call Waiting S Register	Description
S79.2=1	Enable Call Waiting on POTS port 1 (default).
S79.2=0	Disable Call Waiting on POTS port 1.
S79.3=1	Enable Call Waiting on POTS port 2 (default).
S79.3=0	Disable Call Waiting on POTS port 2.

Table 31. Call Waiting S Register

There are several ways of using call waiting to deal with an incoming call:

Put your current call on hold and answer an incoming call

Step 1. You are currently on an active call between A and B.

Step 2. You hear an indicator tone signaling an incoming call C.

Step 3. Press and immediately release the Flash key.

Step 4. This will put caller B on hold and activate the call between A and C.

Call Hold/Retrieve

Switch back and forth between two callers

After using the call waiting option to answer a second incoming call, pressing the Flash key allows you to switch back and forth between caller B and C by putting either one on hold.

Hang-up your current call before answering an incoming call

Step 1. You are currently on an active call between A and B.

Step 2. You hear an indicator tone signaling an incoming call C.

Step 3. Simply hanging-up will terminate the call between A and B.

Step 4. Wait for the phone to ring.

Step 5. Answering the incoming call will start an active call between A and C.

Disconnect the second call and switch back to the first call

While caller B is on hold, simply hang-up the phone set to disconnect caller C. Then wait for the phone to ring, and pick-up to return to the active call with caller B.

Three Way Conferencing

The three way conferencing feature allows you to add another party to an existing call, and gives you additional flexibility in selecting which call to drop at closure.

You first need to subscribe this service from your telephone company. Then, issue the command [ATS120.7=1&W0Z0] that will assign the Flash key to supplementary service.

In addition, and *for USA only,* request the IOC (ISDN Ordering Code) from your telephone company. The IOC is used by your omni.net TA as feature access code to conference calls (The IOC should range between 0 and 63.) Save the IOC to the omni.net TA by typing the following command: `AT&ZFl=IOC-of-CONFERENCE`

Starting a conference call

If you wish to call another party C and let them join in to conference with an existing call, follow these steps:

Step 1. Press the flash key and immediately release to put the existing caller B on hold and receive a dial tone.

Step 2. Dial to third party C that you want to invite in your conversation.

Step 3. After party C answers, press the flash key and immediately release to establish a three way conference call.

> **NOTE:** If you wish to cancel your attempt to establish a conference call (third party line is busy or if they do not answer), simply hang-up the phone and pick it back up after it starts ringing to return to the first caller.

Canceling the conference call *(for DSS1 switch only)*

When you wish to cancel the current conference call, simply press the Flash key.

Dropping the last call added to the 3-way conference call *(USA only)*

During a three way conference call, when you are ready to close with caller C, simply press the flash key. The last call C that was added to the conference will be dropped.

Leaving the conference call, while the other two parties connected *(USA only)*

If you wish to leave the conference call, but allow the other two parties to remain connected, simply hang-up the phone. If the two callers remain on the line, the ISDN network will do an implicit transfer to directly connect the two remaining callers together

Call Forwarding

For DSS1 switch

The omni.net supports the following three call forwarding options when connected to a DSS1 type of switch:

■ Call forwarding unconditional (CFU): all incoming calls are systematically forwarded to the designated number.

■ Call forwarding busy (CFB): if your line is busy, then incoming calls are forwarded to the designated number.

■ Call forwarding no-reply (CFNR): after your line rings and there is no reply, then the incoming call is being forwarded to the designated number.

Call forwarding on DSS1 switch can be activated/deactivated by using the [ATCFxy] AT command.

Call Forwarding AT Command	Description
ATCFxy<forwarded-number>	Activate call forwarding on DSS1 switch
Where x = B	Call forwarding busy (CFB)
x = U	Call forwarding unconditional (CFU)
x = NR	Call forwarding no-reply (CFNR)
Where y = S	All services
y = I	ISDN data (unrestricted digital)
y = A	:A:
y = B	POTS port (phone B) only or modem (for omni.net LCD+M only)
ATCFxy	Deactivate call forwarding on DSS1 switch

Table 32. Call Forwarding AT Command

For USA NI-1 and DMS-100 switch types, the omni.net supports call forwarding variable (CFV) service that can be done passively through the POTS ports. Your telecommunications company will provide you with the appropriated dial access code you must use via an analog phone

connected to a POTS port in order to activate or deactivate the CFV function.

In most cases, dialing [*73<forwarded_number>] will activate CFV and dialing [*73] will disable it. Please check with your telecommunications provider first.

In addition, CFV can be controlled by typing the following AT commands:

- ATCF<forwarded-number>: activate call forwarding to the designated number.
- ATCF: deactivate call forwarding.

Reminder Ring (USA NI-1 & DMS-100 switch)

The reminder ring function is used in conjunction with call forwarding. Your omni.net will alert you every time a call has been forwarded by sending a short ring to your telephone, just to let you know that your calls are being forwarded.

Message Waiting (USA NI-1 & DMS-100 switch)

The Message Waiting feature is designed to work in conjunction with the voice mail service provided by your telephone company.

If you have a waiting message, the B1 and B2 LED indicators on the front panel of your omni.net ISDN TA will be blinking. Then you can retrieve your message from your voicemail.

To deactivate the Message Waiting service, use the AT command 'ATMW'.

Call Transfer (USA NI-1 & DMS-100 switch)

To transfer incoming calls (after you answer this call) follow these steps:

Step 1. Press the flash key to put the caller on hold.

Step 2. When you hear the dial tone, simply dial the number you want, to transfer the first call.

Step 3. After you hear the ring signal, hang-up the phone without waiting for the second party to answer.

Chapter 6
Feature Phone Operation
(for omni.net LCD/LCD+M/Plus)

The omni.net LCD/LCD+M/Plus supports ZyXEL's powerful and advanced feature phone operation. By connecting to the analog ports, you can get the benefits of analog phone services, plus additional features over your ISDN line, including:

- InterCom
- Call Waiting
- Call Hold/Retrieve
- Call History

- Quick Dial
- Last Number Redial
- 3-Way Conference

The Flash Key

All feature phone operations start from the Flash Key. Locate the flash key labeled "FLASH" on your telephone keypad.

Commands for feature phone operations are listed in the table below:

Flash Key Commands

Feature Phone operation	Flash Key Commands	Description
Hold/Release/Cancel	Press the Flash key	1. Put caller on hold. 2. Resume with caller presently on hold. Cancel the second dial connection attempt.
Call Waiting	Press the Flash key and 0	1. Answer the incoming call and place the existing call on hold. 2. Switch back and forth between the two calls; either two remote calls or one remote call and one local call. 3. Put a call on hold to place a second call.
InterCom	Press the Flash key and 2	1. Dial to another local phone. 2. Transfer the call to another local phone.
Three-Way Conference	Press the Flash key and 3	Create three-way conference connection in Mixing mode (1 remote party and 2 local parties or 2 remote parties and 1 local party.)
Call Reject	Press the Flash key and 5	1. Reject the second incoming call. 2. Disconnect the current phone connection.
Last Number Redial	Press the Flash key and * *	Allows you to redial the last number called on POTS port Phone 1 and 2.
Quick Dial	Press the Flash key and * *nn* * *phone-number* #	To record a phone number for quick dial. (Note: nn=00-09, stored phone number index)
	Press the Flash key and * *nn* * #	To clear a quick dial number
	Press the Flash key and * *nn* #	To dial a stored phone number quickly

Table 33. Flash Key Commands

InterCom

Your omni.net can work as an InterCom by connecting two phones to Phone 1 and Phone 2 analog ports at the rear panel of your omni.net.

Please follow the instructions below to operate the InterCom:

Step 1. Pick up the telephone handset.

Step 2. Press the Flash key, the push 2 on the phone keypad.

Step 3. The other local phone will start to ring.

Call Waiting

The Call Waiting feature enables you to place a call on hold by pressing the Flash key. If you press the Flash key again, the call waiting function will be disabled and return to the previous call.

Step 4. Press the Flash key to put the current call on hold.

Step 5. To return to the previous call, press the Flash key again.

Receiving a Second Call

During a current call, your omni.net can warn you that a second caller is trying to reach you by emitting a signal tone through your telephone handset. Then, you can decide whether to put the current caller on hold and take or reject the second call.
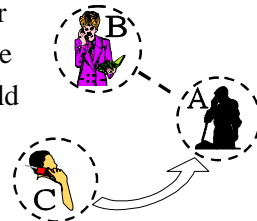
The call waiting option must be enabled to be able to receive a second call. To enable the call waiting option, use the AT commands in the following table.

Call Waiting AT Commands	Description
ATS79.2=0	Disables call waiting for POTS port 1.
ATS79.2=1	Enables call waiting for POTS port 1 (Default).
ATS79.3=0	Disables call waiting for POTS port 2.
ATS79.3=1	Enables call waiting for POTS port 2 (Default).

Table 34. Call Waiting AT Commands

NOTE:

1: If you disable the call waiting function (S79.2=0 or S79.3=0), the second incoming call will be blocked.

2: If you configure the POTS port for Modem/Fax connection (S79.4=1 or S79.5=1), the call waiting feature of the respective POTS port will be always disabled.

There are several ways to deal with a second incoming call.

1. Accept the call

Press the Flash key and 0 to accept the second call and put the current call on hold.

2. Reject the call

Press the Flash key and 5 to reject the second incoming call.

3. Establish a 3-Way Conference

Press the Flash key and 3 to establish the three-way conference.

Call Broker

The call broker function enables you to switch back and forth between the first and second calls by pressing the Flash key and 0.

When you accept a second call, you can use the call broker function to switch back and forth between caller B and C.

Step 1. Switch to caller C

Press the Flash key and 0 to switch to second caller C.

Step 2. Return to caller B

Press the Flash key and 0 again to switch back to caller B.

Repeat steps 1 and 2 above to switch back and forth between callers B and C.

Call Reject

The call reject option allows you to disconnect an active call and return to a call that is on hold without having to hang up your handset.

To disconnect caller C and switch back to caller B

Pressing the Flash key and 5 to will automatically switch back to caller B while disconnecting caller C.

Call Transfer

With this feature gives you the ability to transfer an incoming call to another local phone (connected to the other POTS port of your omni.net).

Step 1. To transfer a call to the other local phone connected to your omni.net, press the Flash key and 2.

Step 2. Hang up your handset and the other local phone will start to ring.
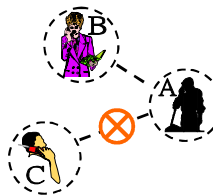
Three-Way Conference Call

The conference call feature can be used in two ways:

1. To connect 2 local parties (2 phones connected to the two POTS ports of you omni.net) to a remote party (1 dial-out number.)

2. To connect one local party (1 phone connected to POTS port 1 or 2 of your omni.net) to 2 two remote parties (2 dial-out numbers.)
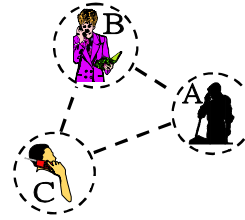
Conference Call (1 local and 2 remote call)

Step 6. Place a call to remote party B.

Step 7. After they answer, put party B on hold by pressing the Flash key and 0.

Step 8. Place a call to the second remote party C.

Step 9. After party C answers, press the Flash key and 3 to establish the 3-way conference call.

Conference Call (2 local and 1 remote call)

Two local parties A and B connected to one remote party C:

Step 10. Place a call to the other local party B by pressing the Flash key and 2.

Step 11. After they answer, place party B on hold by pressing the Flash key and 0.

Step 12. Place a call to the remote party C.

Step 13. After party C answers, press the Flash key and 3 to establish the 3-way conference call.

Last Number Redial

This functions allows you to redial the last number called on POTS port Phone 1 and 2, even after the omni.net has been powered off and on again. The last numbers dialed on Phone 1 and 2 are stored in Non-Volatile RAM (NVRAM) at locations [AT&Z38] and [AT&Z3]9 respectively.

To redial the last number

Press the Flash key, and * *

Quick Dial

With quick dial, you can instantly dial a number stored in the NVRAM memory of your omni.net. Your omni.net can store up to 10 phone numbers (nn=00-09) available for quick dial.

1. To record a phone number for quick dial

Press the Flash key, and * *nn* * *phone-number* #

(Where nn=00-09, stored phone number index)

2. To clear a quick dial number

Press the Flash key and * *nn* * #

3. To dial a stored phone number quickly

Press the Flash key and * *nn* #

The omni.net stores the quick dial numbers in NVRAM at locations [AT&Z0]-[AT&Z9] on Phone 1 and [AT&Z10]-[AT&Z19] on Phone 2.

To display the list of quick dial phone numbers, issue the commands [ATQP1] (Phone 1), and [ATQP2] (Phone 2), or [AT&Z?]

Part IV

Data Function

Chapter 7
Point-to-Point Protocol (PPP)

Introduction to PPP

Point-To-Point Protocol (PPP) is designed for simple links, which transport packets between two peers. These links provide full-duplex simultaneous bi-directional operation, and are assumed to deliver packets in order. PPP is intended to provide a common solution for easy connection for a wide variety of hosts, bridges and routers.

In the process of configuring, maintaining and terminating the point-to-point link, PPP goes through several distinct phases, as specified in the following simplified state diagram:

Point-to-Point Link Pathway
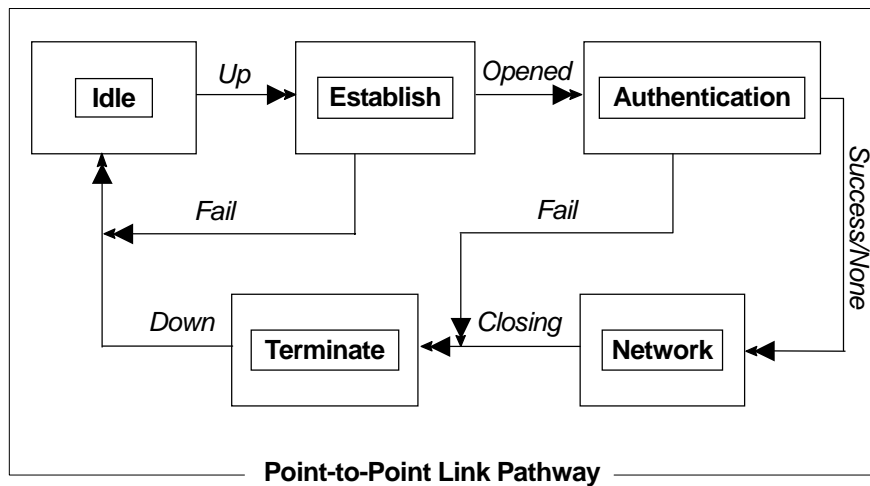
Figure 7. Point-to-Point Link Pathway

Data will be transmitted only when the link is in the open phase. Negotiation details are described in *RFC1661.*

Feature List

Async to Sync Conversion

PPP uses HDLC-like framing as encapsulation, which can be bit-oriented or character-oriented. Most ISDN routers use bit-oriented HDLC framing, also known as synchronous transmission. However, serial transmission in most personal computers is still character-oriented, also known as asynchronous transmission. In order for an ISDN router and PC to communicate, it is necessary to do asynchronous to synchronous conversion. The omni.net can be used as a bridge. Any data from a PC to a ZyXEL Omni TA will be converted from asynchronous to synchronous form and vice versa.

PPP HDLC framing is described in *RFC1662.* PPP over ISDN is described in *RFC1618.*

Related AT Comn and	Description
ATB40	Async to Sync PPP Conversion

Table 35. Related AT Command for Async to Sync Conversion

Authentication Conversion

After a link is established, it is necessary to authenticate the peer for security reasons. There are two popular authentication methods. One is Password Authentication Protocol (PAP) and the other is Challenge Handshake Authentication Protocol (CHAP). PAP is less secure because it transmits the username/password in plain text form. Unlike PAP, CHAP transmits the username/password in coded form. Some ISPs may support CHAP as the only method for authentication.

