Omni TA128

User's Manual

ZyXEL

ACCESSING INTERNET & INTRANET

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 option, 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 remanufactured functionally equivalent product of equal value, and will be solely at the option 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. Note: 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. ZyXEL shall in no event be held liable for indirect or consequential damages of any kind or character to the purchaser.

To obtain the services of this warranty, please 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 option 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 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 which vary from state to state.

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Acknowledgments

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FCC Part 15 Information

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

1) This device may not cause harmful interference.

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

This equipment has been tested and found to comply with the limits for a CLASS B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio/television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Shielded RS-232 cables are required to be use

d to ensure compliance with FCC Part 15, and it is the responsibility of the user to provide and use shielded RS-232 cables.

Omni TA128; FCC ID# i88OMNITA128U

Information for Canadian Users

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

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that the compliance with the above conditions may not prevent degradation of service in some situations.

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

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

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

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop used by the device without overloading. The termination on a loop may consist of any combination of devices, subject only to the requirement that the total of the Load Numbers of all the devices not exceed 100.

This digital apparatus does not exceed the class B limits for radio noise emissions from digital apparatus set out in the radio interference regulations of Industry Canada (formerly Canadian DOC).

Table of Contents

Foreword..... ii

ZyXEL Limited Warranty ii
Copyright © 1996 by ZyXEL ii
Acknowledgments ii
FCC Part 15 Information..... iii
Information for Canadian Users..... iv

Chapter 1 - Introduction 1-1

Key Features of the Omni TA128 1-1
U-Interface Option 1-3
Unpacking Your Omni TA128 1-3
How to Become a Registered Owner 1-3

Chapter 2 - Installing your Omni TA128.....2-1

Connecting Your Omni TA128 to the Power Supply.....2-1
Connecting the Omni TA128 to Your Computer.....2-2
Connecting the Omni TA128 to Your ISDN Line 2-3
S/T Interface Model 2-3
U Interface Model 2-4
Power On and Self Diagnostics 2-4
Omni TA128 Front Panel 2-5
The LED Indicators.....2-5
Front Panel Switch.....2-6
Understanding AT Commands 2-6
Supported AT command types:.....2-7
Quick Tips when issuing AT commands: 2-7

Chapter 3 - Configuring Your ISDN Line and Network .3-1

ZyXEL Configuration Manager Software 3-1
Configuring your Modem using a Terminal program.....3-2
Getting a Terminal Program Ready.....3-2
Configuring Your ISDN Line Switch Type and SPID.....3-3
Switch Type Configuration.....3-3
SPID Setup 3-4
Testing your Connection.....3-5
Making Your First ISDN Data Connection.....3-6

Chapter 4 - ISDN Communication Basics 4-1

Outgoing Calls 4-1
Dialing out using ISDN mode 4-1
Dialing out using ISDN mode optional Speech Bearer Service 4-1
Dialing out for Analog Adapter Port 1 4-2
Manually switching communication modes 4-2
Placing the Call 4-2

Incoming Calls 4-2
Answering a Call using MSN 4-5
Data over Speech Channel 4-5
Best-effort call answering 4-6
Ambiguity resolution switch for voice calls 4-6
Multi auto-answering of data calls 4-6

Chapter 5 - Setup for Windows 95 and NT.....5-1

Installing the Windows 95 Driver (INF file) 5-1

Configuring Windows 95 Dial-Up Networking 5-3

Windows NT RAS Setup 5-7

Chapter 6 - Async to Sync PPP and SLIP 6-1

Internet and Remote Access PPP and SLIP 6-1

Making Async to Sync PPP and SLIP calls 6-1
Keeping a Line Connection During Idle Time 6-2

Answering Async to Sync PPP calls 6-2

Multilink PPP 6-2
Making a call using Multilink PPP 6-3
Endpoint Discriminator 6-3
Dynamic Bandwidth Allocation 6-4

Chapter 7 - V.120 ISDN Communications.....7-1

Placing outgoing calls 7-1

Answering incoming calls 7-2

Speeds of 128Kbps 7-2
Identifying your line provisioning 7-3
Making a Bundled Call with V.120 7-3
Dialing pre-stored phone numbers 7-4
Dynamic Bandwidth Allocation 7-4

Error Correction and Data Compression with V.120 7-5

Selecting V.120 for European ISDN (DSS1) switch 7-6

Selecting V.120 for Germany National ISDN (1TR6) 7-6

Chapter 8 - X.75 ISDN Communications 8-1

Answering an X.75 call....8-1
Making an X.75 Call....8-2
Making a Bundled Call with X.75....8-2
Dynamic Bandwidth Allocation....8-3
Invoking V.42bis Data Compression....8-4
Data Encryption....8-5
Manual DES Key Generation....8-6
Control of Data Encryption....8-8

Chapter 9 - V.110 ISDN Communications....9-1

Answering a V.110 call....9-1
Making V.110 Calls....9-2
Asynchronous V.110 Calls....9-2
Synchronous V.110 calls....9-2

Chapter 10 - Handling Analog Calls....10-1

Placing a Call from the Analog Adapter....10-2
Accepting an Incoming Call....10-2

Chapter 11 - Advanced ISDN Call Control....11-1

Call Control for DSS1 (Digital Subscriber Signaling #1)....11-1
Control of Outgoing Service Indicator....11-1
Control of ISDN Phone Number and Sub-address....11-2
Call Control for 1TR6 (Old German ISDN)....11-3
Control of Outgoing Service Indicator....11-3
Control of ENDGERÄTEAUSWAHLZIFFER (EAZ)....11-4
Answering a Call....11-5
Answering a Call for DSS1....11-5
Answering a Call for 1TR6....11-6
Best-effort Call Answering....11-6
Ambiguity Resolution Switch for Voice Calls....11-6
Multi-Auto-Answering of Data Calls....11-7
Disable inbound call connection....11-8
Point-to-Point Configuration....11-8
Placing a Call....11-10
Placing a call for DSS1....11-10
Placing a call for 1TR6....11-10
User-To-User Information....11-11

Chapter 12 - Security Functions....12-1

Password Security Functions....12-1
Security Types and Levels....12-1
Setting and Modifying Passwords....12-2

Non-password Auto Call Back Function....12-3

Chapter 13 - Upgrading Your Omni TA128....13-1

Upgrading with Flash EPROM....13-1

Chapter 14 - Usage of DTE Port 2....14-1

Selection of the Two DTE Port Mode....14-1

Configuration of the DTE Port 2....14-2

Basic "AT" Command Set....14-2
Extended "AT&" Command Set....14-4
Setting of DTE port 2 Speed....14-5

Call Control of the DTE Port 2....14-5

Chapter 15 - Diagnostics and Protocol Analyzer....15-1

Diagnostics....15-1

Power-on Self-test....15-1
ISDN Loopback test (AT&T9)....15-1
Loopback with Self-test (AT&T10)....15-2
The Diagnostic Command (ATCG)....15-2

Resetting The Omni TA128....15-2

Using The Embedded Protocol Analyzer....15-3

Setting up the Embedded EPA....15-3
Capturing the Protocol Data....15-3
Analyzing the Captured Data....15-4

Chapter 16 - AT Command Set Reference....16-1

Operation Modes of the DTE Interface....16-1

Simplex mode....16-1
Multiplex mode....16-1

AT Command Descriptions....16-1

Basic "AT" Command Set....16-2
Extended "AT&" Command Set....16-7
Extended "AT" Command Set....16-10*

Chapter 17 - Status Registers and Result Codes....17-1

Viewing and Setting S-Registers....17-1

S-Register Descriptions....17-3

Basic S-Registers "ATSn=x"....17-3
Extended S-Registers "ATSn=x"....17-3
"ATXn" Result Code Option Table....17-11
Result Code Field Descriptions....17-13
Connect Strings for Error Corrected Connections....17-14

Chapter 18 - ISDN General Reference....18-1

Terminal Adapter....18-1
Basic Rate Interface (BRI)....18-1
D channel Protocol....18-1
Rate Adaptation & B channel Protocol....18-2
Out-of-band signaling....18-2
ISDN Basic Rate Interface Points....18-3

Chapter 19 - Ordering Your ISDN Line....19-1

ISDN Service Ordering Information....19-1
ZyXEL ISDN Order Form - Switch: AT&T 5ESS....19-2
ZyXEL ISDN Order Form - Switch: DMS-100....19-3
ZyXEL ISDN Order Form - Switch: EWSD....19-4
ISDN Service Ordering Checklist....19-5
What are SPIDs?....19-5

Chapter 20 - Contacting ZyXEL....20-1

ZyXEL Phone Numbers....20-1
Online Access....20-2
Internet....20-2
CompuServe....20-2

Appendix A - Phone Jack Pinout Assignments....A-1

RJ-45 Connector for the S/T Interface Model....A-1
RJ-45 Connector for the U Interface Model....A-1
RJ-11 Analog Adapter (Phone 1&2)....A-1

Appendix B - Serial Port Interface....B-1

EIA-232D 25 Pin Serial Port Interface....B-1
9 Pin Serial Port Interface....B-1
Async. Hardware Flow Control Cable Connection....B-2

Appendix C - INDEX....C-1

Chapter 1 - Introduction

The ZyXEL's Omni TA128 ISDN Terminal Adapter (TA) sets a new price/performance standard for the explosively growing Internet and telecommuting applications.