For those applications that do not support CHAP, the omni.net converts PAP into CHAP. By default, the PAP/CHAP conversion is always activated, so the authentication from the ISDN TA to PC is always PAP. That means you must configure your software to accept plain text as password authentication. Do not worry about password leakage, the omni.net TA will send the password out

in hashed form by CHAP. Sometimes CHAP can not be supported by the ISP. You may set [S87.2=1] to use PAP only. If you do not want to do authentication at all, set [S118.3=1] to disable the conversion.

CHAP is described in *RFC1994* and PAP is described in *RFC1334.* The only hash method supported by CHAP is MD5; MS-CHAP is not supported yet. Presently, authentication conversion works for clients only.

> **NOTE:** Disabling authentication may cause problems in Windows 95.

Authentication AT Commands	Description
ATS118.3 = 0	Enable authentication conversion. Depends on [S87.2] (default).
ATS118.3 = 1	Disable authentication conversion.
ATS87.2 = 0	Accept CHAP/PAP/None (default).
ATS87.2 = 1	Accept PAP/None only.

Table 36. Authentication AT Commands

Compression Control Protocol (CCP)

The ISDN channel can be utilized more effectively when using compression. Compression Control Protocol (CCP) is used by PPP to negotiate compression methods between peers.

CCP starts after the PPP reaches the network phase. Both ends must support the same compression method to start packet compression. ZyXEL omni.net supports STAC/LZS. Right now STAC/LZS is only supported with single history check mode 0 (none), 3 (sequence) and 4 (extended). Mode 1 (LCB) and mode 2 (CRC) are not supported due to patent limitations. CCP negotiation is described in *RFC1962.* STAC/LZS is described in *RFC1974.*

The omni.net will monitor the DTE activity. If software compression has been negotiated, the ISDN TA will automatically disable STAC/LZS compression.

Compression Control AT Commands	Description
AT&K00	Disable CCP negotiation (default).
AT&K44	Enable CCP negotiation.

Table 37. Compression Control AT Commands

Multilink PPP

There are two B channels in basic rate ISDN. This offers the possibility of opening multiple simultaneous channels between systems giving users additional bandwidth on demand. Multilink PPP is a method for bundling both B-channels into one PPP link for higher throughput.

Multilink PPP must be negotiated in the establish-link phase by both peers. If the negotiation is successful, the second link will be dialed after the first link reaches network phase. In some countries the directory number is not the same for both channels. For dialing the second B-channel with a different directory number, both numbers must be obtained before dialing out unless the peer supports BACP/BAP, which will be described later in this chapter. Multilink PPP is described in *RFC1990.*

CCP AT Commands	Description
AT&J3	Enable Multilink PPP.
ATDI<num1>[+<num2>]	Dial Multilink PPP with num1 twice or with num1 and num2 if they differ.
ATS61.3 = 0	Use rotate method to bundle both channels (default).
ATS61.3 = 1	Use split method to bundle both channels.

Table 38. CCP AT Commands

Call Bumping

You can place or answer a voice call from a device that is attached to one of the POTS ports while Multilink PPP is active. The omni.net automatically drops one of the channels and assigns it to voice calls. Once a voice-call ends, the omni.net automatically re-establishes the channel.

When fully disconnecting with the central switch, there is a 10-seconds time delay between on-hook phone and channel re-establishment. During call bumping, the traffic for BOD is still

under calculation. In other words, the add/persist time is calculated from the time when the traffic is above the add-threshold whether or not the phone is on-hook or off-hook. However, it will not dial until the phone has been on-hook for 10 seconds.

Call bumping works for both client (dialing) side and server (answering) side. However, the channel re-establishment is only effective on the client side.

Call Bumping AT Commands	Description
ATCE0	Disable the call bumping function.
ATCE1	Enable the call bumping function (default).

Table 39. Call Bumping AT Commands

Bandwidth On Demand (BOD)

The function of Bandwidth On Demand (BOD) will monitor the traffic on ISDN links while in Multilink PPP mode. If there is light traffic on the link, one of the channels will be dropped automatically. On the other hand, if only one B-channel is used and data traffic is high enough, BOD will establish the second B-channel to increase the bandwidth of the data link.

The wait for the second B-channel carrier is 60 seconds. If the second B channel can not be connected successfully the BOD will try again after 60 seconds. If the second call is connected but negotiation failed, the omni.net will retry three times. If a connection is still not established after the third try, the Multilink PPP will be disabled automatically.

For BOD, there are four parameters to set high/low threshold and persist time. Traffic utilization is measured in the ISDN link. Highly compressible data may not generate enough traffic to start the second B-channel. Both add-persist time and subtract-persist time must be set to activate BOD.

BOD AT Commands	Description
ATJAn	Add traffic threshold for 'n' K bits per second. 'n' = 48 (default).
ATJSn	Subtract traffic threshold for 'n' K bits per second. 'n' = 32 (default)
ATKAmn	Add persist time for 'n' period in 'm' unit, n = 0-127, m = s for seconds and m for minutes.
ATKSmn	Subtract persist time for 'n' period in 'm' unit, n = 0-127, m = s for seconds and m for minutes.

```
Table 40. BOD AT Commands
```

BACP/BAP

Bandwidth Allocation Control Protocol (BACP) and Bandwidth Allocation Protocol (BAP) is used for call request and link drop under Multilink PPP.

BACP is negotiated during the network phase. Without BACP/BAP, the directory numbers of both B-channels must be specified before dialing out. In some cases, it is not possible for the ISP to support more than one chassis that is capable of bundling both channels at the same time. With BACP/BAP, the second B-channel directory number can be obtained while requesting a call.

The second directory number is not necessary any more. The BACP/BAP is supported on the client side only, and the server side of BACP/BAP will be implemented in an upcoming release.

BACP/BAP AT Commands	Description
ATBP0	Disable BACP/BAP negotiation.
ATBP1	Enable BACP/BAP negotiation (default).

Table 41. BACP/BAP AT Commands

NOTE: The status of BACP/BAP negotiation can be saved in profile. It is enabled after power on. The status can be changed only by the power cycle of another [ATBP] command. [AT&F] and [ATZ] do not change the status.

Chapter 8
V.110, V.120, X.75 and Synchronous Mode ISDN Communications

This chapter describes how to set-up and configure your omni.net ISDN TA with the V.110, V.120, and X.75 protocols. The following table summarizes the specifications of those ISDN protocols.

	Synchronous	V.110	V.120	X.75
Layer 1	Transparent	80 Bits Framing	HDLC	HDLC
Layer 2	None	None	LAPD	LAPB
Layer 3	None	None	V.120	Transparent, T.70
• **Error Control**	No	No	Yes	Yes
• **V.42bis**	No	No	Yes	Yes
• **Async or Sync if used with** • **V-Series DTE**	Sync	Async Only	Async Only	Async Only
Bundle	Yes (Note)	No	Yes	Yes
Max. Line Speed	64Kbps 128Kbps (Note)	Async: 38.4 Kbps	64Kbps 128Kbps	64Kbps 128Kbps
AT-Command Configuration	ATB11&M1 (Sync Data) ATB11&M3*I1 (V.25bis Sync HDLC)	ATB10	ATB20	ATB00 Transparent ATB01: T.70 NL

Table 42. Specifications of ISDN protocols

About V.110, V.120 and X.75 ISDN Protocols

ISDN Protocols	Description
V.110	V.110 is most popular in Japan.
V.120	V.120 is most commonly used in the U.S.A.
X.75	X.75 was originally designed for packet-switched signaling systems in public networks to provide data transmission services. However, it is now also used as the link layer for telematic services (as defined in T.90) in ISDN. These services include both ISDN circuit-switched mode (DTE-DTE communication) and ISDN packet-switched mode (DTE-DCE communication).

Table 43. Description of V.110, V.120 and X.75 ISDN Protocols

Answering V.110, V.120, and X.75 Calls

In most cases, there is no need to configure the ISDN mode to the protocol of an incoming call. Your omni.net is able to determine the correct protocol to use by examining the data coming in from the remote site if the device is set to auto-answer or once an answer command is issued.

To allow your ISDN TA to auto-answer the incoming call, you need to set [S0] to a value greater than or equal to 1 (i.e. ATS0 1). If [S0] is not set (S0=0), the DCE will report "RING" to your terminal, and also make an audible ring notification.

Placing V.110, V.120, and X.75 Outgoing Calls

The following tables describe the [ATB] commands used to specify the outgoing protocol.

V.110 Outgoing Protocol

AT Command	Description
Use the following commands to configure V.110 outgoing calls.	
ATB10	User rate follows DTE speed (see note below).
ATB13	User rate = 2400bps
ATB14	User rate = 4800bps
ATB15	User rate = 9600bps
ATB16	User rate = 14400bps
ATB17	User rate = 19200bps
ATB18	User rate = 38400bps
ATB19	User rate = 57600bps (For Japanese version only)

S119 bit 4 Setting	Highest Async V.110 User Rate
The highest Async V.110 user rate depends on bit 4 of [S119]. If the DTE speed is higher than the user setting, the user rate on the table below will be used.	
S119.4=0	19200 bps
S119.4=1	38400 bps for areas other than Japan (default).
S119.4=1	57600 bps for Japanese version only.

Table 44. V.110 Outgoing Protocol

V.120 Outgoing Protocol

Some switches transmit all network signals through the D-channel (out-of-band signaling), allowing both B-channels to be used exclusively for your communication purposes. This allows for throughput of 64Kbps per channel. However, not all switches support out-of-band signaling at this time. For switches that do not support out-of-band signaling, network signals are transmitted through the B-channels. This reduces the bandwidth to 56Kbps.

When you are making a V.120 call, make sure that the communication supports out-of-band signaling. If it does not support out-of-band signaling, you will need to set your omni.net to 56K mode using the [AT&E1] command ([AT&E0] to set it back to 64k mode.) If your ISDN TA is on the receiving end, you can keep the setting at AT&E0, 64k data mode. The omni.net will automatically switch between the two speeds in answer mode.

Type AT Command	Description	omni.net Response
`ATB20<Enter>`	Select V.120 for communication.	OK
`AT&E0<Enter>`	Select 64K data mode.	OK
`AT&E1<Enter>`	Select 56K data mode.	OK

Now you are ready to dial the phone number. If you need to save the setting into non-volatile RAM, issue the following commands:

`AT&W0<Enter>`	Save the settings to profile 0 [Profiles available: 0-3]	OK
`ATZ0<Enter>`	Save stored settings as the power on settings to profile 0. [Profiles available: 0-3]	OK

All the above commands can be simplified by combining all of the commands onto one line as follows:

➢   `AT&B20&E1&WZ0<Enter>`

Finally, use the [ATDIn] command to make the call ('n' is the phone number you wish to dial). Once the connection is made, you should see the following connect message.

`ATDIn`	`CONNECT 115200/V120 56000/LAPD`
	This indicates that the connection is made with:
	◆ DTE speed of 115,200bps.
	◆ V.120 Protocol
	◆ Data Speed of 56,000bps.
	◆ Error Control LAPD.

Table 45. V.120 Outgoing Protocol

X.75 Outgoing Protocol

The X.75 protocol can be chosen using the following AT commands:	
AT Command	**Description**
ATB00	X.75 with transparent layer 3.
ATB01	X.75 with T.70 NL.
The ATB0x commands not only specify the outgoing protocol, but also set the default layer 3 for an incoming X.75 call without layer 3 information. It is important for both ends of an X.75 connection to execute the same pre-assigned layer 3 protocol, as it reduces the chance that the ISDN TA will make the wrong protocol selection.	
For European ISDN (DSS1), the Low-Layer-Compatibility (LLC) information element in the SETUP message can be used to specify the layer 3 protocol. Since this is an option for ISDN switches, some of the switches might not deliver the LLC information element to the remote end.	

Table 46. X.75 Outgoing Protocol

Synchronous Connections (for omni.net LCD/LCD+M)

The ZyXEL omni.net LCD/LCD+M has synchronous mode included for transfering the data synchronously. Use the following commands to choose the data rate for synchronous operation:

AT Command	Data Rate
ATB11	64000bps
ATB19	56000bps

Table 47. AT Command for Synchronous Connections

There are two modes of synchronous operation:

Asynchronous commands, synchronous data (`AT&M1`): The omni.net LCD/LCD+M accepts AT commands in asynchronous mode. Once the call is connected, it enters synchronous mode for data transmission.

Synchronous mode (`AT&M3*I1`): The omni.net LCD/LCD+M accepts synchronous commands from V.25 bis or a PC with an add-on synchronous card, and exchanges data synchronously with a remote TA. (For more information on *Async to Sync conversion*, please refer to *Chater 7*.)

> **NOTE:** The omni.net LCD/LCD+M does not support network
> independent clock compensation. The synchronous timing source
> must be supplied by the omni.net LCD/LCD+M , which is phase
> locked to the network synchronous clock.

When in V.25bis command mode, the omni.net LCD/LCD+M supports the bit-oriented HDLC
(High-Level Link Control) synchronous protocol which most synchronous communication links
use. Use `AT*Ii` to enable V.25bis commands. For synchronous applications the TA is set for use
with one application, in normal situations. Save the desired settings in the power-on profile and the
TA will start up in synchronous mode with V.25bis enabled. A special command set RST is
provided to get the TA back to asynchronous AT command mode from V.25bis mode.

When the TA is used as a DCE device with a router or mainframe system, use the following
command string for best results:

```
AT&S1&M3*I1&W0Z0
```

Making V.120 and X.75 Bundled Calls

Speeds of 128Kbps

BRI ISDN consists of three (2B+D) logical channels. Each B-channel can be used independently for a dial-up connection running at 56Kbps or 64Kbps (Kbps = Kilo (1000) bits per second).

The two B-channels can be used together for a single data connection to provide 112K (with In-Band Signaling) or 128K (when Out-of-Band Signaling is used). This is called a "Bundled Connection".

Identifying your Line Provisioning

For bundled connections, the two B-channels of your ISDN line must be able to handle data circuit switch connections with unrestricted 64K or 56Kbps line speeds. Two separate data calls will be established consecutively.

> **NOTE:** V.110 protocol does not support bundled call..

V.120 Bundled Call

A bundled V.120 connection is initiated at the calling site when [ATB20] (B-channel protocol V.120) has been selected and the channel bundling mode has been enabled by an [AT&J3] command.

The channel bundling command [AT&J3] must be set on both the calling and receiving sides, otherwise a single channel connection will be made.

AT Command	Description
ATB20<Enter>	Set B-channel protocol to V.120.
AT&J3<Enter>	Enable the omni.net ISDN TA to make a bundled call.
AT&WZ<Enter>	If you want to save the setting.

Table 48. V.120 Bundled Call AT Command (1)

While 'ATJ&3' allows to make a bundle call in both call and answer modes, other bundled call settings are

available for more flexibility, as shown below:

AT&J0	Disables B-channel bundling.
AT&J1	Enables B-channel bundling in answer mode only.
AT&J2	Enables B-channel bundling in call mode only.
AT&J3	Enables B-channel bundling in both call and answer modes.

Once this is done, the [ATD] command will generate two consecutive SETUP messages to invoke bundle initiation.

For the Northern Telecom switch, each BRI phone number can only be called once at any given time. So if you dial this number, it will report "busy" to any other incoming calls. In order to use two B-channels for aggregation, we must place two calls with different phone numbers. To do this, separate the two numbers with a "+" sign after the ATD command, as shown below:

➢   `ATDI[phone_number_1]+[phone_number_2]<Enter>`

The answering ISDN TA determines that the call is a bundle request: when AT&J3 is set, and two consecutive SETUP messages are received. The two data calls are established as one message. The phone company's ISDN line splits it off into two messages. That is, the ISDN network treats them as two independent calls. Finally, the receiving side receives one bundled message into its computer's serial port.