When used with off-the-shelf Internet or remote access client software, the Omni TA128 enables mobile or home users to connect to the Internet or branch offices over ISDN lines Hassle Free! The same device also allows a user to connect to the analog world via a modem, fax machine, or telephone connected directly to the Omni TA128.

With ZyXEL's Common Application Programming Interface for ISDN published by Telekom Roland in Germany, a user may run most commercially available ISDN applications with the Omni TA128.

To take advantage of constant new developments, the Omni TA128 employs flash EPROMs, which allow for convenient uploading of newly available firmware which preserves your hardware investment.

The Omni TA128 supports both D and B Channels protocols. For the D Channel, it supports DSS1, 1TR6, DMS-100, AT&T Custom, and NI-1. For the B Channels, X.75 SLP, V.120, V.110, PPP Async-to-sync Conversion and Bundle (128Kbps).

ZyXEL's expertise in data compression has been brought to the Omni TA128. With its V.42bis compression on the B Channels using either X.75 or V.120, the Omni TA128 can effectively communicate at speeds up to 512Kbps over ISDN lines.

The Omni TA128 also has two analog ports to connect analog devices such as fax machines, modems, and telephones. Two different analog devices can communicate over the two B channels to two different locations simultaneously, so you can send a fax and make a voice call at the same time! The analog ports also recognize standard DTMF tones as well as pulse dialing.

Key Features of the Omni TA128

Speed and Compatibility

- Plug and Play support for Win95 environment
- Full compatibility with both ISDN and remote PSTN via ISDN
- Multiple signaling protocol compatibility with the following network switches: DSS1, 1TR6, NI-1, AT&T 5ESS, and Northern Telecom DMS 100
- Supports X.75, V.110, V.120, and PPP Async-to-Sync Conversion B Channel protocols
- B Channel speed 56Kbps and 64Kbps
- 112Kbps/128Kbps channel bundling (for DTE #1 only): MLP, CCB, and Multilink PPP(RFC1717)
- V.42bis data compression using the X.75, V.120, and Bundle protocols

- Two application program interfaces:
  - ZyXEL ISDN AT Commands
  - CAPI 1.1a (CAPI 2.0 will be available by firmware upgrade.)

Intelligent Features

- Automatic ISDN/analog call detection
- Two analog telephone jacks (analog adapters) with metering pulse function
- Embedded protocol analyzer with color (ANSI) display
- Built-in internal speaker with volume control
- Push-button switch for quick dial and tear down
- Call-back security with password protection
- Flash EPROM memory for easy firmware upgrades

Technical Specifications

- Status Display: 13 LED indicators
- Flow Control: Software XON/XOFF or hardware CTS/RTS
- Configuration Setting: Software programmable with nonvolatile memory for profile storage
- Diagnostics: Self test and loopback
- Two independent DTE ports:

  DTE Port #1:

  - Asynchronous: Auto Baud Rate up to 460.8Kbps
  - Synchronous: Configurable Rate up to 128Kbps

  DTE Port #2**:**

  - Asynchronous: Data Rate up to 230.4Kbps
  - Synchronous mode

  Note*: At the time of its initial release on the market, the Omni TA128's Synchronous DTE mode is not available. This feature will be firmware upgradeable at a later time (date to be confirmed).*

Physical Charachteristics

- Line Interface: RJ-45 for S/T or U interface, RJ-11 for built-in terminal adapter
- DTE Interface: DB-25 connector for DTE#1, DB-9 connector for DTE#2
- Weight (g): 369, Dimensions (cm): L-13.1 x W-17.9 x H-3.8

U-Interface Option

For the North American ISDN, ZyXEL provides an optional 2B1Q U-interface which allows direct connection to the network without the use of an external NT-1 device.

Unpacking Your Omni TA128

Your Omni TA128 modem should come with the equipment listed below. If any item is missing or damaged, please contact your Dealer or ZyXEL Customer Service Department immediately.

1) one (1) Omni TA128 ISDN Terminal Adapter
2) one (1) power adapter
3) two (2) RJ11 telephone cables
4) one (1) RJ45 ISDN telephone cable
5) one (1) shielded RS-232 25-pin to 25-pin cable (6 feet)
6) one (1) short shielded cable for RS-232 9-pin to 25-pin conversion
7) one (1) 3.5" driver and utility disk
8) what software to be included
9) one (1) warranty/registration card
10) one (1) Omni TA128 User's Manual
11) one (1) Quick Reference Guide

How to 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. Please also save your dated invoice as proof of purchase.

Chapter 2 - Installing your Omni TA128

Connecting Your Omni TA128 to the Power Supply

You will find the following switch and connectors on the back panel of Omni TA128:

ON/OFF Power switch; turns the TA ON or OFF

POWER Input terminal for power adapter

To DTE 1 Serial port DB25 female connector for connection to the serial port of a DTE (computer/terminal). This is the DTE Port #1.

To DTE 2 Serial port DB9 female connector for connection to the serial port of a DTE (computer/terminal). This is the DTE Port #2. This port is currently not in use.

ISDN ISDN RJ45 terminal jack; connects to a S/T interface or a U interface (depending on the Omni TA128 model purchased).

PHONE 1 RJ11 terminal jack for analog adapter 1; for connecting to analog equipment (phone, fax, answering machine, etc.)

PHONE 2 RJ11 terminal jack for analog adapter 2; for connecting to analog equipment.

The signal-pin assignment of the RJ45 and RJ11 phone jacks are listed in Appendix A.

To Connect your Omni TA128 to the power supply, follow these instructions:

1) Turn off your computer.
2) Make sure the power switch on the Omni TA128 is in the OFF (down) position.
3) Connect the round end of the power adapter to the POWER JACK on the modem's back panel (see Figure 2-1).
4) Plug the power supply unit to an AC wall jack then turn on the power switch on the Omni TA128.
5) Observe the LED light status on the front panel of your Omni TA128 and make sure PWR LED is on.

Note: *Use only the power adapter supplied with your modem. Never use a power adapter designed for a different product.*

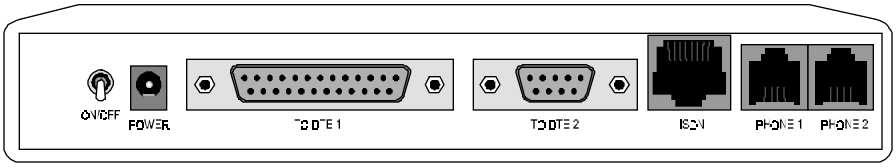


Figure 2-1

Connecting the Omni TA128 to Your Computer

Your Omni TA128 comes with two **serial ports** (RS232C port), one with 25 pin connector and one with 9 pin connector. *When you first install the Omni TA128 The main serial port (the one with 25 pin connector) should be used*

Your Omni TA128 comes with a 25 pin, male to female cable, which is to be used to connect the main serial port of Omni TA128 to your computer serial port. Please see diagrams below:

Connecting the Omni TA128 to your Computer Serial Port

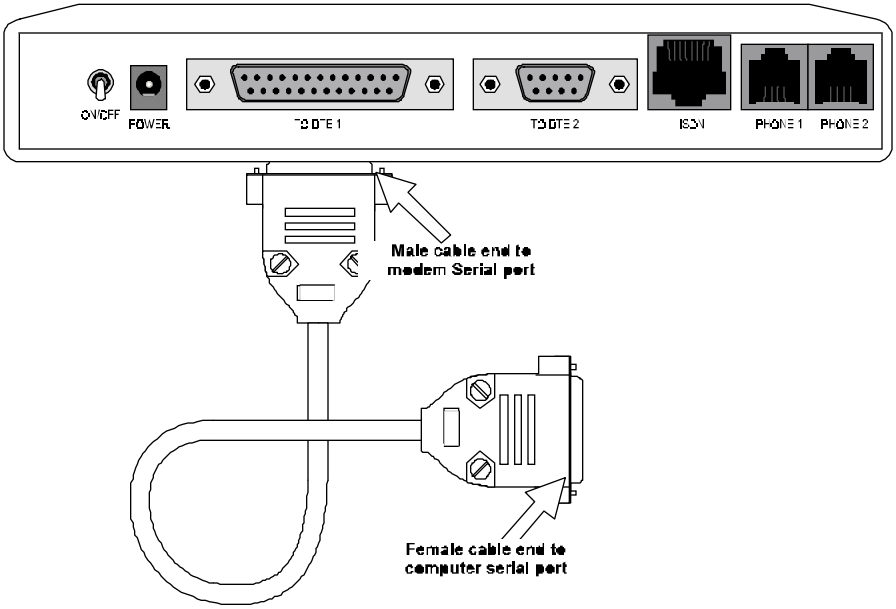


Figure 2-2

1) Find the 25 pin serial port of your Omni TA128.
2) Connect the male end of the 25 pin cable to the serial port of the Omni TA128.
3) Connect the other end of the cable (female end) to your computer's serial port. In case your computer only supplies a 9 pin serial connector, you will need to use a 25 pin to 9 pin converter (9 pin female to 25 pin male). If you have another type of serial port connector, such as on the Macintosh, you will need a special cable for the connection.
4) Once the connection is made, you can turn the computer back on.

Connecting the Omni TA128 to Your ISDN Line

The Omni TA128 comes with a choice of two types of ISDN line interfaces:

- Omni TA128 comes with an S/T interface. This can only connect to your NT-1 (Network Termination) device.
- Omni TA128U comes with a U interface. This allows you to connect directly to your ISDN wall jack.

S/T Interface Model

If you have purchased the Omni TA128 or Omni TA128S/T model, you will need an NT-1 device to connect to the network.

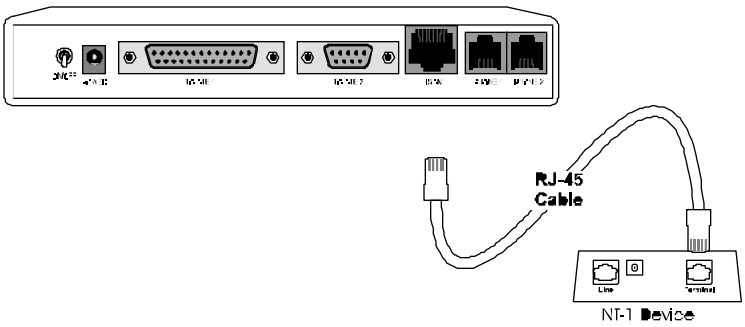


Figure 2-3

Although there are a lot of NT-1s on the market, most of them have two sets of RJ-11 or RJ-45 jacks:

- One set will be marked “Line,” “ISDN,” “Wall,” or “U.” It should be a single RJ-11 or RJ-45 jack.
- The other set will be marked “Terminal” or “S/T.” It can be either a single or multiple RJ-45 jack(s).

Before making the connection, make sure that the termination is set up properly. The termination set-up depends on the number of devices connected to the NT-1 and how the devices are connected. It also depends on the distance from the device(s) to the NT-1. Please refer to the NT-1 manual for more information.

When the telephone company installs your ISDN line, you can specify the type of jack you want installed. You should order the jack that is recommended by the NT-1 device. In most cases, RJ-11 jacks will be installed unless you specified otherwise (In Canada, RJ-45 jack will be installed). The NT-1 device should come with the proper cable for connection from the wall jack and the NT-1’s line jack.

No matter what kind of wall jack you have installed, only the center two pins are connected.

The cable connecting the NT-1 device to the Omni TA128 is provided for you. It is an RJ-45 to RJ-45 cable with four conductors running through it.

Once everything is set up, connect the Omni TA128 to your ISDN line:

1) Use the phone cable (RJ-45) that is included, connect the Omni TA128 "ISDN S" jack to your NT-1 "Terminal" or "S/T" jack.

2) Using the proper cable, connect your NT-1 "line" or "U" jack to the wall jack installed by your phone company.

3) Make sure all the connectors are properly inserted.

Note: If you are using the ISDN line for all your communications, we recommend that you use a UPS (Uninterruptable Power Supply) to provide backup power for the NT-1 and the Omni TA128. Otherwise, these units as well as any devices attached to the POTS port will not function in the event of a power loss at your location.

U Interface Model

If you have purchased the Omni TA128U, you can connect the U-Interface directly to the wall jack.

In most cases, the ISDN jack installed by the phone company is a RJ-11 jack (except in Canada, where RJ-45 jack will be installed), and the U-Interface jack on the back of the Omni TA128U is a RJ-45 jack. A RJ-45 to RJ-45 (or RJ-11 to RJ-45, depends on your regional distributor's request) phone cable is included with your Omni TA128U.

To connect the Omni TA128 to your ISDN line:

1) Connect the RJ-45 connector to the "ISDN U" jack on the back of the Omni TA128.

2) Connect the other end of the RJ-45 cable (or RJ-11) to your wall jack.

Power On and Self Diagnostics

Once you have completed all of the installation steps above, flip the Omni TA128's On/Off switch to the ON (up) position.

The unit should cycle through a self test sequence, where you should see a series of LED lights blinking. After this cycle is complete, the PWR light should stay on.

If the test routine fails, the LNK LED flashes. Please refer to Chapter 15 "**Diagnostics and Protocol Analyzer**" for more information on the self-test and its error codes.

If you have a communication program loaded and active (connected to the same serial port that the Omni TA128 is connected to), you should see the DTR on DTE1 lights go ON after the self test.

***Note**: The Omni TA128 takes longer to initialize than a regular modem because it requires that communication first be established with your local switch when it is powered on.*

Omni TA128 Front Panel

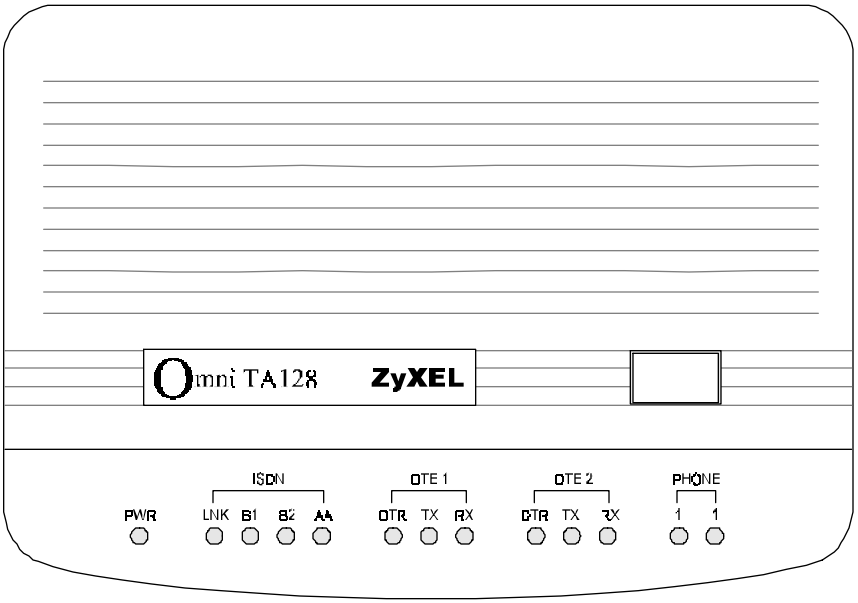


Figure 2-4

The LED Indicators

PWR **P**o**w**e**r** on indicator; lights up when the Omni TA128's power is turned ON.