The success of a bundle connection initiation is indicated by the connect message reported to the DTE:
➢   `CONNECT 115200/V120M 128K/LAPD`
Or
➢   `CONNECT 115200/V120M 128K/LAPD/V42b` *(with data compression)*

Table 49. V.120 Bundled Call AT Command (2)

X.75 Bundled Call

AT Command	Description
A bundle connection is initiated at the calling site by sending two consecutive SETUP messages to the network. The two SETUP messages are all the same except for the Call Reference values. [AT&Jn] can be used for bundle configuration as follows:	
AT&J0	Disables B-channel bundling.
AT&J1	Enables B-channel bundling in answer mode only.
AT&J2	Enables B-channel bundling in call mode only.
AT&J3	Enables B-channel bundling in both call and answer modes.

If channel bundling is enabled, the [ATDIs] command will generate two consecutive SETUP messages to invoke bundle initiation.

For Northern Telecom ISDN, each BRI destination phone number can only be called once in any time. In order to use two B channels for aggregation, we must place two calls with different phone numbers. The following command can be used for this purpose:

➤   `ATDI[phone_number_1]+[phone_number_2]`

If the called site receives two consecutive SETUP messages with the same Calling Party Number and Bearer Capability then it is deemed as a bundle request. The two data calls are established following normal call control procedures. That is, the network treats them as two independent calls.

The omni.net uses X.75 Multiple Link Protocol or 'cFos' channel bundling protocol to coordinate the two B-channels. The former would need an overhead of two octets for each packet. The success of bundle connection initiation is indicated by the connect message reported to DTE as follows:

➤   `CONNECT 460800 / X.75M 128K / V42b`

If a B-channel is unavailable at either site then the bundle initiation will fall back to single channel connection. In this case the connect message may be as follows:

➤   `CONNECT 460800 / X.75 64000 / V42b`

```
Table 50. X.75 Bundled Call
```

Dialing Pre-stored Phone Numbers

The 40 phone numbers stored in the NVRAM can also be used to place a bundled call with V.120 or X.75, by using the [ATDSn] command:		
ATDSn	*n=0-39*	Dial the (n)th phone number twice for both bundle connections.
ATDSn+	*n=0-38*	Dial the (n)th phone number for the first connection and dial the (n+1)th phone number for the second connection.
ATDSn+Sm	*n=0-39* *m=0-39*	Dial the (n)th phone number for the first connection and the (m)th phone number for the second connection.
	For example, ATDIS0+S1<Enter> will dial the number stored in location '1', and the number stored in location '2' for the bundle connection.	

Table 51. AT Command for Dialing Pre-stored Phone Numbers

Using V.42bis Data Compression

The following AT commands are used to switch the V.42bis data compression on or off for ISDN data calls when using X.75 or V.120 protocols:

V.42bis A ˙ Command	Description
AT&K44	Enable V.42bis on V.120 and X.75 ISDN call.
AT&K00	Disable V.42bis on V.120 and X.75 ISDN call.

Table 52. V.42bis AT Command

Bundle Connection with V.42bis Data Compression

If both sites have set [AT&K44] to enable V.42bis negotiation then XID frames will be exchanged through the main B-channel which corresponds to the call established by the first SETUP message.

Only one data compression channel will be used in bundle connections. That means the compression is done before packet disassembly and the decompression is done after packet assembly.

The compression ratio of V.42bis is commonly recognized as up to 4:1 for text files. If the line speed is 128Kbps, then the DTE speed may reach 512Kbps. This makes the DTE's normal RS-232

8-10

serial port unsuitable for bundle applications. A special I/O card on the computer side is required in this situation.

Error Correction and Data Compression with V.120

With V.120, the default setting is for **LAPD error correction** only. No data compression will be negotiated unless V.42bis is enabled by setting [AT&K44].

With the &K44 setting, the omni.net will try to connect using V.42bis data compression. If the remote device does not support V.42, then LAPD error correction will be used.

When a connection is made using V.42bis compression, the following connect message will be displayed:

➢ `CONNECT 115200/V120 56000/LAPD/V42b.`

It takes extra time for the calling ISDN TA to negotiate V.42bis. If you know in advance that the called site has no V.42bis capability, it is advisable to issue the [AT&K00] command beforehand in order to get a quick connection.

Since the V.42bis algorithm needs an error-free transmission channel between the compression and decompression processes, it can only work with a protocol with error control competence. X.75 and V.120 are such protocols that can be used together with V.42bis data compression. V.110, on the other hand, is just an R-interface layer 1 adaptation protocol without error-control and is thus inadequate for V.42bis.

Data Compression with X.75

For X.75, to negotiate compression parameters with the remote ISDN terminal, we exchange XID frames before the Link Layer is established. The calling site will send an XID frame with V.42bis request to the called site. If the called site understands this XID's meaning, it will reply to an XID frame with a V.42bis request. If it is able to execute V.42bis; it will ignore the XID or reply to the XID frame with a V.42bis reject or empty information field.

The calling site will assume that the remote site is unable to execute V.42bis if it gets no reply for a period of time after sending the request XID. In this situation, normal connection without data compression will be established.

It takes about 2 seconds for the calling ISDN TA to send XID and wait until time out. If you know in advance that the called site has no V.42bis capability, it is advisable to issue the AT&K00 command beforehand in order to get a quick connection.

Although not defined in X.75, XID frame is based on the encoding in ISO Standard 8885 and is used in V.42/V.42bis. In addition to the compression parameters, XID can be used to negotiate the packet parameters for example as window size or packet size.

Selecting V.120 for European ISDN (DSS1)

With European ISDN, V.120 is an option in the Bearer Capability (BC) information element, which is a mandatory information element in the SETUP message. Although we can specify V.120 in the Low-Layer-Compatibility (LLC) information element, some switches just don't deliver the LLC. Other switches do deliver the LLC, but the V.120 selection will be discarded midway.

If the called ISDN TA does not get any B-channel protocol information from the incoming SETUP message and the remote device is a ZyXEL ISDN device, the called ISDN TA will be able to identify the V.120 protocol automatically with the Multi Auto-answer routine. Otherwise, with other ISDN devices, the handshake will fail.

Security Settings

The omni.net LCD/Plus/D provides security functions used to prevent unauthorized connections. Your omni.net ISDN TA features two security types with three levels of checks for added flexibility in the device you are connecting to and the transmission protocols you are using.

Two types of security functions are provided.

- **Type 1 Security** is exclusively used when the remote device is ZyXEL ISDN TA.

- **Type 2 Security** can be used with remote ISDN TAs of any brand (including ZyXEL ISDN TAs).

With a Type 1 connection, the dial-in (remote) ZyXEL ISDN TA will send in its supervisor

password for matching with the local omni.net pre-stored password list.

With a Type 2 connection, the remote terminal will be prompted to enter the password at the initial connection and the local omni.net will match the entered password with the pre-stored password list.

These two types of security are summarized in the following table:

	Type 1 Security	Type 2 Security
Remote (Calling) Site	ZyXEL ISDN device only.	Any brand ISDN TA.
Password Check	Automatic	Interactive
Protocols Supported	X.75, V.120	Any data protocol (V.110, V.120, X.75)
AT Commands	[AT*G1] for Level 1 security [AT*G2] for Level 2 security	[AT*G3] for Level 1 security [AT*G4] for Level 2 security [AT*G5] for Level 3 security

Table 53. Two Types of Security Settings

The three levels of security used in conjunction with the security types are described in the following table.

	Level 1	Level 2	Level 3
Password Check	Yes	Yes	Yes
CPN Check OK and S119.6=0	N/A	Call back	Prompts the remote user to enter call back number for calling back.
CPN Check OK and S119.6=1	N/A	Keep the connection	
CPN nmatched	N/A	Disconnect	
CPN not Available	N/A	Call back using the corresponding pre-stored number	
AT Commands	[AT*G1] for Type 1 security [AT*G3] for Type 2 security	[AT*G2] for Type 1 security [AT*G4] for Type 2 security	[AT*G5] for Type 2 security
Level 1 security Will only perform password checking. With Level 1 security, the local omni.net ISDN TA will maintain the connection if the password is matched, otherwise the line will be disconnected.			*Level 3 security* Once the password is matched the local omni.net ISDN TA will prompt the remote user to enter a call back number.
Level 2 security Provides Calling Party Number checking and Callback. The callback number is pre-stored in the password table. If the password has been matched (in a maximum of 3 tries over a 40 second time period) with its pre-stored password list, the local omni.net ISDN TA will check the Calling Party Number (CPN) against the pre-stored number corresponding to the password. If they are matched, the local TA will choose either to keep the connection or to disconnect and then call back according to the setting of bit 6 of S119: ● **S119.6=0** - Disconnect and then call back. ● **S119.6=1** - Keep the connection. If the CPN does not match with what is stored in the table, the local omni.net ISDN TA will disconnect the call. If CPN is unavailable in the SETUP message, the local omni.net will disconnect the call and then call back using the pre-stored number corresponding to the dial-in password.			

Table 54. three levels of security

Setting and Modifying Passwords

Up to 40 user passwords can be defined using the [AT*Hn] command, where 'n' represents the index to the entry (n=0-39).

The corresponding 40 callback numbers are defined by [AT&Zn=xxx] command, where 'n' represents the index to the entry, and 'xxx' represents the assigned callback phone number. Any character (ASCII 0-127) can be used in the password table. The maximum password length is 8 characters for each entry.

Security functions are only accessible through AT commands in terminal mode.

A supervisory password is required for adding or modifying entries. The default supervisor password is 'ZyXEL' when the omni.net is shipped from the factory. The supervisory password is sent to the remote device if Type 1 security is set at the remote end.

Modifying the Supervisory Password

To modify the supervisor password, use [AT*HS].

The system will prompt for the original password and a new password. Then re-enter the new password for verification. For example:

```
Password:
********            (Enter current supervisory password)
Password:
********            (Enter new supervisory password)
Verify:
********            (Enter the new supervisory password again)
OK
```

Modifying the User Passwords

Use command [AT*Hn] to modify the "n"th user password (n=0-39). The system will ask you to enter the supervisory password first and then the user password you want to modify. Use the command [AT*V] to list the 40 user passwords and the supervisor password on screen for viewing.

Non-password Auto Call Back Function

In addition to the standard modem-like security functions described in the previous section, the omni.net provides another simpler call back function that does not require any password check.

The Calling Party Number (origination address) will be checked against the 5 pre-stored call-back numbers before the B-channel is connected. If the CPN is matched with any one of the numbers, the incoming call will be dropped (without connection, hence without any charge) and the omni.net will automatically call back the CPN using the matched phone number.

The non-password auto callback function can be controlled using the following AT commands:

- **AT*GC0** - disable the auto call back function (default).

- **AT*GC1** - enable the auto call back function.

The pre-stored numbers can be set using the following [AT*HCn] command:

```
AT*HCn

Password:

********        (Enter new supervisory password)

Call back phone number:

********

OK
```

The [AT*VC] command can be used to list all the pre-stored numbers.

```
AT*VC
```

```
Password:
```

******** *(Enter new supervisory password)*

```
OK
```

Part V

Fax/Modem Function

Chapter 9
Internal Fax/Modem Function
(for ZyXEL omni.net LCD+M only)

This chapter is designed to describe the internal fax/modem function dedicated to ZyXEL omni.net LCD+M.

Internal Fax/Modem Basics

The ZyXEL omni.net LCD+M contains a built-in 56K modem that can communicate with other analog modem through an ISDN line. What's more, users can send and receive faxes by applying popular compatible fax packages such as WinFax or Microsoft Fax.

Modem Standards and Speeds

The internal modem supports the following standards and speeds, which are recommended by ITU-T or ITU-TSS (International Telecommunications Union - Telecommunications Standardization Sector).

Standard	Speed (bps)	Notes
V.21	300	
V.22	1200	
V.22 bis	2400 or 1200	
V.32	9600 or 4800	
V.32 bis	14400, 12000, 7200	
V.34	33600 – 2400	
V.90	56000 – 28000	

Table 55. Modem Standards and Speeds

MNP Protocols

MNP (Microcom Network Protocol) is a set of protocols first introduced by Microcom, Inc., and alter used by many modem manufacturers. It consists of many classes. Class 1 to 4 are for error correction, and class 5 is for data compression. MNP Class 1 and 2 are obsolete. Normally Class 4 is used for error correction and it uses Class 3 internally.

MNP Class 5 is data compression protocol with a maximum efficiency of 2 to 1. MNP-5 is used with MNP-4 for error correction.

Xmodem, Ymodem, and Zmodem

These are file transfer protocols. They do error checking and ensure data integrity of the file transferred. Some variations of these protocols also appear, like Xmodem-1k, Ymodem-G, etc.

The "G" types of protocols do not include error checking. They allow very high throughput rates, but can be safely used only when the modems use MNP4 or V.42 error protocols and there is no speed overrun on the computer's serial port.

Whenever possible, we recommend the use of Zmodem for added security and high flexibility. Consult your communications program manual for more information on transfer protocols.

Fax and Facsimile

Fax is the abbreviation for facsimile. There are four major parts in a normal facsimile 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 then it is 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.

Modem as a fax

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. Since the data throughput on a serial RS-232 interface is limited, only compressed fax image data should be carried through this serial interface. Fax image coding and decoding must be done in the computer. Modem/Fax, also called faxmodem, 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.

EIA Class 1 Fax Commands

The EIA Class 1 fax commands are a set of AT fax commands defined by EIA/TIA(Telecommunications Industry Association) for controlling faxmodems from a computer through the serial RS-232 interface. Faxmodems and fax software supporting this standard will work together. Class 1 commands control the details of how the modem does on-line negotiation. The Class 1 command set is also called the TIA-578 standard.

Constriction of Using Internal Fax/Modem and Phone2

The internal fax/modem is using the same circuit of POTS port phone2, that is, when POTS port phone2 is in use, you can not dial out/in a modem call. On the other side, when internal fax/modem is in use, if you pick up phone2, you will hear the noise of modem carrier or handshaking.

Dialing Out for Internal Fax/Modem

Using the "M" command following the "ATD" will tell your omni.net LCD+M to automatically switch calls to the internal fax/modem once dialing is complete.

Type: ATDM17146930762<enter>

Manually Switching Communication Modes

The manual switching functions will only be necessary if your communication software does not allow you to change your dial-up string.

Conventional dialing commands: ATD, ATDT and ATDP, used by most existing communication software, can be mapped onto one of the new dialing commands according to the AT&O setting as follows:

AT Command	Dial string it will map to
AT&O0	ATD, ATDT and ATDP are the same as ATDM
AT&O1	Auto-selection of 64kbps and 3.1 kHz on outgoing calls
AT&O2	ATD, ATDT and ATDP are the same as ATDI
AT&O3	ATD, ATDT and ATDP are the same as ATDA

Table 56. AT Command for Conventional dialing commands

The factory default is **AT&O2**. This means the modem will select ISDN data mode when you do not specify which communication mode to use in your dial command (i.e. ATD or ATDT).

ATDMs

This command directs the modem to go on-line, dial according to the string entered and attempt to establish a connection.

If +FCLASS=0 is selected, the modem will behave as a data modem and will attempt to connect to another data modem. The modem will have up to the period of time specified by register S7 to wait for a connect. If this time expires before the modem can connect, the modem will go on-hook with the NO CARRIER response. This command will be aborted in progress upon receipt of any DTE

character before completion of the handshake.

If +FCLASS=1 is selected, the modem will behave as a facsimile modem and attempt to connect to a facsimile machine. This command will be aborted upon receipt of any DTE character if the modem has not finished dialing. In this case, the modem will go on-hook and return to command mode after displaying the NO CARRIER message.