LNK Physical layer (layer 1) active indicator; lights up when Layer 1 of the S0 interface is active; flashes when the data link layer of D channel is in multiple frame mode.

B1 **B1** channel connection indicator; lights up when B1 channel is established; flashes when there are re-transmissions of packets.

B2 **B2** channel connection indicator; lights up when B2 channel is established; flashes when there are re-transmissions of packets.

AA **A**uto-**a**nswer indicator; lights up when the Omni TA128 is in Auto Answer mode; flashes when it rings.

DTE 1

DTR **D**ata **t**erminal **r**eady indicator; lights up when the DTE or Computer connected to the DTE Port #1 indicates that it is ready for communication by raising the corresponding RS232 signal.

TXD **T**ransmit **d**ata indicator; flashes when the DTE/Computer is transmitting data to the DTE Port #1 of the Omni TA128.

RXD **R**eceive **d**ata indicator; lights up when the DTE/Computer is receiving data from the DTE Port #1 of the Omni TA128.

DTE 2

DTR **D**ata **t**erminal **r**eady indicator, lights up when the DTE or Computer connected to the DTE Port #2 indicates that it is ready for communication by raising the corresponding RS232 signal.

TXD **T**ransmit **d**ata indicator; flashes when the DTE/Computer is transmitting data to the DTE Port #2 of the Omni TA128.

RXD **R**eceive **d**ata indicator; lights up when the DTE/Computer is receiving data from the DTE Port #2 of the Omni TA128.

Phone

1 Hook status of the analog adapter 1, lights up when the telephone handset is picked up (off-hook).

2 Hook status of the analog adapter 2, lights up when the telephone handset is picked up (off-hook).

Front Panel Switch

When the TA128 is in **command state**, pressing the front panel button causes the Omni to dial the default phone number pre-stored in the NVRAM. The default number pointer to the telephone directory is assigned by the **AT*D*n*** command.

When the Omni TA128 is **on-line**, pressing the button will tear down the connection and bring it into command state.

To restore the Omni TA128 to its factory default settings and initiate the loop-back test, press and hold the switch for 3 seconds while turning the power ON.

Understanding AT Commands

The Omni TA128 communicates asynchronously with computers using AT commands. AT commands are used to configure and control the Omni TA128. A command statement is usually sent to the modem by being typed from the computer keyboard.

Command statements must be written in a specific form in order for the Omni TA128 to recognize them. A command statement begins with the letters “AT” or “at”. It is then followed by one or more commands and then by a<Enter>.

AT commands can only be issued when the Omni TA128 is in “command” or “off-line” mode.

Once the Omni TA128 has established a connection with the remote device, it goes into “on-line” mode, and the characters sent from your computer (through the Omni TA128) 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 the Omni TA128. Please refer to your communications software manual if this is not the case.

Once the communication terminal program is running and the Omni TA128 is connected:

Type:

```
AT<Enter>
```

Omni TA128 responds:

```
OK
```

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

Supported AT command types:

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

You may also browse the list by using the on-line help commands: AT$, AT*$, AT&$, and ATS$.

Quick Tips when issuing AT commands:

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

Multiple AT commands can be combined into one line. For example, AT&O2and ATB02 can be combined into one line AT&O2B02.

The Omni TA128 processes commands from left to right. The AT command that appears to the right might over-write the command to the left. For example, ATB1B0 will result in ATB0 since both B1 and B0 can not co-exist.

If you see duplicated characters for each one you type, your Omni TA128 and software both have their echo feature turned on (the Omni TA128 defaults to enable command echo). To eliminate the double characters, turn off software command echo.

Use “A/” to repeat the last command. No ‘AT’ prefix is needed for this command.

The Omni TA128 supports either verbose result code (i.e. “OK”) or numerical result code (i.e. “0"). You can use **ATV*n*** command to set it one way or the other:

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

Chapter 3 - Configuring Your ISDN Line and Network

You are now ready to set-up your ISDN network. Based on our experience, most problems can be traced back to two factors. Either the line was not ordered correctly, or the line was ordered correctly, but not programmed correctly.

It would be wise to have your Omni TA128 ready to use before your phone company comes to install your line. That way, you can enter the SPID to your line and confirm that the ISDN network is responding properly before the phone installation people leave.

There is a simple Windows 3.x or Windows 95 utility provided by ZyXEL to help you set-up the network. This set-up procedure needs to be done only once. The network information will be stored in the non-volatile memory of the Omni TA128. Turning the power off will not erase the information. The only time you will need to reconfigure your line is when you perform a hardware reset on your modem or when you change options on your ISDN line.

ZyXEL Configuration Manager Software

Along with your Omni TA128, you will find a disk labeled "ZyXEL ISDN Configuration Manager". The Configuration Manager utility is an easy way to set up and configure your Omni TA128 without the use of a terminal program. To install this software simply run the setup file from the Run line. Refer to your Quick Start Guide for instructions on using the ZyXEL ISDN Configuration Manager.

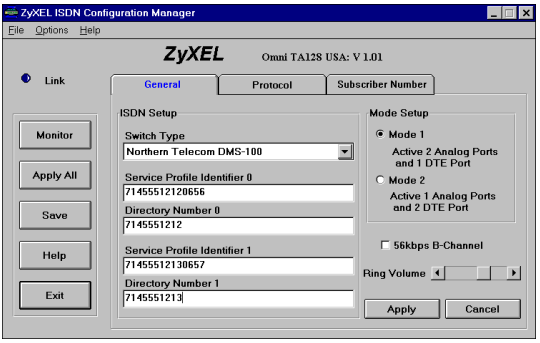


Figure 3-1 ISDN Configuration Manager

If your Omni TA128 is not going to be set-up by a computer running Windows, you will need some type of terminal program that allows you to send AT commands to the modem and receive responses from the modem.

Configuring your Modem using a Terminal program

Getting a Terminal Program Ready

If you are not using the ISDN configuration utility that is packaged with the Omni TA128, you will need a terminal program to from which to configure the unit. The Omni should work with any asynchronous terminal program that can communicate directly with one of the communication ports on your system. If you do not know how to use a terminal program, please refer to the instructions that came with the terminal program.

Make sure the program is set up to communicate with the COM port that the Omni TA128 is connected to. You can check to see if the DTR LED is on when the terminal program is active. In most cases, if the terminal program is active and ready to communicate with the port that the Omni TA128 is connected to, it will activate the DTR signal. This will cause the DTR LED to light up. If DTR is not ON, you will need to check the program's settings.

The communication speed can be set to anywhere between 1,200bps and 460,800bps, but 115,200bps is a good default value. The Omni TA128 will automatically adjust its speed to match your communication speed.

Once the terminal communication program is ready, you can type a simple command to see if the Omni TA128 responds to it.

Type:

```
AT<Enter>
```

Omni TA128 should respond:

```
OK
```

Type:

```
ATI<Enter>
```

Omni TA128 should respond:

```
1281
```

Type:

```
ATI1<Enter>
```

Omni TA128 should respond:

```
Omni TA128  USA: V 1.00a
```
(Firmware version number)

```
7607
```
(Firmware checksum will change based on your firmware version)

```
OK
```

Once the Omni TA128 accepts the commands that you typed, it is ready to be programmed and ready to operate with your ISDN network. If you do not see any response from the device, go over your installation procedures again or contact the ZyXEL Technical Support.

Configuring Your ISDN Line Switch Type and SPID

Switch Type Configuration

In North America there are three popular types of switches, they are:

- AT&T 5ESS
- Northern Telecom DMS100
- Siemens EWSD

These switches are either running software that conforms to the National ISDN-1 standard, or a custom version. Currently, the Omni TA128 supports a total of 6 different combinations, listed in Table 3-1.

You must have the switch type information available when you install your ISDN line. If you used the ZyXEL ISDN order forms to order your ISDN service, you should have recorded this information on the order form.

The ATPn command is used to program the D channel protocol. This is to allow the Omni TA128 to work with the type of switch your ISDN line is connected to. "n" is a digit that indicates the type of switch. Please use the following table for the "n" value.

The Omni TA128 is shipped with a default value of ATP0, which is Northern Telecom's DMS-100 switch with Custom protocol.

ISDN Network Switch	Switch Version (protocol)	AT Command	# of SPIDs
AT&T 5ESS	Point-to-Point	ATP4	0
	Point-to-Multipoint	ATP5	1
	Point-to-Multipoint	ATP6	2
	National ISDN-1	ATP1	1
	National ISDN-1	ATP2	2
NT DMS 100	Custom	ATP0	2
	National ISDN-1	ATP1	1
	National ISDN-1	ATP2	2
Siemens EWSD	National ISDN-1	ATP1	1
	National ISDN-1	ATP2	2
Other	National ISDN-1	ATP1	1
	National ISDN-1	ATP2	2

Table 3-1

Once you have identified the switch you have, enter the proper value.

Example: if your switch type is DMS 100 with Custom protocol:

Type:

```
ATP0<Enter>
```

Omni TA128 should respond:

```
OK

Switch Type: Northern Telecom DMS100
```

At this point you should save the settings in the power-up.

Type:

```
AT&WZ<Enter>
```

The Omni TA128 responds:

```
OK
```

SPID Setup

You are ready to enter the SPID (Service Profile Identifier) number. Unless your switch type is AT&T 5ESS with Point-to-Point protocol, SPID(s) will be needed. The ISDN switches use Service Profile Identifier (SPID) to represent the network services to which the Omni TA128 has subscribed. Each 0SPID corresponds to one Terminal End point Identifier. Different switches may provide different rules for the SPID number format. You should get the SPID number from your local phone company.

To program your SPID number into the Omni TA128:

Type:

`ATSPID0=`*n* (n is the SPID provided by your phone company)

Omni TA128 should respond:

```
OK
```

If a second SPID is required.

Type:

`ATSPID1=`*n* (n is the second SPID provided by your phone company)

Omni TA128 should respond:

```
OK
```

If the response is:

```
SPID Error!
```

This indicates an error entering the SPID number.

Once the SPID(s) are entered and accepted, toggle the Omni TA128 power off then back on. Wait until you see the **LNK** LED light up (this indicates an open communication link between your TA and the local switch). If you are not able to get the **LNK** LED to light up, verify the SPID number(s) with your phone company again. You should recheck all your cable connections before calling your phone company. If it still does not work, you will need your phone company's support to make sure the SPIDs are correct and the line you ordered has been correctly setup.

***Note**: We recommend that you always make sure the cable connections are correct and securely in place. This will make it easier for you to isolate*

the problem area when talking to our technical support staff or the phone company.

Correctly entered and accepted SPID numbers will be stored in nonvolatile memory. That way you won't need to enter the SPID again, even if the power is turned off. However, if you perform a hardware reset, you will need to re-enter the SPID number(s) and switch type again. Make sure you write down or store all the relevant information so it can be retrieved at a later date.

Testing your Connection

After the SPID number(s) are entered and accepted, use your terminal program to dial ZyXEL V.120 number (714-263-0398 or 714-263-0498) to see if you can get a "CONNECT" message.

Follow these instructions to make your test call:

Type:

```
AT<Enter>
```

Omni TA128 responds:

```
OK
```

Type:

```
AT&F<Enter>
```

Omni TA128 responds:

```
OK
```

Type:

```
ATDI7142630398<Enter>
```

Omni TA128 responds:

```
CONNECT 115200/V.120 56000/LAPD
```

You may only get a "CONNECT" message and no other communication. This is OK. In Chapter 4 - "ISDN Communication Basics" you will learn how to setup your Omni TA128 to connect and then communicate over the line.

Making Your First ISDN Data Connection

Your Omni TA128 should already be connected to you ISDN line properly. Also make sure that the **LNK** LED light is on. If the LED is unlit, check that your ISDN switch setup and SPID number(s) are correct. (Refer to the previous section.)

Start your terminal program.

Type:

```
AT&V<Enter>
```

Omni TA128 responds:

```
Current settings .....
Switch Type : Northern Telecom DMS
ISDN Outgoing Service : V.120 56K
 E1  L0  M1  N2  P0  Q0  V1  X5  Z0
```

```
&D2 &E0 &H3 &J0 &K00 &O2 &R1 &S0
*A0 *C0 *D0 *M0 *N0 CB0 CC0 CD0 CP0
S00 =  0 S01 =  0 S02 = 43 S03 = 13 S04 = 10 S05 =  8 S06 =  3 S07 = 60
S08 =  2 S09 =  6 S10 =  7 S11 = 70 S12 =  0 S13 =  0 S14 =  2 S15 =  2
S16 =  0 S17 = 30 S18 =  0 S19 = 17 S20 =  8 S21 =178 S22 =  0 S23 =105
S24 =138 S25 =  0 S26 =  0 S27 =155 S28 = 68 S29 =  0 S30 =  0 S31 = 17
S32 = 19 S33 =  0 S34 = 30 S35 = 34 S36 =  0 S37 =  0 S38 =  0 S39 =  0
S40 =  0 S41 =  0 S42 =  0 S43 =  0 S44 =  0 S45 =100 S46 = 28 S47 = 64
S48 =  0 S49 =  0 S50 =  0 S51 =  0 S52 =  0 S53 =  0 S54 =  0 S55 =  0
S56 =  0 S57 =  0 S58 =  0 S59 =  0 S60 =  0 S61 =  0 S62 =  0 S63 =  0
S64 =  0 S65 =  0 S66 =  0 S67 =  0 S68 =  0 S69 =  0 S70 =  0 S71 =  0
S72 =  0 S73 =  0 S74 =  0 S75 =  0 S76 =  0 S77 =  0 S78 =  0 S79 =  0
S80 =  0 S81 = 62 S82 = 62 S83 = 32 S84 =  0 S85 =  0 S86 =  0 S87 =  0
S88 =  2 S89 =  0 S90 =  0 S91 =  0 S92 =  0 S93 =  0 S94 =  0 S95 =  0
S96 =  0 S97 =  0 S98 =  0 S99 =  0 S100=  0 S101= 62 S102= 62 S103=  0
S104=  0 S105=  0 S106=  0 S107=  0 S108=  0 S109=  0 S110=  0 S111=  0
S112=  8 S113=  0 S114=  8 S115=  0 S116=  0 S117=  0 S118=  0 S119=  0
S120=  0 S121=  0 S122=  0 S123=  0 S124=  0 S125=  0 S126=  0 S127=  0
OK
```

Please make sure that you are using V.120 with a 56K channel. The **ATB20** command switches to V.120 mode, and **AT&E1** tells the Omni TA128 to utilize the 56K bandwidth.

Now you are ready for your first call. As a test, you may dial into our ISDN BBS line at **714-263-0398.**

Type:

```
ATDI17142630398<Enter>
```

You should now see the **B1 LED** go on.

Omni TA128 responds:

```
CONNECT 115200/V120 56000/LAPD

FrontDoor 2.20c.mL/OX000046; MultiLine

Press <<Esc>> twice for ZyXEL BBS
```

From this screen, you can either continue the session or hang up.

Dual B Channel Connection

To make a bundled connection, follow the above instructions, with one change. You must let the Omni TA128 know that you want to make a bundled connection. Typing **AT&J3** will tell the Omni TA128 to set up a bundled call.

When dialing into an AT&T 5ESS or a Seimens EWSD switch, dial a normal ATD<<number>>. If you are dialing into a DMS switch, then tell the remote Omni TA128 that it needs to make 2 separate connections.

To dial our BBS, type:

```
AT&J3<Enter>
```
(set bundled B channel mode)

```
ATDI17142630398+17142630498<Enter>
```

Omni TA128 responds:

```
CONNECT 115200/V120 112000/LAPD
```

```
FrontDoor 2.20c.mL/OX000046; MultiLine
Press <Esc> twice for ZyXEL BBS
```

From this screen, you can either continue or hang up.

Chapter 4 - ISDN Communication Basics

In this chapter, we will cover how to initiate and receive calls over digital lines using your Omni TA128.