Dial Modifiers. The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9   DTMF digits 0 to 9.

,   Dial pause: the modem will pause for a time specified by S8 before dialing the digits following ",".

( )   Ignored: may be used to format the dial string.

-        Ignored: may be used to format the dial string.

<space>   Ignored: may be used to format the dial string.

Incoming Calls for internal Fax/modem

Answering a Call Using MSN

AT&ZI6=sAssign the phone number to a POTS port, Phone 2 and internal fax/modem when AT&L1 was set. (For more information, please refer to *Answering a Call Using MSN on chapter 4*)

Allow Internal Fax/Modem to Answer Incoming Analog Calls.

The factory default will not allow the internal fax/modem to answer an incoming call (AT&L0). Command AT&L1 will make an incoming analog call not only to phone2 but also to the internal fax/modem.

When AT&L1 is set, an incoming analog call to phone2 will also report a 'RING' message to the DTE. You can answer an incoming analog call to the internal fax/modem by the command 'ATA'. If the register S1 is not zero, the internal modem will automatically answer an incoming analog call when the Ring counter reaches the register S1 value. However, you can pick up phone2 (or phone1 when Global Call is enabled) to answer this incoming analog call.

LCD Panel When Internal Fax/Modem Operation

When the modem (or fax) calls out, the LCD panel will display the destination number of the modem (or fax) to dial to. When using the internal fax/modem to answer an incoming analog call, the LCD panel will display the calling party number of the modem (or fax) the call came from. After the modem (or fax) call has finished, the LCD panel will record the modem (or fax) call in the dial in (or out) log.

Control the Speaker of Internal Fax/Modem

Use command ATLn (n=0-3) to control speaker volume according to the parameter supplied. [S24b4-5]

AT Co nmand	Description
ATL0	Turn OFF speaker.
ATL0	Low volume.
ATL2	Medium volume.
ATL3	High volume.

Table 57. AT Command for controlling speaker volume

Use command ATMn (n=0-3) to select when the speaker will be on or off. [S21b1-2]

AT Co nmand	Description
ATM0	Speaker is always off.
ATM1	Speaker is on during call establishment, but off when receiving carrier. (Default.)
ATM2	Speaker is always on.
ATM3	Speaker on after the last digit is dialed out and off when carrier is detected.

Table 58. AT Command for selecting speaker

Control Data Compression

Use command AT&Kn (n=0-3) to enable or disable data compression negotiation. The internal fax/modem can only perform data compression on an error-corrected link. [S27b0-1]

AT Co nmand	Description
AT&K0	Disables data compression.
AT&K1	Automatic data compression (Default.)
AT&K2	Enables MNP 5 data compression.
AT&K3	Enables V.42 bis data compression.

Table 59. Control Data Compression AT Command

Fax Operation

The ZyXEL omni.net LCD+M supports the Group 3 sending and receiving facsimile function. You must connect the modem to a computer, usually a PC. The computer is the input/output device for the fax function. The interface between the modem and the computer is the normal RS-232 serial connection. The modem uses the same interface for both data and fax applications. In fax operation, it performs protocol handshaking and image data transfer, and the computer does the job of image data creation, capturing, conversion, compression, decompression, retrieving, and storing. You can send and receive fax by applying popular compatible fax packages such as Winfax or Microsoft Fax.

The fax may achieve a14400 bps transmission speed. The character format is 8 bit data, no parity, and 1 stop bit. Start and stop elements are removed from the transmit data and added to the receive data. Both transmit and receive data are buffered. Flow control using XON/XOFF (DC1/DC3) or RTS/CTS is provided.

Fax Command Sets

Besides the AT commands supported by omni.net LCD, there are additional AT commands for internal fax/modem usage for a control speaker (ATMn and ATLn), data compression (AT&Kn), modem dial out (ATDMs), fax command sets (EIA Class 1 fax commands), etc.

The omni.net LCD+M internal modem supports Class 1 command set for the fax function. The Class 1 protocol uses the modem to transmit the fax data only. The connected computer handles the complete organizational overhead for this protocol. The available Class 1 commands are listed first in this chapter.

Command	Value	Description
+FCLASS=n		Service class selection
+FTS=n	0-255	Stops transmission and pauses, in 10ms units.
+FRS=n	0-255	Waits for silence, in 10ms units.
+FTM=<MOD>		Transmits data with a <MOD> carrier.
+FRM=<MOD>		Receives data with a <MOD> carrier.
+FTH=<MOD>		Transmits HDLC data with a <MOD> carrier.
+FRH=<MOD>		Receives HDLC data with a <MOD> carrier.

Table 60. Fax Command Sets A Command

Internal Fax/Modem AT Command Set Summary

ATDMs: Dials (number and options) that follows for the internal fax/modem

ATI1, ATI9: Displays information about product.

ATLn (n=0-3, default: 1): Speaker volume control, the higher the value, the higher the volume.

[S24b4-5]

ATMn (n=0-3, default: 1): [S21b1-2]
ATM0: Speaker always OFF
ATM1: Speaker ON until carrier is detected.
ATM2: Speaker always ON.
ATM3: Speaker ON after the last digit is dialed

AT&Kn (n=0-3, default: 1) [S27b0-1]
AT&K0 Disables data compression.
AT&K1 Automatic data compression (Default.)
AT&K2 Enables MNP 5 data compression.
AT&K3 Enables V.42 bit data compression.

AT&Ln (n=0-1, default: 0): Modem and POTS ports selection during call answering. [S84b5]
AT&L0: Sets priority to POTS port, Phone1
AT&L1: Sets priority to POTS port, Phone2 and internal modem.

AT&On (n=0-3, default: 2) Sets default call type for commands: ATDs, ATDPs, ATDTs. [S83b4-5]
AT&O0: To make fax/modem calls
AT&O1: Auto-selection of 64kbps and 3.1 kHz on outgoing calls
AT&O2: To make ISDN calls.
AT&O3: To make calls for POTS port, Phone 1

FAX commands: (FAX CLASS 1)
+FCLASS=n Service class.
+FRH=n Receives data with HDLC framing.
+FRM=n Receives data.
+FRS=n Receives silence.
+FTH=n Transmits data with HDLC framing.
+FTM=n Transmits data.
+FTS=n Stops transmission and wait.

(For more information on *AT Command Set Referenc*e, please refer to Appendix A, and for the information on *Additional Result Code Table for Internal Fax/Modem* please refer to Appendix D)

Part VI

Diagnostics

&

Firmware Update

Chapter 10
Diagnostics

The omni.net can perform its own diagnostic tests, providing you with valuable information. This chapter presents diagnostic tables for interpreting test results.

The following table summarizes of the omni.net self-test sequence:

		Front Panel LED Status			
Test Sequence		**LNK**	**B1**	**B2**	**AA**
1	**Memory test**	* ☀	O	O	O
2	**ISDN chip interface test**	O	* ☀	O	O
3	**ISDN chip functional test**	O	O	* ☀	O
4	**HDLC functional test**	O	O	O	* ☀
Note: * The LED lights up while test is in progress and blinks if a test fails.					

Table 61. omni.net self-test sequence

Diagnostic Tests

The omni.net ISDN TA provides several diagnostic capabilities:

- Power-on Self-test

- Local Digital Loopback Test

- Diagnostic Command

- omni.net Reset

Power-on Self-test

At each power-up or after reset command from the panel, the omni.net will test the ROM code checksum, system RAM memory, EEPROM, digital circuits and analog circuit calibrations.

The LNK LED will light up for half a second to indicate the success of the TA's power on self-test. After completing a successful self-test, the LNK LED will become the normal physical layer (layer 1) active indicator.

ISDN Loopback Test (AT&T9)

The [AT&T9] command will invoke an ISDN loopback test connection. The loopback point is in the S/T interface chip (Siemens 2086 chip). This loopback checks almost every part of the omni.net ISDN TA and RS-232 cable, except for the passive front-end of the ISDN S/T interface.

During ISDN loopback test, data from the terminal or computer is sent through the DTE interface to the omni.net's transmitter and is packaged to the proper frame format according to the B-channel protocol selected. Then the test data-packet are loop-backed to the receiver, unpacked, and sent through the DTE interface back to the terminal or computer's screen. The screen should show the data you have sent to the ISDN TA.

Loopback with Self-Test (AT&T10)

The [AT&T10] command will invoke an ISDN loopback connection with self-test. The data is generated by the omni.net and goes through the same path as with the above Loopback Test. The data pattern is printable ASCII characters. You can see the result on the screen. The loop-backed data is compared with the transmitted data. Should an error occur, the LNK LED will start to flash. Sending any character through the DTE interface to the ISDN TA will discontinue the test.

B1/B2 Loopback with Self-Test (AT&T11)

The [AT&T11] string commands testing for the readiness of your ISDN line which uses one B-channel (B1) to place a call and the other B-channel (B2) to receive the call. Follow these instructions to make your test call:

Type: `AT&ZOI=`*[your_isdn_number]*`<Enter>`

omni.net responds: `OK`

Type: `AT&T11<Enter>`

omni.net responds: `OK`

```
               Dial [your_isdn_number]
               Loop from B1 to B2 through the switch established!
               Sending and receiving data.....
               B1/B2 loopback test succeeded.
               Disconnecting.....
               NO CARRIER
```

The Diagnostic Command (ATCG)

The [ATCG] command can be used to test and isolate hardware problems. Some of the tests are interactive, please follow the instructions on your screen. If the omni.net is operating normally, the test results will display as follows:

```
System address & data bus test .......................OK
Layer 1 hardware test ............................... OK
Layer 2 hardware test ............................... OK
Layer 1 activation test.............................. OK
First B channel hardware test ....................... OK
Second B channel hardware test....................... OK


Listen to the Ring and then pick up phone set #1..... !!
Off-hook action is detected, (Hook Interrupt) ....... OK
Listen to the dial tone and then dial 1234567890*# in sequence.    !!
1234567890*#
Dialed digits detected, please hang-up the handset…. !!
On-hook action is detected, (Hook Interrupt)........ OK


Listen to the RING and then pick up phone set #2 ....!!
Off-hook action is detected, (Hook Interrupt) ....... OK
```

10-3

```
Listen to the dial tone and then dial 1234567890*#  in sequence.   !!
1234567890*#
Dialed digits detected, please hang-up the handset ..!!
On-hook action is detected, (Hook Interrupt) ........ OK
```

Resetting Your omni.net

If you have modified the setting and cannot get your ISDN back on-line (the unit is locking up), you need to reset your omni.net. Also, you can follow the reset procedure to help you reset the omni.net back to the factory set default-state.

To reset your omni.net Plus/D, hold the DATA/VOICE button pressed down while turning the unit ON; to reset your omni.net LCD/LCD+M, hold any key in LCD panel,, and keep holding down the switch for 5 seconds after the power switch is turned ON, then release the switch. The omni.net will reset itself back to the factory defined setting, and it will also run a continuous loop-back self-test. Printable characters will show on the terminal screen (if connected). Finally, toggle the power OFF and ON again.

Other than the mechanical reset described above, you can use the terminal program to perform software and hardware reset by issuing the following AT commands:

omni.net Reset AT Commands	Description
ATSWR	Software reset. After ATSWR is issued, the omni.net restarts the system.
ATHWR	Hardware reset. After ATHWR is issued, the omni.net clears the NVRAM, loads factory default S parameters, and restarts the system.
Note: These two reset commands are protected by key S38.2=1. This implies that you must set [S38.2=1] before issuing a ATSWR or ATHWR command.	

Table 62. omni.net Reset AT Commands

Using the Embedded Protocol Analyzer (EPA)

The embedded protocol analyzer (EPA) records and analyzes various protocols on the B-channel,

D-channel and DTE-DCE interface. The EPA is designed for hobbyists as well as users with technical backgrounds. The EPA enables you to examine messages exchanged between your ISDN TA and the Central Exchange office when making an ISDN call. You can review the packets sent or received through the B-channel (for X.75 or V.120) to or from the remote site. AT commands issued from an application software program can also be checked. This will help you understand their causal relationship with other events.

In addition to its tutorial purpose, the EPA is very useful for diagnostics. If you have compatibility problems with your Central Exchange or with another ISDN TA device at a remote site, the EPA will be your first aid resource. According to the EPA analysis, you may decide to fix the problem yourself (for example, modify the configuration and try again) or log the analyzed results as a file (a very comprehensive bug report), and then send it to *ZyXEL Technical Support* department.

Capturing the Protocol Data

The data captured by the EPA can be classified into three categories:

- B-channel user data protocols

- D-channel signaling protocols

- DTE-DCE protocols

The B-channel user data protocols include X.75 and V.120. Only the layer-2 header (addresses and control bytes) and layer-3 header are captured. Since X.75 may be used with various layer-3 protocols (for example, T.70, T.90, and ISO8208), only the first 8 octets of the information field are recorded as the layer-3 header, then displayed in raw data form. ZyXEL Technical Support department will carry out the analysis of the protocol data.

The D-channel signaling protocols include layer-2 and layer-3 call control protocols. Frames and messages exchanged via the D-channel are all recorded for further analysis. These data messages are essential to understanding interactive operations between an ISDN TA and the ISDN network. They contain the compatibility information for the ISDN TA and your Central Exchange.

The DTE-DCE protocols (at the R reference point according to the ISDN nomenclature) include the AT commands/responses as well as the CAPI internal interface. The CAPI internal interface is

used with the ZyXEL CAPI driver. The ZyXEL CAPI driver communicates with the ISDN TA through this internal interface. It is not recommended that users get involved in this internal interface. The AT commands/responses, on the other hand, are in a standard user interface. An analysis of these commands and responses might prove very informative. All messages captured by the EPA are tagged with a time stamp according to a free running timer that starts at the beginning of data capture. The resolution of this timing information is in 10ms intervals.

The following commands determine the kind of protocol data captured by the (Embedded Protocol Analyzer) EPA:

EPA-Capture AT Commands	Description
ATCDn	Configuration of embedded protocol analyzer for D-channel.
CD0	Disable the capture of D-channel protocols.
CD1	Enable the capture of D-channel protocols (default).
ATCBn	Configuration of embedded protocol analyzer for B-channel.
CB0	Disable the capture of B-channel protocols (default).
CB1	Enable the capture of B-channel protocols.

Table 63. EPA-Capture AT Commands (1)

EPA-Capture AT Commands	Description
ATCCn	Configuration of embedded protocol analyzer for DTE-DCE interface protocols.
CC0	Disable the capture of DTE-DCE interface protocols (default).
CC1	Enable the capture of DTE-DCE interface protocols.

Table 64. EPA-Capture AT Commands (2)

The EPA starts to capture data when the command [ATCT] is issued. This capturing process continues until the command [ATC$] is issued. The EPA maintains 8 Kbytes RAM as a ring buffer. In case the buffer is full, the earliest data captured will be overwritten by the latest data.

Analyzing the Captured Data

To view the analyzed result, use the command [ATC$]. For your convenience, the relevant AT

commands are summarized as follows:

EPA-Analyze AT Commands	Description
ATCT	Clears buffer and starts the embedded protocol analyzer. Captures data immediately and starts the timer.
ATC$	Invokes the interpretation function of the embedded protocol analyzer and displays the results on the DTE screen.

Table 65. EPA-Analyze AT Commands

The analyzed results can be viewed as if in a full screen editor. Several number keys are used to control the display. For PC users, it is convenient to use the keys on the numeric keypad (make sure that Num-Lock is on.).

The display control key functions are detailed in the following table:

Control Key	Function	Description
1	End	Display to the end of buffer.
2	Cursor Down	Scroll one line up.
3	Page Down	Display the next page.
7	Home	Display the first page.
8	Cursor Up	Scroll one line down.
9	Page Up	Display the previous page.
Q, q	Quit	Quit embedded protocol analyzer.