Outgoing Calls

The Omni TA128 has 3 modes in which to send communication over ISDN network.

- ISDN data
- Analog port, Phone 1 communication
- Analog port, Phone 2 communication

These modes are auto-switching based on the commands you issue. Let's take a look at how the communication mode is automatically switched. At your terminal program, proceed with the following instructions:

Dialing out using ISDN mode

The command "ATDI" tells your Omni TA128 that you want to make an ISDN data call and to therefore use the ISDN mode to call out.

Type:

```
ATDI17142630398<enter>
```
(Make an ISDN call)

Dialing out using ISDN mode optional Speech Bearer Service

Omni TA128 supports ISDN data utilizing Speech Bearer Service. To Enable this function, you need to set S-register S83 bit 7 to 1, or ATS83.7=1. This function is useful in the areas where ISDN service providers charge lower usage rate for voice (speech) calls. To enable this function, type:

```
ATS83.7=1<enter>
```

To disable it, type:

```
ATS83.7=0<enter>
```

Dialing out for Analog Adapter Port 2

Using the "B" command following the "ATD" will tell your Omni TA128 to automatically switch call to analog adapter, Phone 2, once dialing is complete.

Type:

```
ATDB17146930762<enter>
```

Dialing out for Analog Adapter Port 1

Using the "A" command following the "ATD" will tell your Omni TA128 to automatically switch call to analog adapter, Phone 1, once dialing is complete.

Type:

```
ATDA17146930762<enter>
```

Note: *You must have an analog modem connected to your POTS port before you issue this command.*

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 many 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 ATDB
AT&O2	ATD, ATDT and ATDP are the same as ATDI
AT&O3	ATD, ATDT and ATDP are the same as ATDA

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).

Placing the Call

To initiate a call, choose the proper communication mode and configure the mode according to the bearer service (or protocol) you want to use. Here are some simple commands that will be useful when placing a call:

Command	Description
ATB*n*	Changes ISDN B channel protocol setting
ATDL	Re-dials the last dialed telephone number

Incoming Calls

When a call comes in, it will be carried by one of the following protocols:

- V.120
- HDLC PPP, MPPP or SLIP
- V.110
- X.75

or the call may be initiated by an analog device.

This section will provide some general guidelines for setting up the device for call answer handling. Be aware that the Omni TA128 will not automatically answer a call unless S-register **S0** is set to a value greater than 0 (zero). If S-register S0=0, the Omni TA128 will only report “RING” to your terminal program. It can also respond with an audible tone that will allow you to decide whether or not you should to take any action.

When an ISDN data call comes in, the Omni TA128 will try to negotiate a connection using the proper ISDN protocol. When an analog call comes in, the Omni TA128 will send the call to the analog port as the factory default, Phone 1 and then Phone 2.

Digital Data

The Omni TA128 currently supports Circuit Switched Data (CSD) for ISDN data applications. The CSD protocols supported by the Omni TA128 include: PPP, MPPP, V.120, X.75, and V.110. PPP is the most popular protocol used in North America; it is used by most of Internet service providers. Once the Omni TA128 answers a call, it will examine the incoming data to determine which protocol to use, and automatically switch to this mode. This operates transparently to the user. The Omni TA128 is able to auto-switch for PPP, MPPP, V.120, X.75, V.110, and above protocols over speech channel. In most cases, you can rely on the auto-switching feature for your applications. If you need more specific settings for answering calls, please refer to the section entitled "Answering a Call using MSN" found later in this chapter.

Determining the Packet Length

The user's information is sent on a frame-by-frame basis for V.120. Sometimes we call it "packetized." The maximum frame length on the sending side should not exceed the maximum frame length that the receiving side allows. Sometimes this information will be exchanged during handshaking. However, few manufacturers, if any, have implemented this mechanism.

If the sending side sends packets greater than what the receiving side allows, the receiving side will discard the frame and reply with a Frame Reject Frame (FRMR). The FRMR indicates that the information received is too long. Both sides will then reset their link layer negotiation and re-send the frame again. Usually this will happen repeatedly until the call gets disconnected.

The Omni TA128 has a fixed maximum receiving frame size of 2048 bytes which is larger than most devices can support. The default maximum sending frame size is 252 bytes, which is small enough that it should not create any problems. If you need to change the maximum sending frame size, the ATCL command should be used.

Type:

```
ATCL252<Enter>
```
(Set the frame size to 252 octets, user value between 1-2048)

Omni TA128 responds:

```
OK
```

Type:

```
ATCL?<Enter>
```
(To inquire about the current setting of the packet length)

Omni TA128 responds:

```
Maximum user data length in a packet (byte) : 252
```

Answering a Call using MSN

When answering an incoming call, the call will first be identified if the caller 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 supports many different communication protocols and two analog adapters, each of these ports can be assigned to an ISDN number using the following 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
&ZI5=s	assigns MSN 's', phone number for PPP, MPPP
&ZI6=s	assigns MSN 's', phone number for Phone 2
&ZI7=s	assigns MSN 's', phone number for Phone 1

Table 4-1

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 TA128 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 is not used by the Omni TA128 to select the protocols or services. It just indicates the subaddress (if any) to the DTE.

Data over Speech Channel

If you are expecting ISDN data calls through Speech (Voice) channel, you would need to setup MSN for it. If no MSN entries are found in MSN ISDN data lists, all Speech (Voice) calls will be send to either Phone 1 jack or Phone 2 jack. Which entry to use would depend on the type of data call that you are expecting. If you only expect PPP type of calls, you should enter the number that remote user will use to dial in into entry #3 (AT&ZI3=xxx) or entry #5 (A&ZI5=xxx). Once this is set, when the caller dials into

this number, Omni TA128 will attempt to use PPP protocol to handshake with remote no matter what the setup message is coming from the switch indicates either a ISDN data call or Speech (Voice) call.

Best-effort call answering

If some numbers have been set using &ZIn command (as can be seen by the AT&ZI? command) and they are not matched with the address of the incoming call, the Omni TA128 will, by default, ignore the call as it may be intended for other devices that share the same S/T interface (S0 bus) with the TA128.

If you want the Omni TA128 to answer inbound calls using all possible protocols, you can set the best-effort call answering bit as follows:

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

Ambiguity resolution switch for voice calls

For a Speech or voice-band-data call, if the &ZI number assignment can tell which of the analog adapters is being addressed, then the call will be delivered to the proper destination. But sometimes, ambiguity of address matching may exist. This may happen if the &ZIn numbers of the various protocols are either unassigned or not matched or the address information is absent in the incoming SETUP message. In this case, users may wish to set answering priority to an analog port. The **AT&L*n*** command sets the address ambiguity resolution flag as follows.

AT&L0 The analog adapter 1 has the higher priority to answer a voice or voice-band-analog-data call; if the analog adapter 1 is busy, the call will be routed to the analog adapter, Phone 2.

AT&L1 The analog adapter 2 has the higher priority to answer a voice or voice-band-analog-data call; if the analog adapter 2 is busy, the call will be routed to the analog adapter, Phone 1.

Multi auto-answering of data calls

When an ISDN data call comes in, the Omni TA128 can determine the protocol to be used in one of two exclusive ways.

1) By way of the information conveyed by the SETUP message (for DSS1, these include the Bearer-Capability, Low-Layer-Compatibility, or High-Layer-Compatibility information elements; for 1TR6, these include the Service Indicator as well as an Additional Octet of the Service Indicator)

2) By the Multi Auto-answering process. The Omni TA128 determines the protocol by monitoring the B channel signal sent by the calling site.

With either method, the data call can be identified by the Omni TA128 to be X.75, V.110, V.120, or PPP, MPPP Async-to-Sync conversion.

If the address-matching process is again unable to tell which protocol to use, the Omni TA128 will go into its “Multi Auto-answering Routine,” by examining the B channel data pattern and hence determine the protocol to use.

When alerted, the Omni TA128 will send a RING message to the DTE in the following format:

```
RING

FM:17145522863   TO:17142630398
```

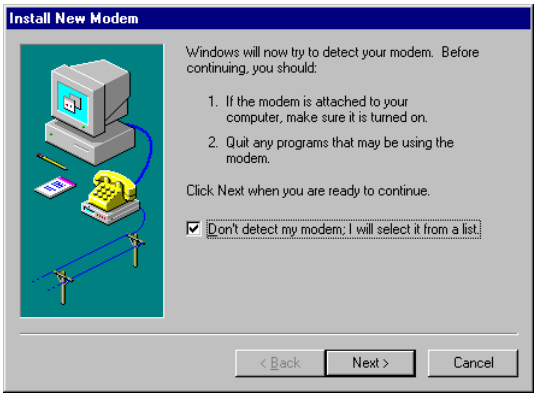
Chapter 5 - Setup for Windows 95 and NT

This chapter contains step by step procedures for installing the Windows 95 and NT drivers, and configuring Dial-up Networking for the Omni TA128.

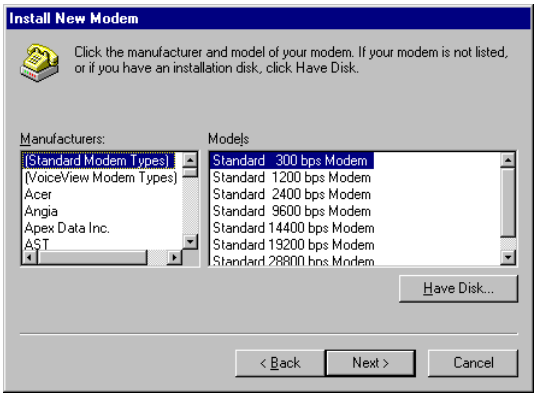
Installing the Windows 95 Driver (INF file)

Step 1 - Open the Control Panel by double clicking the “Control Panel” icon in your “My Computer” folder.

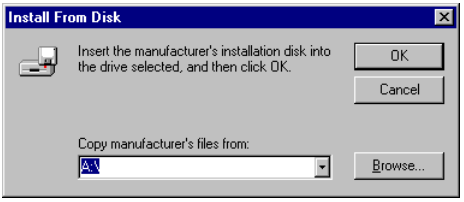
Step 2 - Double click “Modems,” then click the “Add” button. The following dialog box will appear.



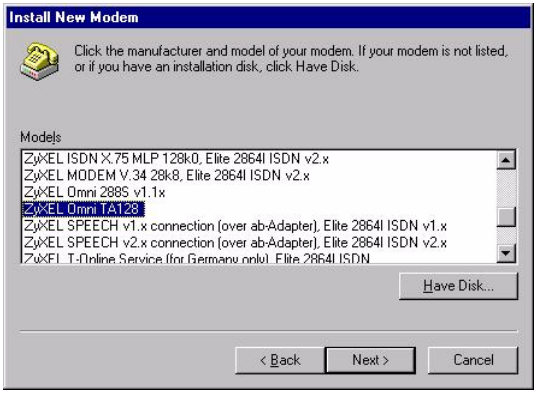
Step 3 - Select “Don't detect my modem; I will select from a list.” Then click “Next.”



Step 4 - Click the “Have Disk” button.



Step 5 - Insert the ZyXEL Windows 95 driver disk into your floppy drive and click OK. If you have downloaded an updated INF file from ZyXEL's FTP, Website, or BBS, use "Browse" to find the location of the updated .INF file, click "Open," then click "OK."



Step 6 - Select the Omni TA128 driver with the protocol that your host is using. Generally, the samples listed below will work. However, we recommend that you check with your ISP to verify the protocol they use.

If you are connecting to an Internet Service Provider (ISP), select:

Omni TA128 V1.xx PPP

If the ISP has **not** upgraded to an ASEND compatible server, select:

Omni TA128 V1.xx V.120

If you are calling another location such as a BBS system, select:

Omni TA128 V1.xx V.120

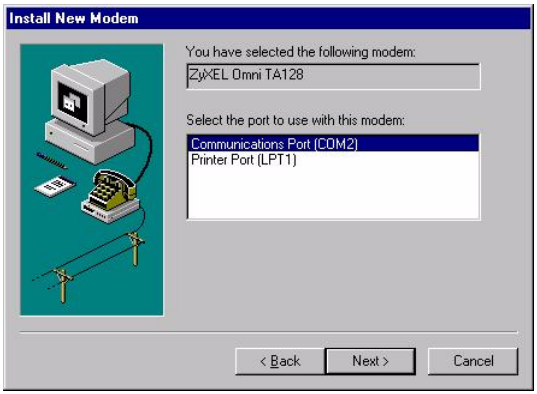
If you dial up to CompuServe, select:

Omni TA128 V1.xx V.120

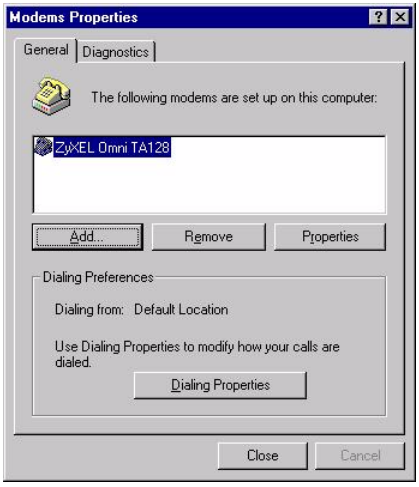
If you are calling MicroSoft Network's (MSN) ISDN line, select:

Omni TA128 V1.xx PPP

After you have completed the selections above, click "Next."



Step 7 - Select the COM port your modem is connected to and click "Next." A final dialog will appear. Click "Finish." You should see a window similar to the one below.

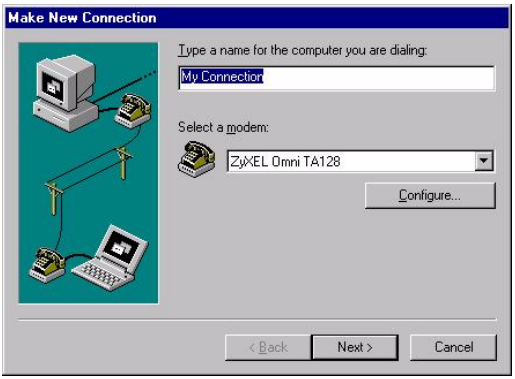


Step 8 - Click "Close." This completes the installation of your Omni TA128 modem driver. You may now use programs such as "Dial-Up Networking" with your Omni TA128.

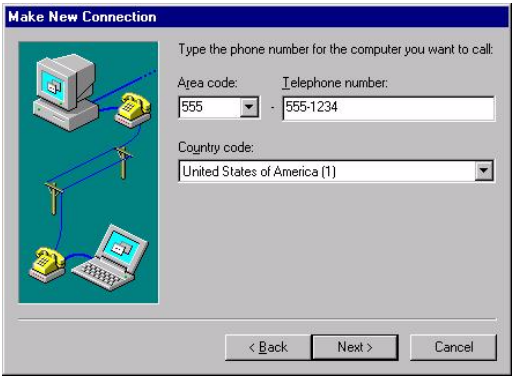
Configuring Windows 95 Dial-Up Networking

This section assumes you have already fully installed Windows 95. If you have not installed the Dial-Up Networking feature in Windows 95, please install it before you continue.

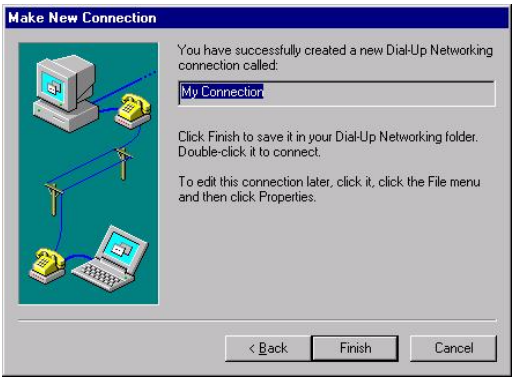
Step 1 - Double click on the "My Computer" icon and then double click on the "Dial-up Networking" icon. From within the Dial-up Networking folder, double click on the "Make New Connection" icon.



Step 2 - Choose a name for your connection and select your modem type from the drop down window. Then click on the "Next" button.