Table 66. display control key functions

Chapter 11
Firmware Upgrade

This chapter describes how to upgrade the flash EPROM firmware of your omni.net when a new version is available.

Upgrading with Flash EPROM

Your omni.net ISDN TA employs a flash EEPROM (Electronic Erasable Programmable Read Only Memory) that lets you conveniently update firmware and program the ISDN TA with new features and enhanced functions.

If you use a Windows operating system, run the ZyXEL ISDN Configuration Manager to upgrade new firmware. For other Operating Systems, use a terminal program that supports the X-modem protocol.

Obtain the new firmware from ZyXEL's BBS, WWW, or FTP site. See *Contacting ZyXEL* for more information. The firmware is distributed with the file name (your model) d.vvv, where the extension 'vvv' denotes the version of this firmware. The modifier 'd' in the filename has the following definitions:

- d = E - European ISDN (DSS1), also used in most other countries including Asian countries.

- d = A - American ISDN (AT&T 5ESS, Northern Telecom DMS-100, or National ISDN-1, the active D-channel protocol can be chosen by an AT command).

> **NOTE:** The American firmware version supports both the S/T
> interface and U interface models. During the power-on test, it checks
> the hardware configuration and follows the initialization procedures
> of the specific interface.

Follow these steps to upgrade you omni.net with flash EPROM, by using a communications
program:

Step 1. Make sure your omni.net has the power turned ON.

Step 2. Start any communications program on your computer that supports the Xmodem
protocol, and type:

- ATUPX<Enter>

- omni.net responds: `You have chosen Xmodem (128 octets of`
  `data with checksum) protocol to update your TA. Data`
  `in Flash ROM will be erased !!!`

  `Are you sure (Y/N) ?`

Step 3. Press 'Y'. The following message then appears:

        `Start programming, please upload.`

Step 4. Use the Xmodem protocol to upload the file ONETd.vvv to your ISDN TA. This
step updates the omni.net's flash EPROM with the new firmware. When installation
is complete, the omni.net will restart automatically.

Kernel Mode

In the unlikely event that your omni.net fails to respond to AT commands after upgrading the flash
EPROM, follow the procedure below:

1. Power on the omni.net. The reset will prompt the omni.net to check the integrity of the codes in
the flash EPROM.

2. If proper valid firmware can not be verified, the omni.net will initiate Kernel Mode. Once it is
in Kernel mode, you can issue limited AT commands. From this point, you can start from Step

3 of the flash upgrading procedure outlined above.

Part VII

Appendices

Appendix A
AT Command Set Reference

Operation Modes of the DTE Interface

There are two operation modes for the DTE interface:

■ **Simplex mode** - used for conventional AT Command operation.

■ **Multiplex mode** - used as an internal interface for ZyXEL CAPI drivers.

Simplex mode

In simplex mode, the omni.net is used just like an ordinary ISDN TA. The DTE interface will be either in command state or in data state. At the most, only one data connection session is possible at any time.

A number of different AT Commands can be used to invoke various functions. The simplex mode is designed for AT Command users. The guides and descriptions throughout the rest of this manual, if not otherwise specified, are applicable to this mode. The power-on default of the DTE interface is in simplex mode as well.

Multiplex mode

The multiplex mode is designed for ZyXEL CAPI drivers. It can also be used by third parties to develop various drivers on different platforms for public domain or for commercial purposes.

The commands or data are packaged. Each packet has its own destination address. All the DTE channels can be accessed individually by way of multiplexing.

AT Commands Description

An AT Command is a command in asynchronous data format issued by the computer to the ISDN TA through the asynchronous computer-modem interface. AT Commands control the ISDN TA behavior and actions. To send an AT Command from a computer to the omni.net, you must run a communication software program and the omni.net must be in command state.

Exceptions to the above requirement are [A/, A>, and +++.] These commands are neither preceded by the prefix AT, nor followed by any other character:

■ **A/** - re-executes the last command once.

■ **A>** - re-executes the last command once. Also used to repeat the last call up to 9 times until aborted by pressing down any key on the keyboard or front panel or until a successful connection with a remote ISDN TA has been made.

■ **+++** - is the escape sequence code that is entered in data state to return the ISDN TA to command state. The omni.net will accept AT commands only while it is in command state.

AT Commands Prefix (AT)

All other AT Commands require the command prefix [AT]. The prefix may be typed in either upper 'AT' or lower case 'at'.

> **NOTE:** Do not use a combination of upper and lower cases in the prefix.

The following tables list all of the AT commands supported by the omni.net LCD/Plus/D. An asterisk (*) following a command option or value indicates that it is a default setting when the omni.net is shipped.

Basic 'AT' Command Set

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

Table 67. Description of Basic 'AT' Command Set

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
A		Go on-line in answer mode. (See also S39b2)	
B*nn*		Select ISDN Tele-service	S102
		'B' must be followed by two digits.	
	B0*n*	X.75	
	B00	X.75 Transparent	
	B01	X.75 T.70	
	B04	BTX (Datex-J)	
	B10	V.110 user rate follows DTE speed (async.)	
	B11	V.110 user rate = 64000 bps (sync mode)	S117
	B13	V.110 user rate = 2400 bps.	
	B14	V.110 user rate = 4800 bps.	
	B15	V.110 user rate = 9600 bps.	
	B16	V.110 user rate = 14400 bps.	
	B17	V.110 user rate = 19200 bps.	
	B18	V.110 user rate = 38400 bps (async only).	
	B19	V.110 user rate = 57600 bps (async only).	
	B20	V.120	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
	B40	PPP async-to-sync conversion.	
	B41	SLIP to sync HDLC conversion	
		Multi Auto Dial Out (valid only if S80.6=1)	
	B42	Eurofile Transfer	
	B90	PPP+X.75	S122
	B91	PPP+X.75+T.70+ISO_8208+T.90+BTX	
	B92	X.75+T.70+ISO_8208+T.90+BTX+PPP	
	B93	PPP+V.120	
	B94	V.120+PPP	
	B95	PPP+X.75+V.120	
	B96	PPP+V.120+X.75	
	B97	X.75+V.120+PPP	
BP*n*	n=0-1	Configure PPP BACP/BAP.negotiation	
	BP0	Disable PPP BACP/BAP.	
	BP1 (*)	Enable PPP BACP/BAP.	
CB*n*	n=0-1	Configuration of embedded protocol analyzer (EPA.)	S84b1
	CB0	Disable the capture of B-channel protocols.	
	CB1	Enable the capture of B-channel protocols.	
CC*n*	n=0-1	Configuration of embedded protocol analyzer.	S84b0
	CC0	Disable the capture of DTE/DCE interface protocols.	
	CC1	Enable the capture of DTE/DCE interface protocols.	
CD*n*	n=0-1	Configuration of embedded protocol analyzer.	S84b2
	CD0	Disable the capture of D-channel protocols.	
	CD1	Enable the capture of D-channel protocols.	
CE*n*	n=0-1	Call bumping control for PPP/MP.	S85b0
	CE0	Disable the call bumping function.	
	CE1 (*)	Enable the call bumping function.	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
CF(transfer_no.)		For USA NI-1 & DMS-100 switch, activate the call forwarding variable function from the switch.	
		(*Note:* You should issue AT&ZF4=*n* first, where n=IOC of CFV)	
CF		For USA NI-I & DMS-100 switch, deactivate the call forwarding variable.	
CF*xy*(transfer_no.)		For DSS1, active the call forwarding service.	
CF*xy*		For DSS1, deactivate the call forwarding service	
	x=B	Call forwarding busy(CFB)	
	U	Call forwarding unconditional(CFU)	
	NR	Call forwarding no-reply(or no-response,CFNR)	
	y=S	All services	
	I	ISDN data(unrestricted digital)	
	A	POTS 1, phone1	
	B	POTS 2, phone2	
CF?		Query the status of call forwarding (DSS1 only.)	
CG		Diagnostics	
CH?		Display the accumulated charging unit of the last call.	
CI<prefix>		Prefix number string to be added to the calling-party-number before indicating to the DTE when the type of number denotes national.	
CL*n*	n=0-2048	Maximum size of user data in a packet (number of octets).	
CL?		Inquire the current setting of ATCL*n*	
CN<prefix>		Prefix number string to be added to the Calling-Party-Number before indicating to the DTE when the type of number denotes national.	
CP*n*		Loopback 4 control.	S83b0
	CP0	Disable Loopback 4.	
	CP1	Enable Loopback 4.	
CR*n*	n=0-3 (0 *)	Resumes a previously suspended call, 'n' is the call identifier (DSS1).	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
CS*n*	n=0-3	Suspend a call, 'n' is the call identifier (DSS1).	
	(0 *)		
CT		Clear buffer and start the embedded protocol analyzer. Capture data immediately and start timer.	
C$		Invoke the interpretation function of the embedded protocol analyzer and display the results on DTE.	
D*s*		Dial 's' (numbers and options) that follows (see also S38b0, S35b4). The options for 's' are listed as follows:	
	,	Pause for a time specified in S8. Remaining digits will be dialed as in-band DTMF.	
	Y0 (*)	Unknown type of number	
	Y1	International number	
	Y2	National number	
	Y3	Network specific number	
	Y4	Subscriber number	
	Y6	Abbreviated number	
	Z0 (*)	Type of sub-address - NSAP with AFI=$50,	
		IA5 characters	
	Z2	Type of sub-address - user specified, IA5 characters	
	N0 (*)	Unknown numbering plan	
	N1	ISDN/Telephony numbering plan (CCITT E.164/E.163)	
	N3	Data numbering plan (CCITT X.121)	
	N8	National standard numbering plan	
	N9	Private numbering plan	
	/	Called party sub-address delimiters	
The format of 's' is:		[[Yn][Nn]called_party_number][[W][,]]inband_dtmf_number or [[Yn][Nn]called_party_number][/[Zn]called_party_subaddress/]	
DA*s*		Dial 's' (number and options) that follows for the POTS port, Phone 1.	
DB*s*		Dial 's' (number and options) that follows for the POTS port, Phone 2.	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
DI*s*		Dial 's' (number and options) that follows for ISDN data call.	
DL		Repeat last ATD command.	
DM*s*		Dial 's' (number and options) that follows for the internal fax/modem (LCD+M only)	
DN*n*	n=0-1	Set the Directory Numbers (USA.)	
	DN0=xxx	Set the DN0 value.	
	DN0=	Clear the DN0.	
	DN?	Query present DNs.	
DS*n*	n=0-39	Dial number stored in non-volatile RAM (NVRAM) at location 'n'.	S44b3
		Use '+' to dial two consecutive numbers for bundling or MPPP calls.	
E*n*		Control local echo of keyboard commands.	S23b0
	E0	Echo off	
	E1 (*)	Echo on	
H*n*		On/Off Hook control	
	H0 (*)	Hang up (on-hook) the ISDN Data Call, same as 'ATH'.	
	H1	Go off-hook.	
	H3	Hang up the POTS port, Phone 1.	
	H4	Hang up the POTS port, Phone 2.	
HWR		Hardware reset	S38b2
I*n*		Display inquired information.	
	I0	Display product code, same as 'ATI'.	
		Results:	
		1291 (USA)	
		1292 (DSS1)	
		1293 (1TR6)	
	I1	Display product information and ROM checksum.	
		Results: ZyXEL omni.net (LCD/Plus/D)<switch>: V x.xx	
		where <switch>= USA, DSS1, or 1TR6.	
	I3	Display link status report *(See Description of ATI3 Output)*	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
	I9	Display Microsoft PnP code.	
	I11	Display PPP status.	
JA*n*	n=0-255 (48 *)	Add-threshold for PPP/MP Bandwidth-On-Demand in Kbps unit	S126
JS*n*	n=0-255 (32 *)	Sub-threshold for PPP/MP Bandwidth-On-Demand in Kbps unit	S127
KA*xn*	n=0-63 (0 *)	Add-persist time interval for BOD; BOD disabled if n=0. x= M(in Minute unit) or S(in Second unit)	S85b1-7
KS*xn*	n=0-63 (0 *)	Sub-persist time interval for BOD; BOD disabled if n=0. x= M(in Minute unit) or S(in Second unit)	S125b1-7
Ln	n=0-3	to control speaker volume	S24b4-5
	L0	Low volume.	
	L1	Low volume. (Default.)	
	L2	Medium volume.	
	L3	High volume.	
Mn	n=0-3	select when the speaker will be on or off	S21b1-2
	M0	Speaker is always off.	
	M1	Speaker is on during call establishment, but off when receiving carrier. (Default.)	
	M2	Speaker is always on.	
	M3	Speaker on after the last digit is dialed out and off when carrier is detected.	
MW		For USA NI-1 message waiting service, disable the audible & feature message waiting.	
O		Return to on-line state	
Pn	n=0-6	D-channel protocol selection (USA) for American Version	
	P0 (*)	Northern Telecom proprietary ISDN	
	P1	National ISDN 1 (1 SPID)	
	P2	National ISDN 1 (2 SPID)	
	P3	Reserved	

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All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
	P4	AT&T custom point-to-point	
	P5	AT&T custom point-to-multipoint (1 SPID)	
	P6	AT&T custom point-to-multipoint (2 SPID)	
Q*n*	n=0-2	Result code displayed	S23b7
	Q0 (*)	omni.net returns result code.	
	Q1	omni.net does not return result code.	
	Q2	omni.net returns result code but quiet after answering on a RING. (will not show in AT&Vn)	S40b1
QP*n*	n=1-3		
	QP1	Display the setting of quick dial (speed dial) numbers.	
	QP2	Display the call-out history.	
	QP3	Display the call-in history.	
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'.	
SD?		Display current Date of omni.net LCD.	
SD=yyyy/mm/dd		Set Date of omni.net LCD.	
		(*Note:* yyyy:year, mm:month, dd:day)	
ST?		Display current Time of omni.net LCD.	
ST=hh:mm:ss		Set Time of omni.net LCD.	
		(*Note:* hh:hour, mm:munite, ss:second)	
SPIDr=*nnn…*		User enters Service Profile ID 'nnn' (SPID), (USA only).	
	SPID0	First SPID number.	
	SPID1	Second SPID Number, if any.	
SPID?		Display the SPID setting(s), (USA only).	
SWR		Software reset	S38b2

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
UNIT=xxx		(0.001 →65) save the charging fee per unit to NVRAM.	
UNIT?		View the value of charging fee per unit.	
UPX		Upload firmware to the Flash EPROM.	
V*n*		Verbal/Numeric result codes.	S23b6
	V0	Display result code in numeric form. (See also S35b7 and the result code table of 'ATXn').	
	V1 (*)	Display result code in verbose form.	
X*n*	n=0-8 (5 *)	Result code options, see the Options Table.	S23b3-5
Z*n*	n=0-4	Reset omni.net and set power-on profile.	S15b5-7
	Zn	Reset omni.net and load user profile (n=0-3).	
	Z4	Reset omni.net and load factory settings.	
$		Basic command summary help.	

```
               Table 68. Basic 'AT' Command Set
```

Description of ATI3 Output

The Link Status Report output appears as follows:

```
ZyXEL ISDN TA LINK STATUS REPORT

Connect DTE Speed      :
Error Control Level         :
Protocol Link Speed        :
Octets Received            : 0
Octets Sent                : 0
Cause                      :
Cause Value                : 0
HDLC FCS Error      : 0
HDLC Receive Over-run  : 0
```

```
HDLC Transmit Under-run: 0
```

Refer to the following table for a description of the Output Parameters of the Link Status Report.

Link Status Report (ATI3) Output Parameters	
Output Parameter	**Output Value Description**
Connect DTE Speed	Current on-line DTE speed.
Error Control Level	Error control protocol used for current session.
Protocol Link Speed	Current on-line DCE speed, line speed.
Octets Received	Number of data octets received from remote.
Octets Sent	Number of data octets sent to remote.
Cause	Verbose disconnection reason for the last session.
Cause Value	Numerical disconnection reason for the last session.
HDLC FCS Error	Errors in frame (block) checksum. (If there are many FCS Errors, you may be experiencing problems on the line.)
HDLC Transmit Under-run	For TA's processor power measurement.
HDLC Receive Over-run	For TA's processor power measurement.

```
Table 69. Link Status Report (ATI3) Output Parameters
```

Extended 'AT&' Command Set

AT Com.	Options	Function & Description	Reference
All the Following Commands Require a 'AT' Prefix			
&C*n*		Carrier Detect (CD) options	S21b4
	&C0	CD always ON (See also S42b7).	
	&C1 (*)	CD tracks presence of carrier (See also S38b3).	
&D*n*		Data Terminal Ready (DTR) options. (See also S25)	S21b6-7
	&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*D*n*' and S48b4)	
	&D2 (*)	108.2, Data Terminal Ready, DTR OFF causes the TA to hang up.	
	&D3	Same as '&D2' but DTR OFF causes the omni.net to hang up and reset from profile 0.	
&E*n*		B-channel line speed for ISDN data call.	S118b2
	&E0 (*)	64Kbps	
	&E1	56Kbps (Default for American ISDN)	
&F		Load factory settings to RAM as active configuration.	
&H*n*		DTE port 1 Data-flow control, DTE/DCE.	S27b3-5
	&H0	Flow control disabled.	
	&H3 (*)	Hardware (CTS/RTS) flow control.	
	&H4	Software (XON/XOFF) flow control.	
&J*n*		Bundle selection (See also S100)	S87b5-6
	&J0 (*)	Bundle connection is disabled.	
	&J1	Bundle connection is enabled in answer mode only.	
	&J2	Bundle connection is enabled in call mode only.	
	&J3	Bundle connection is enabled in both directions.	

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
&K*n*			S27b0-1
	&K0	Disables data compression	
	&K1	Automatic data compression (Default.)	
	&K2	Enables MNP 5 data compression	
	&K3	Enables V.42 bis data compression.	
&K*nn*		PPP/V.120/X.75 data compression control.	S83b2
		&K must be followed by two digits.	
	&K00	Disable V.42bis.	
	&K44	Enable V.42bis (PPP/V.120/X.75), STAC (PPP)	
&L*n*		POTS port selection during call answering.	S84b5
	&L0	Set priority to POTS port, Phone 1.	
	&L1	Set priority to POTS port, Phone 2, and internal modem.	
&O*n*		Set default call type for conventional dialing commands.	S83b4-5
	&O0	ATDs, ATDPs, and ATDTs default to make calls for the POTS port, Phone 2, and fax/modem.	
	&O1	Auto-selection of 64kbps and 3.1 kHz on outgoing calls (LCD+M only).	
	&O2	ATDs, ATDPs, and ATDTs default to make ISDN data calls.	
	&O3	ATDs, ATDPs, and ATDTs default to make calls for the POTS port, Phone 1.	
&S*n*		Data Set Ready (DSR) function selection.	S21b3
	&S0 (*)	DSR overridden, DSR always ON.	
	&S1	DSR according to CCITT (ITU-TSS). (See also S41b5, S44b4)	
&T*n*		omni.net testing.	
	&T9	Initiate ISDN Loopback test.	
	&T10	Initiate ISDN Loopback with self-test.	
	&T11	Initiate ISDN Loopback from B1, through switch, to B2.	
&V*n*		View profile settings.	
	&V0	View current active settings.	

*All the Following Commands Require a 'AT' Prefix*			
AT Com.	**Options**	**Function & Description**	**Reference**
	&V1-4	View the (n-1)th user profile settings (n=1-4).	
	&V5	View factory-set default settings.	
	&V6	View POTS port, Phone 1 setting.	
	&V7	View POTS port, Phone 2 setting.	
&W*n*	n=0-3	Write current settings to user profile 'n' in NVRAM.	
		(See also S35b6)	
&Z?		Display all the phone numbers stored in NVRAM.	
&Z*n=s*	n=0-39	Write phone number 's' to NVRAM at location 'n' (n=0-39).	
		Use AT*D*n* or ATS29=*n* to set the default dial pointer.	
&ZI*n=s*	n=0-7	Assign the phone number (including subaddress, if any) for various B-channel protocols. In answer mode, these numbers will be compared with the received called_party_number and called_party_subaddress information. The call will be accepted using the specific protocol if the assigned number of this protocol matches with the called_party_number.	
	s=phone number		
	&ZI0=s	Assign the phone number for X.75.	
	&ZI1=s	Assign the phone number for V.110.	
	&ZI2=s	Assign the phone number for V.120.	
	&ZI3=s	Assign the phone number for PPP, PPP/MP.	
	&ZI4=s	Assign the phone number for ISDN data.	
		(Multi-Auto Answering, auto detect the protocols.)	
	&ZI6=s	Assign the phone number for POTS port, Phone 2 and modem.	
	&ZI7=s	Assign the phone number for POTS port, Phone 1.	
&ZI?		Display the phone number (including subaddress, if any) for various B-channel protocols.	
&ZF*n=s*	n=0-4	For USA NI-1 switch only, assign the relative ISDN Ordering Code, IOC (or dial access code) for each supplementary service.	
	s=0-63		
	&ZF0=s	Assign the IOC for Conference.	
	&ZF1=s	Assign the IOC for Drop.	
	&ZF2=s	Assign the IOC for Transfer.	

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All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
	&ZF3=s	Assign the IOC for Message Waiting.	
	&ZF4=s	Assign the IOC for Call Forwarding.	
&ZF?		Show the setting of 'AT&ZF*n*=s'	
&ZO*x=s*		Write own phone number (including sub-address, if any).	
		The number specified by '&ZO*x*' will be used as the calling party number while dialing.	
		(DSS1 only)	
	x=I	ISDN Data.	
	x=A	POTS port, Phone 1.	
	x=B	POTS port, Phone 2.	
&ZO?		Display the own phone numbers assigned via the 'AT&ZO*x=s*' command (DSS1 only).	
&ZP*x=s*		Write service provider preselect number. (DSS1 only)	
		The number specified by &ZPx will be inserted in the front of the called_party_number while dialing.	
		X = I (ISDN)	
		X = A (POTS port, phone 1)	
		X = B (POTS port, phone 2)	
&ZP?		Display the service provider preselect numbers assigned via the 'AT&ZP*x=s*' command. (DSS1 only)	

Table 70. Extended 'AT&' Command Set

Extended 'AT*' Command Set

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Options**	**Function & Description**	**Reference**
*Cn		Character length, including start, stop and parity bit.	S15b3-4
	*C0 (*)	DTE port 10-bit character length.	
*Dn	n=0-39	Set default dial pointer at telephone directory location 'n'.	S29
	*D0 (*)	(See also S35b4 and S38b0)	
*Gn		Security function selection.	S36b5-7
	*G0 (*)	Disable security function.	
	*G1	Enable type 1 security, with password check (Proprietary).	
	*G2	Enable type 1 security, with password check and call back (Proprietary).	
	*G3	Enable type 2 security, with password check.	
	*G4	Enable type 2 security, with password check and call back.	
	*G5	Enable type 2 security, with password check and call back, remote site enters the call back number.	
*GCn	n=0-1	Call-back function selection.	S119b0
	*GC0 (*)	Disable call-back function.	
	*GC1	Enable call-back function.	
*HCn	n=0-4	Assign call-back phone number, 's' to storage location, 'n'.	
*Hn	n=0-39	Modify user password table at location 'n'.	
*HS		Modify supervisory password (Default:: See *User's Manual*)	
*T		Recall the last CND (Caller ID) information.	
*V		View the password table.	
*VC		View the call-back number table.	
Fax *VC		View the call-back number table.	

Table 71. Extended 'AT*' Command Set

Fax Command

All the Following Commands Require a 'AT' Prefix			
AT Com.	**Value**	**Function & Description**	**Reference**
+FCLASS=n		Service class selection	FAX CLASS 1
	n=0	Sets to modem mode.	
	n=1	Sets to Class 1 mode	
+FTS=n	0-255	Stops transmission and pauses, in 10ms units.	
+FRS=n	0-255	Waits for silence, in 10ms units.	
+FTM=<MOD>		Transmits data with a <MOD> carrier.	
+FRM=<MOD>		Receives data with a <MOD> carrier.	
+FTH=<MOD>		Transmits HDLC data with a <MOD> carrier.	
+FRH=<MOD>		Receives HDLC data with a <MOD> carrier.	

Table 71a. Fax Command

The <MOD> parameter takes on the following values:

Modulation values

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

*w/st means with V. 17 short training

Table 71b. Modulation values

Appendix B
Status Registers & Result Codes

S-registers (Status Registers) contain values that determine and reflect how your omni.net Terminal Adapter (TA) operates and executes commands. You can read the values and change them, using either terminal commands or the TA's panel controls with the same results.

Every user profile corresponds to a separate set of S-register values, but when we mention S-registers, we are referring to the ones that correspond to the active profile. If you want to read or change the values in a profile that is currently inactive, you will first have to recall that profile to make it active.

At the time of this edition of the manual, the omni.net is equipped with 125 S-registers, from S0 to S124. S0 to S11 are standard AT S-registers, and S12 to S124 are mostly bit-map configured. Changes in the bit-map configuration can have the same effect as issuing AT Commands. However, it is recommended to use equivalent AT Commands.

Viewing and Setting S-Registers

There are several AT Commands that are used to view the values stored in the S-registers.

Viewing S-registers

To display the value stored in S-register 'r' use the following AT command:

- ``ATSr?``

To view all of the S-register settings use the '&Vn' AT command:

- `AT&Vn`

The following table summarizes the S-register viewing commands.

S-register Viewing AT Commands		Description
ATS*r*	r=0-124	Display the value stored in S-register 'r'.
AT&V*n*	n=0-7	View all of the S-register settings.
	&V0	View S-register settings for current active profile.
	&V1 to &V4	View settings for user profile number (n-1).
	&V5	View the factory set default settings.
	&V6	View the POTS port 1 setting, Phone 1. (for omni.net LCD/Plus).
	&V7	View the POTS port 2 setting, Phone 2. (for omni.net LCD/Plus).
Note: The S-register values may be displayed in either Decimal or Hexadecimal format when using the preceding commands. Bit 3 of S-register 84 sets which numbering system is used for display.		
ATS84b3=0		Display in decimal format.
ATS84b3=1		Display in Hex format.
For example, to display the value of bit 'm' of S-register 'r', use:		
■ ATS*r*b*m?*		

Table 72. S-register Viewing AT Commands

Setting S-registers

In order to change the value in S-register 'r' to value 'n', use:

- ■ `ATSr=n` (range 0-255)

In order to change the value in a specific bit 'm' of S-register 'r', use:

- ■ `ATSrbm=n` (range 0-1)

In both commands, 'n' is a decimal number in the given range. While the first command modifies all

bits in the S-register simultaneously, the second command lets you change bit 'm' without affecting other bits in this S-register. When using ATSr=n, you need to do a conversion to or from the binary number to find out which bits you manipulate.

For example, if you want to set S38 bit 3 to 1 for a specific application, you may either use the straight-forward command ATS38b3=1 or use the following ATS38=n command, as explained in the following example:

1. Read the value from S38 using ATS38?

> **NOTE:** The values used in the example below differ from the actual values in the S-register and are used for demonstration purposes only.

2. Convert it to binary, using the following weight table:

Bit	Binary value	Decimal value	Hexadecimal value
0	00000001	1	$01
1	00000010	2	$02
2	00000100	4	$04
3	00001000	8	$08
4	00010000	16	$10
5	00100000	32	$20
6	01000000	64	$40
7	10000000	128	$80

3. To set bit 3 to 1 (binary), do a logic OR operation with the value.

Operation	Example-1			Example-2		
	Binary	Dec.	Hex	Binary	Dec.	Hex.
	10001000	136	$88	01000000	64	$40
OR	00001000	8	$08	00001000	8	$08
	10001000	136	$88	01001000	72	$48

4. To set bit 3 to 0 (binary), you must invert the value using a logic NOT operation and then do a logic AND operation.

Operation	Example-1			Example-2		
	Binary	Dec.	Hex	Binary	Dec.	Hex.
NOT	00001000	8	$08	00001000	8	$08
	11110111	247	$F7	11110111	247	$F7
AND	10001000	136	$88	01000000	64	$40
	10000000	128	$80	01000000	64	$40

5. Finally, using the result decimal value 'n', issue an **ATS38=*n*** to set the register S38 to the new desired value.

S-Register Descriptions

In most bit-mapped S-registers, the default bit value is 0 (which is the normal situation), only the non-default situation is described. Some reserved bits are for factory use and the user should not change them.

Values followed by an asterisk (*) are the factory set default settings.

The following sections provide a description for each S-register.

Basic S-Registers 'ATSn=x'

All the Following Commands Require a 'AT' Prefix		
S Com.	**Function & Description**	**·Definition**
S0=	Set the number of rings on which the omni.net will answer. A '0' value disables auto-answer.	+000
S1=	Counts and stores number of rings from an incoming call.	+000
S2=	Define escape code character, default <+> (43 dec.).	+043
S3=	Define ASCII Carriage Return.	+013
S4=	Define ASCII Line Feed.	+010
S5=	Define ASCII Backspace.	+008
S7=	Set duration, in number of seconds, omni.net waits for a connection.	+060
S8=	Set duration, in seconds, for pause (,) option in Dial command and pause between command re-executions for Repeat (>) command.	+002

Table 73. Basic S-Registers 'ATSn=x'

Extended S-Registers "ATSn=x"

S Com.	bit	dec	hex	Function and description	+Def./Ref.
All the Following Commands Require a 'AT' Prefix					
S14=	bit	dec	hex	Bit mapped register	+002
	0	0	0	omni.net auto-handshake mode on originate mode.	
		1	1	omni.net auto-handshake mode on answer mode.	
S15=	bit	dec	hex	Bit mapped register	+130
	0,1	0	0	Even parity	
		2	2 (*)	No parity	
	2	0	0 (*)	1 stop bit	
	4,3	0	0 (*)	10-bit character length	*C0
	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
		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.	
		9	9	Loopback test in progress.	&T9
		10	A	Loopback with self-test in progress.	&T10
		11	B	Loopback from B1, through switch, to B2.	&T11
S18=		dec		Force omni.net to fix DTE baud rate when idle.	+000
		0 (*)		Disable fixed baud function	
		1-14, 32	1-E, 20	Enable baud rate to be fixed when answering.	
				Baud rate value settings same as S20, except for S18=32 at 230400 bps.	

				All the Following Commands Require a 'AT' Prefix		
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
S20=		dec	hex	DTE port speed (bps).	+003
				Auto detected from AT Command.	
		0	0	230400 bps	
		1	1	115200 bps	
		3	3	57600 bps	
		4	4	38400 bps	
		5	5	19200 bps	
		9	9	9600 bps	
		11	B	4800 bps	
		12	C	2400 bps	
		13	D	1200 bps	
		14	E	460800 bps	
S21=	bit	dec	Hex	Bit mapped register	+178
	0-1			For omni.net LCD+M only.	
	3	0	0	DSR always On.	&S0
		8	8	According to CCITT (see also S44b4, S41b5).	&S1
	4	0	0	CD always On.	&C0
		16	10	CD tracks presence of data connection (see also S38b3).	&C1
	5	0	0	CTS follows RTS, in synchronous mode.	&R0
		32	20	Ignore RTS (CTS always On), in synchronous mode	&R1
	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 omni.net to hang up and return to command state.	&D2
		192	C0	108.2, DTR Off causes the omni.net to hang up and reset the omni.net to profile #0 after DTR dropped.	&D3

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
S23=	bit	dec	hex	Bit mapped register	+105
	0	0	0	Command echo disabled.	E0
		1	1	Command echo enabled.	E1
	2	0	0	Insertion is not allowed during a phone call.	
		4	4	Insertion is allowed during a phone call.	
	3-5	0	0	ATX0 (See result code table).	
		8	8	ATX1 dec hex AT	
		16	10	ATX2 40 28 X5	
		24	18	ATX3 48 30 X6	
		32	20	ATX4 56 38 X7	
	6	0	0	Display result code in numeric format (see S35b7).	V0
		64	40	Display result code in verbose format.	V1
	7	0	0	omni.net returns result code.	Q0
		128	80	omni.net does not return result code (see S40b1).	Q1
S24=	bit	dec	hex	Bit mapped register	+34
	2	0	0	Ignore the setting of S21(b1-2) when Phone 1 keypad-dial.	
		1	1	The setting of S21(b1-2) will be affected to Phone 1 keypad-dial.	
	3	0	0	Ignore the setting of S21(b1-2) when Phone 2 keypad-dial.	
		1	1	The setting of S21(b1-2) will be affected to Phone 2 keypad-dial.	
	6	0	0	POTS Port tone volume low.	
		1	1	POTS Port tone volume high.	
S27=	bit	dec	hex	Bit mapped register	+156
	0-2			Modem data compress (for omni.net LCD+M only)	
	3-5	0	0	DTE port Flow Control disabled.	&H0
		24	18	DTE port Hardware (RTS/CTS) flow control.	&H3
		40	28	Reserved.	&H5

S Com.	bit	dec	hex	Function and description	+Def./Ref.
				All the Following Commands Require a 'AT' Prefix	
S29=		0-39	0-39	Set default dial phone number pointer, use 'AT&Z*n*=*s*' to store phone numbers.	+000 *D
S31=		0-255	0-FF	Holds the ASCII decimal value of the XON.	+017
S32=		0-255	0-FF	Holds the ASCII decimal value of the XOFF.	+019
S35=	bit	dec	hex	Bit mapped register	
	6	64	30	Enable password protection to profile saving, when <AT&W*n*> is issued, and the 'n' profile in the memory has this bit on, supervisory password will be requested.	&W*n*
	7	128	60	Enable extended numerical result codes from 50-71 when an error corrected connection is made. Use with 'ATV0' (see result code table).	V0 S23b6
S36=	bit	dec	hex	Bit mapped register	+000
	5-7			Security function control register	
		0 (*)	0	Disable security function.	*G0
		32	20	Enable type 1 security, with password check (Proprietary).	*G1
		64	40	Enable type 1 security, with password check and callback (Proprietary).	*G2
		96	60	Enable type 2 security, with password check.	*G3
		128	80	Enable type 2 security, with password check and callback.	*G4
		160	A0	Enable type 2 security, with password check and callback. Remote site enters the callback number.	*G5
S38=	bit	dec	hex	Bit mapped register	+000
	0	1	1	Repeatedly dialing default number.	*D*n*, S29
	1-2			Reserved.	
	2	4	4	Key for ATSWR, ATHWR.	
	3	8	8	DCD on/off sequence follows UNIX standard, DCD high before connect message is sent, DCD off after last DCE response is sent.	&C1 S21b4
S40=	bit	dec	hex	Bit mapped register	+000
	1	2	2	No result code displayed in answer mode.	Q2

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
S41=	bit	dec	hex	Bit mapped register	+000
	3	8	8	Enable CCITT signals 140 and 141 on EIA-232D interface.	
	5	32	20	DSR follows DCD and pulses (see S44b4).	&S*n*
	6	64	40	Force S0>=2.	S0
S42=	bit	dec	hex	Bit mapped register	+000
	3	8	8	Disable escape sequence code in answer mode.	
	6	64	40	Disable <RINGING> result code.	X*n*
	7	128	80	DCD forced on, but pulse off for 0.5 seconds at carrier loss.	&C0
S44=	bit	dec	hex	Bit mapped register	+000
	3	8	8	'ATDS*n*' initiates auto-dial of the stored numbers consecutively until connection is made.	&Z*n* S38b0
	4	16	10	DSR follows DTR (see also S41b5).	&S*n*
S50=		0-255		Inactivity timer for RS 232 port.	+000
				This timer counts when there is no data flow in or out of the RS 232 serial port; omni.net will hang up , when timed out.	
				Units is 10 seconds.	
				'000' disables timer.	
S56=		0-255	0-FF	Hook flash detected time for POTS port adapter, in units of 10ms.	+050
				Default setting 50 = 0.5 seconds.	
S57=	fax	Class			
S61=	bit	dec	hex		
	3	0 (*)	0	MP data sent in rotate mode.	
		1	1	MP data sent in split mode.	
S64=		dec	hex		+005
		0-255	0-FF	Security callback timer in unit of 1 second.	
S78=	bit	dec	hex	Bit mapped register	
	0	0 (*)	0	Can get busy tone from Phone 1.	

S Com.	bit	dec	hex	Function and description	+Def./Ref.
		1	1	Can NOT get busy tone from Phone 1.	
	1	0	0	Can get busy tone from Phone 2.	
		2	2	Can NOT get busy tone from Phone 2.	
	2	0 (*)	0	Disable the 'RING' message to DTE port for analog call.	
		4	4	Enable the 'RING' message to DTE port for analog call.	
S79=	bit	dec	hex	Bit mapped register.	+000
	0	0 (*)	0	Ignore POTS port 1 global incoming call when port 1 is busy.	
		1	1	Discard POTS port 1 global incoming call when port 1 is busy (Sending RELEASE COMPLETE).	
	0	0 (*)	0	Ignore POTS port 2 global incoming call when port 2 is busy.	
		2	2	Discard POTS port 2 global incoming call when port 2 is busy (Sending RELEASE COMPLETE).	
	2	0	0	POTS 1 call-waiting/multiple-answer disabled.	
		4 (*)	4	POTS 1 call-waiting/multiple-answer enabled.	
	3	0	0	POTS 2 call-waiting/multiple-answer disabled.	
		8 (*)	8	POTS 2 call-waiting/multiple-answer enabled.	
	4	0 (*)	0	POTS port 1 is connected to a telephone.	
		16	10	POTS port 1 is connected to a Fax/Modem.	
	5	0 (*)	0	POTS port 2 is connected to a telephone.	
		32	20	POTS port 2 is connected to a Fax/Modem.	
	7	0 (*)	0	Sending RELEASE COMPLETE will cause 'call reject' for 'ATH1'.	
		128	80	Sending RELEASE COMPLETE will cause 'user busy' for 'ATH1'.	
S80=	bit	dec	hex	Bit-mapped register	+000
	4	0 (*)	0	Not sending Low Layer Compatibility information for POTS port 2.	
		16	10	Sending Low Layer Compatibility information for POTS port 2.	
	6	0 (*)	0	Not sending Low Layer Compatibility information for ISDN data call.	

All the Following Commands Require a 'AT' Prefix				
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
		64	40	Sending Low Layer Compatibility information for ISDN data call.	
	7	0 (*)	0	Not send Low Layer Compatibility information for POTS port 1.	
		128	80	Sending Low Layer Compatibility information for POTS port 1.	
S82=		dec		ISDN B-channel protocol.	B*n*
		60		V.120 64000	
		61		V.120 56000	
		62		X.75 64000 Transparent	
		63		X.75 56000 Transparent	
		64		X.75 64000 T.70	
		65		X.75 56000 T.70	
		70		X.75 64000 BTX	
		71		X.75 56000 BTX	
		72		V.110 64000	
		73		V.110 56000	
		74		PPP async to sync 64K	
		75		PPP async to sync 56K	
		76		SLIP to sync HDLC conversion 64K.	
		77		SLIP to sync HDLC conversion 56K.	
S83=	bit	dec	hex	Bit-mapped register	+000
	2	0	0	ISDN without V.42bis.	&K00
		4	4	ISDN with V.42bis if applicable.	&K44
	4-5	0	0	ATDs, ATDPs, and ATDTs is mapped to ATDBs.	&O0
		32	20(*)	ATDs, ATDPs, and ATDTs is mapped to ATDIs.	&O2
		48	30	ATDs, ATDPs, and ATDTs is mapped to ATDAs.	&O3
	7	0	0 (*)	ISDN data call using normal Bearer Service. (for USA only)	
		128	80	ISDN data call using Voice Bearer Service.	

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
S84=	bit	dec	hex		
	0-2			Embedded Protocol Analyzer control.	CC*n*
	0	1	1	Capture DTE-DCE interface protocol information.	
	1	2	2	Capture B-channel (X.75 or V.120) frames.	
	2	4	4	Capture D-channel protocol information.	
	3	0	0 (*)	Display S register value in decimal format.	
		8	8	Display S register value in hex format.	
	4	0 (*)	0	Indicate Caller ID after the 1st RING message.	
		16	10	Disable Caller ID indication.	
	5	0	0	POTS port 1 has higher priority for answering an analog call.	&L0
		32	20	POTS port 2 has higher priority for answering an analog call.	&L1
S85=	bit	dec	hex		
	0	0	0	Call Bumping function disabled.	CE0
		1	1 (*)	Call Bumping function enabled.	CE1
	1-6		0 (*)	Add-persist time interval.	KA*xn*
	7	0	0 (*)	S85b1-6 is in Second unit.	KAS*n*
		128	80	S85b1-6 is in Minute unit.	KAM*n*
S87=	bit	dec	hex		
	0	0 (*)	0	Enable POTS port 1 to receive global calls.	
		1	1	Disable POTS port 1 to receive global calls.	
	1	0 (*)	0	Enable POTS port 2 to receive global calls.	
		2	2	Disable POTS port 2 to receive global calls.	
	2	0 (*)	0	CHAP/PAP for authentication conversion.	
		4	4	PAP only for authentication conversion.	
	4	0 (*)	0	Result code 46 for X7 is CONNECT 112K/..	
				Result code 47 for X7 is CONNECT 128K/..	
		16	10	Result code 46 for X7 is CONNECT 112000/..	
				Result code 47 for X7 is CONNECT 128000/..	
	5-6	0 (*)	0	Bundle connection is disabled.	&J*n*

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
		32	20	Bundle connection is enabled in answer mode only.	
		64	40	Bundle connection is enabled in call mode only.	
		96	60	Bundle connection is enabled in both directions.	
S89=	bit	dec	hex	Bundle and data encryption control.	
	5	0	0	Disable the metering pulse of POTS port 2.	
		32	32	Enable the metering pulse of POTS port 2.	
	6	0	0	Disable the metering pulse of POTS port 1.	
		64	40	Enable the metering pulse of POTS port 1.	
S100=		dec	hex	B-channel bundling protocol selection	
		0	0 (*)	Multiple Link Protocol (MLP)	
S102=				Outgoing ISDN data type.	B*nn*
				Value has the same definition as S82.	
S104+*n*=		dec	hex	Outgoing Service Indicator (for 1TR6 only),	
				n=0, POTs port, Phone 2	
				n=2, ISDN data	
				n=3, POTS port, Phone 1	
		1	1	Fernsprechen	
		2	2	a/b - Dienste	
		7	7	Daten bertragung 64 Kbps. The defaults are :	
				* s104=1 - for POTS port 2	
				* s105= - reserved	
				* s106=7 - for ISDN data	
				* s107=1 - for POTS port 1	
S108+*n*=		dec	hex	Outgoing Service Additional (for 1TR6 only) Information.	
				n=1, POTS port, Phone 2	
				n=2, ISDN data	
				n=3, POTS port, Phone 1	
	SI=1	1	1 (*)	ISDN-Fernsprechen 3.1 kHz	
		2	2	Fernsprechen analog	

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S Com.	bit	dec	hex	Function and description	+Def./Ref.
All the Following Commands Require a 'AT' Prefix					
	SI=2	2	2	Fax Gruppe 3	
		3	3 (*)	Daten Ober Modem	
		4	4	Btx Ober Modem	
	SI=7	0	0	Daten bertragung 64 Kbps (X.75 SLP)	
	11------			Async. V.110	
	01------			Extensions of async.	
	--0-----		(*)	Number of data bits: 8	
	--1-----			Number of data bits: 7	
	---0----		(*)	Number of stop bits: 1	
	---1----			Number of stop bits: 2	
	----0---		(*)	No parity	
	----1---			Even parity	
	11---000			1200 bps	
	11---011			2400 bps	
	11---100			4800 bps	
	11---101			9600 bps	
	11---110			14400 bps	
	11---111		(*)	19200 bps	
	01---000			38400 bps	
	1010----			Sync. V.110	
	10100000			1200 bps	
	10100011			2400 bps	
	10100100			4800 bps	
	10100101			9600 bps	
	10100110			14400 bps	
	10100111			19200 bps	
	10101000			48000 bps	
	10101001			56000 bps	
	10101010			56000 bps for 56kbit-network	

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
		10101111		In band negotiation	
S108+*n*=		dec	hex	High Layer Compatibility (Non-1TR6)	
				n=1, POTS port, Phone 2	
				n=2, ISDN data	
				n=3, POTS port, Phone 1	
		0 (*)	0	No High-Layer-Compatibility information element will be sent.	
		1	1	Telephone	
		4	4	Facsimile Group 2/3	
		40	28	Teletex service (Rec.F.220)	
		49	31	Teletex service (Rec.F.200)	
		50	32	Information Interworking for Video Services (Rec.F.300 T.110)	
		53	35	Telex service (Rec.F.60)	
		56	38	Message Handling Systems (MHS) (Rec.X.400 series)	
		65	41	OSI application (Rec.X.200 series)	
S114=				I-field data length (MSB byte)	
S115=				I -field data length (LSB byte)	
S117=				V.110 user rate	B1*n*
S118=	bit	dec	hex		
	0	0 (*)	0	Enable dial-in call.	
		1	1	Disable dial-in call (dial out only).	
	2	0 (*)	0	Default B-channel line speed is 64Kbps for ISDN data call.	&E0
		4	4	Default B-channel line speed is 56Kbps for ISDN data call	&E1
	3	0 (*)	0	Disable CHAP option for PPP/MLPPP.	
		8	8	Enable CHAP option for PPP/MLPPP.	
	4	0 (*)	0	Use 3.1KHz Bearer service whenever possible for POTS port, Phone 2.	

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
		16	10	Use Speech Bearer service whenever possible for POTS port, Phone 2.	
	5	0 (*)	0	Use 3.1KHz Bearer service whenever possible for POTS port, Phone 1.	
		32	20	Use Speech Bearer service whenever possible for POTS port, Phone 1.	
	6	0 (*)	0	Enable the a/b adapter to accept global calls.	
		64	40	Forbid the POTS port to accept global calls.	
	7	0 (*)	0	Enable analog incoming calls.	
		128	80	Reject analog incoming calls.	
				(pure ISDN data).	
S119=	bit	dec	hex		
	0	0 (*)	0	Disable callback function (See 'AT*CG).	
		1	1	Enable callback function.	
	1	0 (*)	0	D-channel layer-2(LAPD) 'point-to-multipoint' operation mode.	
				(dynamic TEI, 64 <= n <= 126).	
		2	2	D-channel layer-2(LAPD) 'point-to-point' operation mode.	
				(static TEI=0).	
	2	0 (*)	0	Disable 'overlap receiving' signaling function.	
				(for ISDN supplementary service 'MSN').	
		4	4	Enable 'overlap receiving' signaling.	
				(for ISDN supplementary service DDI).	
	3	0 (*)	0	When no MSN (EAZ) is matched, the inbound call will be ignored.	
				Note: default = 1 for USA, default = 0 for other	
		8	8	When no MSN (EAZ) is matched, use default protocol to accept.	
	4	0	0	V.110 user rate = 19200 bps if DTE speed greater than 19200 bps	
		16 (*)	10	V.110 user rate = 38400 bps if DTE speed greater than 38400 bps	

				All the Following Commands Require a 'AT' Prefix	
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
	5	0 (*)	0	Enable normal MSN function	&ZI*n*
		32	20	Treat the number assigned by '&ZI=*n*...' as sub-address, and match with the called_party_subaddress for inbound call routing.	
S120=	bit	dec	hex		
	0	0 (*)	0	Enable POTS port 1 call out.	
		1	1	Disable POTS port 1 call out.	
	1	0 (*)	0	Enable POTS port 2 call out.	
		2	2	Disable POTS port 2 call out.	
	2	0 (*)	0	Enable multi-answering while omni.net LCD MSN is not assigned.	
		4	4	Handle incoming call according to 'AT&L*n*' setting.	
	3	0 (*)	0	If S120b2=1 is set and the POTS port is busy, this call will be routed to another POTS port.	
		8	8	If S120b2=1 is set and the POTS port is busy, this call will be rejected.	
	4	0 (*)	0	Enable omni.net LCD to accept global calls for a/b adapter and ISDN data.	
		16	10	Forbid omni.net LCD to accept incoming calls with MSN unmatched for a/b adapter and ISDN data.	
				(including global calls, see 'AT&ZI=*s*')	
	5	0 (*)	0	Reserved.	
	6	0 (*)	0	Disable supplementary service 'CLIR' (Calling Line Identification Restriction).	
		64	40	Enable supplementary service 'CLIR' (Calling Line Identification Restriction).	
	7	0	0	Feature (flex)phone functions are enabled when pressing Flash key on the phone set.	
		128	80	Supplementary service functions are enabled when pressing Flash key on phone set.	
				(For USA default=1, for DSS1 default=0)	
S121=	bit	dec	hex		

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All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
	0-1	0-3	0-3	Programmable ring frequency, using following value to choose ring frequency:	
		0 (*)	0	50Hz	
		1	1	40Hz	
		2	2	25Hz	
		3	3	20Hz	
	4	0 (*)	0	D-channel L2 send DISC actively.	
		16	16	D-channel L2 doesn't sent DISC.	
	2-3, 5-7			Reserved.	
S122=	bit	dec	hex		
	0-1	0-3	0-3	Select a preferred B-channel for outgoing data call (USA only).	
		0 (*)	0	Any channel.	
		1	1	Reserved.	
		2	2	B1-channel preferred.	
		3	3	B2-channel preferred.	
	2-4	0-28	0-28	Set sequence for multi auto dial out.	
		0	0	PPP+X.75	
		4	4	PPP+X.75+T.70+ISO_8208+T.90+BTX	
		8	8	X.75+T.70+ISO_8208+T.90+BTX+PPP	
		12	C	PPP+V.120	
		16	10	V.120+PPP	
		20	14	PPP+X.75+V.120	
		24	18	PPP+V.120+X.75	
		28	1C	X.75+V.120+PPP	
	5	0	0	Disable multi auto dial out.	
		32	20	Enable multi auto dial out.	
	6	0	0	Choose MDMF format as FSK caller ID output	
		40	64	Choose SDMF format as FSK caller ID output	

All the Following Commands Require a 'AT' Prefix					
S Com.	**bit**	**dec**	**hex**	**Function and description**	**+Def./Ref.**
	7			Reserved.	
S123=	bit	dec	hex		
	0	0-3	0-3	Select Caller ID signaling method.	
		0 (*)	0	Country default.	
		1	1	DTMF, prior to ring.	
		2	2	ETS FSK, during ring.	
		3	3	ETSI FSK, prior to ring.	
	2-7			Reserved	
S124=		dec	hex	Empty IP packet interval for PPP	+000
		0-25 5	0-FF	in units of 1s.	
S125=	bit	dec	hex		
	1-6		0 (*)	Sub-persist time interval.	KS*xn*
	7	0	0 (*)	S125b1-6 is in Second unit.	KSS*n*
		128	80	S125b1-6 is in Minute unit.	KSM*n*
S126=	bit	dec	hex		
		0-25 5	0-FF	Add-threshold for BOD in Kbps unit	JA*n*,+48
S127=	bit	dec	hex		
		0-25 5	0-FF	Sub-threshold for BOD in Kbps unit	JS*n*,+32

Notes:
- In 'Reference' column, 'AT' is omitted when AT command is referred to.
- +*nnn* is manufacturer default when listed in 'Reference' column.
- **bit** = S-register bit number, 'b', used in 'ATSr.b=*n*', 'ATSr.b=?'
- **dec** = Decimal value, 'x', used in 'ATSn=*x*'
- **hex** = Hex value, used in omni.net LCD model for setting 'STATUS REGISTER' manually from front panel.

Table 74. Extended S-Registers "ATSn=x"

'ATXn' Result Code Option Table

The following table shows the different options available when setting the 'ATX*n*' command. The default value for 'n' is 5 when the omni.net is shipped:

ATV0	ATV1	ATX0	X1	X2	X3	X4	X5	X6	X7	X8
0	OK	V	V	V	V	V	V	V	V	V
1	CONNECT	V	V	V	V	V	@	$	#	&
2	RING	V	V	V	V	V	V	V	V	V
3	NO CARRIER	V	V	V	V	V	V	V	V	V
4	ERROR	V	V	V	V	V	V	V	V	V
5	CONNECT 1200		%	%	%	%	@	$	#	&
6	NO DIAL TONE			V		V	V	V	V	V
7	BUSY				V	V	V	V	V	V
8	NO ANSWER				V	V	V	V	V	V
9	RINGING*				V	V	V	V	V	V
10	CONNECT 2400		%	%	%	%	@	$	#	&
11	CONNECT 4800		%	%	%	%	@	$	#	&
12	CONNECT 9600		%	%	%	%	@	$	#	&
14	CONNECT 19200		%	%	%	%	@	$	#	&
15	CONNECT 7200		%	%	%	%	@	$	#	&
16	CONNECT 12000		%	%	%	%	@	$	#	&
17	CONNECT 14400		%	%	%	%	@	$	#	&
18	CONNECT 16800		%	%	%	%	@	$	#	&
19	CONNECT 38400		%	%	%	%	@			&
20	CONNECT 57600		%	%	%	%	@			&
21	CONNECT 76800		%	%	%	%	@			&
22	CONNECT 115200		%	%	%	%	@			&
23	CONNECT 230400		%	%	%	%	@			&
24	CONNECT 460800		%	%	%	%	@			&
25	CONNECT 921600		%	%	%	%	@			&
26	CONNECT 307200		%	%	%	%	@			&
27	CONNECT 153600		%	%	%	%	@			&

ATV0	ATV1	ATX0	X1	X2	X3	X4	X5	X6	X7	X8
28	CONNECT 102400		%	%	%	%	@			&
29	CONNECT 61440		%	%	%	%	@			&
30	CONNECT 51200		%	%	%	%	@			&
31	CONNECT 62400		%	%	%	%	@			&
32	CONNECT 124800		%	%	%	%	@			&
33	CONNECT 62400		%	%	%	%	@			&
34	CONNECT 41600		%	%	%	%	@			&
35	CONNECT 31200		%	%	%	%	@	$	#	&
36	CONNECT 249600		%	%	%	%	@			&
37	CONNECT 20800		%	%	%	%	@			&
38	CONNECT 33600		%	%	%	%	@	$	#	&
39	CONNECT 28800		%	%	%	%	@	$	#	&
40	CONNECT 26400		%	%	%	%	@	$	#	&
41	CONNECT 24000		%	%	%	%	@	$	#	&
42	CONNECT 21600		%	%	%	%	@	$	#	&
43	CONNECT 48000		%	%	%	%	@	$	#	&
44	CONNECT 56000		%	%	%	%	@	$	#	&
45	CONNECT 64000		%	%	%	%	@	$	#	&
46	CONNECT 112000		%	%	%	%	@	$	#	&
47	CONNECT 128000		%	%	%	%	@	$	#	&
*: Use 'S42b6' to disable 'RINGING' result code.										

Table 75. 'ATXn' Result Code Option Table

Result Code for Internal Fax/Modem (for ZyXEL omni.net LCD+M only)

The internal fax/modem will report the connect speed in the following format:

1. ATX1-ATX4(%): <cr><lf>CONNECT DTE_Speed<cr><lf>

2. ATX5(^): <cr><lf>CONNECT DTE_Speed/Modem DCE_Speed/Data Compression<cr><lf>
   example: CONNECT 115200/Modem 33600/V42b

3. ATX6 : <cr><lf>CONNECT DCE_Speed[/Error_Code]<cr><lf>
   example: CONNECT 33600/ARQ

4. ATX7(&): <cr><lf>CONNECT DCE_Speed/Data Compression<cr><lf>
   example: CONNECT 33600/V42b

Note: Data compression = V42b, MNP5, or NONE

The following table shows the additional result codes that does not include in 'ATXn' result code option table of omni.net series.

ATV0 code	ATV1 String	X0	X1-X4	X5	X6	X7	X8
121	CONNECT 28000		%	^	$	*	&
120	CONNECT 29333		%	^	$	*	&
119	CONNECT 30666		%	^	$	*	&
118	CONNECT 32000		%	^	$	*	&
117	CONNECT 33333		%	^	$	*	&
116	CONNECT 34666		%	^	$	*	&
115	CONNECT 36000		%	^	$	*	&
114	CONNECT 37333		%	^	$	*	&
113	CONNECT 38666		%	^	$	*	&
112	CONNECT 40000		%	^	$	*	&

111	CONNECT 41333	%	^	$	*	&
110	CONNECT 42666	%	^	$	*	&
109	CONNECT 44000	%	^	$	*	&
108	CONNECT 45333	%	^	$	*	&
107	CONNECT 46666	%	^	$	*	&
106	CONNECT 48000	%	^	$	*	&
105	CONNECT 49333	%	^	$	*	&
104	CONNECT 50666	%	^	$	*	&
103	CONNECT 52000	%	^	$	*	&
102	CONNECT 53333	%	^	$	*	&
101	CONNECT 54666	%	^	$	*	&
100	CONNECT 56000	%	^	$	*	&

Table 76. Additional Result Codes

Result Code Chart Symbol Reference

V	Supported
%	Reporting the DTE rate as: <cr><lf>CONNECT DTE_Speed<cr><lf>
@	<cr><lf>CONNECT DTE_Speed/Protocol[DCE_Speed/Error_Control[/Data_Compression]]<cr><lf>
$	<cr><lf>CONNECT DCE_Speed[/Error_Code]<cr><lf> *Example:* CONNECT 64000/ARQ
#	<cr><lf>CONNECT DCE_Speed/Error_Code/Protocol[/Error_Control[/Data_Compression]]<cr><lf>
^	<cr><lf>CONNECT DTE_Speed/Modem DCE_Speed/Data_Compression<cr><lf>
*	<cr><lf>CONNECT DTE_Speed/Data_Compression<cr><lf>
&	<cr><lf>CARRIER DCE_Speed<cr><lf> <cr><lf>PROTOCOL: Protocol<cr><lf> <cr><lf>ERROR CONTROL: Error_Control<cr><lf> [<cr><lf>COMPRESSION: Data_Compression<cr><lf>] <cr><lf>CONNECT DTE_Speed<cr><lf>

Table 77. Result Code Chart Symbol Reference

Result Code Field Descriptions

Field Name	Possible Values
Error_Code	NONE
Error_Control	LAPB, LAPD, ARQ (This field will not show if no error control is negotiated)
Data_Compression	V42b (for ISDN data connection) V42b, MNP5, or NONE (for modem connection)
DTE_Speed	All possible DTE speeds supported.
Protocol	X.75
	X.75M (X.75 with MLP Bundle)
	V110
	V120
	V120M (V.120 with MLP Bundle)
	SLIP
	PPP
	BTX
	LAPM (LCD+M only)
	ALT (LCD+M only)
	ALT-CELLULAR (LCD+M only)
	NONE (LCD+M only)

Table 78. Result Code Field Descriptions

Connect Strings for Error Corrected Connections

Use 'ATS35' bit 7 ('ATS35b7=1') to enable the following numerical result codes when an error control connection is made.

ATV0 Code	ATV1 String	ATV0 Code	ATV1 String
50	CONNECT	61	CONNECT 24000
51	CONNECT 1200	62	CONNECT 26400
52	CONNECT 2400	63	CONNECT 28800
53	CONNECT 4800	64	CONNECT 31200
54	CONNECT 7200	65	CONNECT 33600
55	CONNECT 9600	66	CONNECT 38400
56	CONNECT 12000	67	CONNECT 48000
57	CONNECT 14400	68	CONNECT 56000
58	CONNECT 16800	69	CONNECT 64000
59	CONNECT 19200	70	CONNECT 112000
60	CONNECT 21600	71	CONNECT 128000

Table 79. Connect Strings for Error Corrected Connections

Appendix C
Phone Jack Pinout Assignments

The omni.net LCD/Plus/D features one RJ-45 phone jack, and in addition, the omni.net LCD/Plus has two RJ-11 phone jacks.

■ The RJ-45 jack labeled "ISDN S' is used for ISDN line connection (S/T interface)

■ The RJ-11 jacks labeled "PHONE 1" and "Phone 2" (also known as an analog adapter or POTS port in European countries) provide for an optional connection to analog telephone equipment such as telephone set, answering machine, fax machine or analog modem.

RJ-45 Connector for the S/T Interface Model

RJ-45 Connector Pin Assignment	
Pin	Description
1	Not Connected
2	Not Connected
3	RCV +
4	XMT +
5	XMT -
6	RCV -
7	-48V
8	-48V RTN

Table 80. RJ-45 Connector Pin Assignment

RJ-11 POTS Port Phone 1&2 (for omni.net LCD/LCD+M/Plus)

RJ-11 Connector Pin Assignment	
Pin	Description
1	Not Connected
2	Ring
3	Tip
4	Not Connected

Table 81. RJ-11 Connector Pin Assignment

Appendix D
Serial Port Interface

EIA-232D 25 Pin Serial Port Interface

Pin # Description		ITU-TSS Signal Name	EIA Signal Name	Signal Description	Signal Direction DTE - DCE
1	GND	101	AA	Protective Ground	←→
2	TXD	103	BA	Transmitted Data	→
3	RXD	104	BB	Received Data	←
4	RTS	105	CA	Request To Send	→
5	CTS	106	CB	Clear To Send	←
6	DSR	107	CC	Data Set Ready	←
7	GND	102	AB	Signal Ground	←→
8	DCD	109	CF	Data Carrier Detected	←
15	Clock Source: DCE	114	DB	Transmit Clock Signal	←
17	Sync RX Clock	115	DD	Synchronous Receive Clock.	←
18	LA/LBK	141		Local Analog Loopback Test.	→
20	DTR	108/2 108/1	CD	Data Terminal Ready. Connect DCE to line.	→
21	RD/LBK	140		Remote Digital Loop Test.	→
22	RI	125	CE	Ring Indicator	←

Pin # Description		ITU-TSS Signal Name	EIA Signal Name	Signal Description	Signal Direction DTE - DCE
24	Clock Source: DTE	113	DA	Transmit Clock Signal	→
25	TI	142		Test Indicator.	←

Table 82. EIA-232D 25 Pin Serial Port Interface

Async. Hardware Flow Control Cable Connection

Modem (DCE) DB25	Signal	to PC (DTE) DB 9	to DCE (Null) DB25	To MAC Mini 8	to NeXT 68040 Mini 8
2	TXD	3	3	3	3
3	RXD	2	2	5	5
4	RTS	7	5	1	6
5	CTS	8	4	2	8
6	DSR	6	20		
7	Ground	5	7	4,8	4
8	CD (DCD)	1	20		2
20	DTR	4	6,8	1	1
22	RI	9			

Table 83. Async. Hardware Flow Control Cable Connection

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