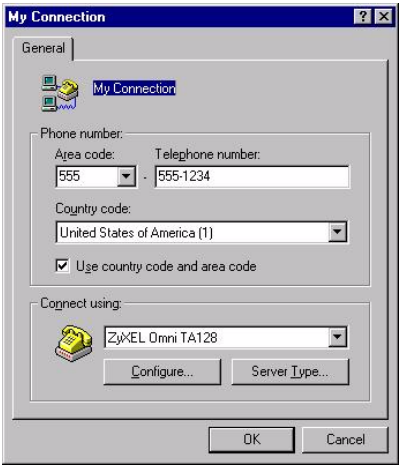


Step 3 - Type the phone number of your ISP or whatever host you will be calling. Click on the "Next" button.

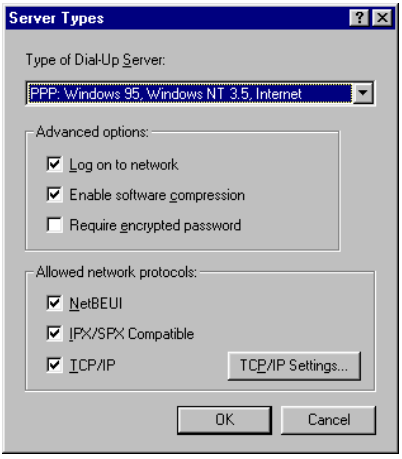


Click on the Finish button. A new icon is created in the Dial-up Networking folder.

Step 4 - Right click on this icon, then select "Properties" from the menu.



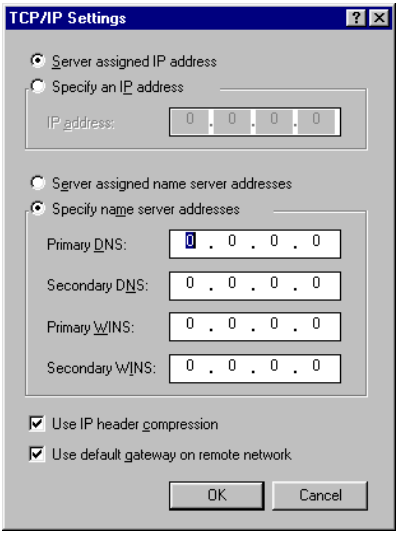
Step 5 - Make sure your Omni TA128 modem appears in the "Connect Using" box. Then click on the "Server Type" button.



These options are mostly host or server specific.

- If you are using PPP, use the default settings shown above.
- If you are connecting to a LAN, then select "Login to Network."
- If you are logging on to a Microsoft Windows network, select "NetBEUI."
- If you are logging on to a Novell network, then select "IPX/SPX Compatible."
- If you are logging on to an Internet connection, then select "TCP/IP."

Step 6 - Click on "TCP/IP Settings."

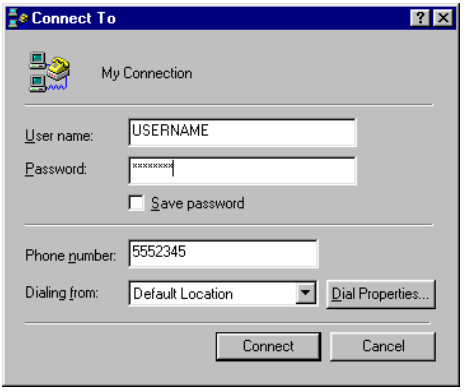


If your host requires you to specify an IP address (Static IP), then click on the "Specify an IP address" radio button and enter your IP address. If your host assigns an IP when you log in (Dynamic IP), then leave the "Server assigned IP address" checked. Most servers assign an IP to you when you log in.

Click the “Specify name server address” radio button and enter your primary and secondary DNS (Domain Name Server) IP.

In most cases, you should leave "Use IP header compression" and "Use default gateway on remote network" checked. When all of the selections have been made, click “OK.”

Step 7 - This completes the remote connection definition. Locate the new connection icon in your “Dial-up Networking” folder, and double click on it.



Step 8 - If the **User name** and **Password** are incorrect or are not there, type them in. Click on the Connect button and your Omni TA128 will dial the number and establish a connection.

Windows NT RAS Setup

1) From the NT Program Manager open the “Main” program group and double click on “Control Panel,” then double click on Network. This will bring up Network Settings. If you have not already done so, create a Computer name and Workgroup name for your system.
2) In the “Network Software and Adapters Cards” group window, there is a list box. Scroll through this list and see if you have “Remote Access Service” listed as one of the installed components. If you do not, then click on the “Add Software” button and install the remote access service.
3) Find the .INF file (either from the driver disk or that you downloaded from ZyXEL) and copy it to replace the MODEM.INF in your \WINNT35\SYSTEM32\RAS directory. Then reboot your computer to load the new drivers into memory.
4) Once done, open “Control Panel” and “Network” then select the Remote Access Service option in the list box and click on the “Configure” button.
5) You will be presented with a new window. This is where you setup your modem. If your modem is not setup, click on “Add” to set it up.
6) Use the drop down list box to select the COM port your modem is connected to, then click “OK.” In the new dialog box, click on CANCEL to select the modem for yourself.
7) Here you can select whether you want dial out only capabilities, receive or both. Unless you intend to connect to your computer from another location, select "Dial out only.” Click on OK and you will be returned to the previous window.
8) Find your modem in the list box and select it, then click on the “Network” button.
9) This is where you define the Dial out Protocol you will be using. Generally speaking, only “TCP/IP” should be selected. “IPX” should be selected only if you are connecting to a Novell Network. “NetBEUI” should be selected for a Windows Network. Once the selections are made, click OK. You should now reboot your computer.
10) Once your computer has rebooted, double click on the Remote Access Service group icon. Now double click on the Remote Access icon in this group.
11) If you already have a connection, just leave it as is. Otherwise it will tell you the phone book is empty and to “Press OK to add a new entry.” Just click OK, or the Add button if you have an existing entry and you will get the next window. From here, click on the “Advanced” button.
12) Type in a name for your connection in the “Entry Name” field, the phone number you wish to connect to in the “Phone Number” field, and a description of the connection (optional).
13) Now click on the down arrow button in the “Port” field and select the COM port your modem is attached to. Then click on the “Modem” button.

14) In this dialog box, click on the down arrow of the “Initial speed (BPS)” field and select the maximum speed of your modem (DTE Speed). From “Hardware features,” select all three options. When all these selections are made, click on OK. You will then be returned to the previous window.

15) Click on the Network button. Select the PPP radio button, then select “TCP/IP,” and “Request LCP extensions (RFC 1570).” Now click on the “TCP/IP Settings” button.

16) Click the IP address option that is required by your ISP (usually server assigned IP address). Now select the “Use specific name server addresses” and enter the DNS and DNS backup IP addresses given to you by your ISP. Also select the “Use VJ header compression” and “Use default gateway on remote network” selections if your ISP supports these features.

17) Click the OK buttons until you return to the “Edit Phone Book Entry” window, then click on the “Security” button. The rest of this is dependent on your ISP. If you are making an NT to NT server just check “Accept Authentication,” and click OK.

18) Finally Click OK again, then click “Dial.” Your Omni TA128 will dial the number and establish a connection.

Chapter 6 - Async to Sync PPP and SLIP

Internet and Remote Access PPP and SLIP

More and more Internet Service Providers are offering their services through dial-up ISDN lines for higher data bandwidth. The equipment used at the service provider's location are frequently ISDN LAN routers which, unlike terminal adapters, do not have asynchronous capability. For this reason, terminal adapters that support only V.120 or asynchronous protocol will not work with this type of equipment.

The Omni TA128 is able to convert the asynchronous data it receives from your computer to synchronous format in order to communicate with ISDN LAN routers. We call this process asynchronous to synchronous HDLC conversion. To simplify it, we call it Async to Sync PPP (Point-to-Point Protocol) or Async to Sync SLIP (Serial Line Internet Protocol) protocol.

Making Async to Sync PPP and SLIP calls

In order to communicate with an ISDN LAN router (from vendors such as Ascend and Cisco), you'll need to set the Omni TA128 B channel protocol to one of the following:

`ATB40<Enter>` *(HDLC PPP)*

or

`ATB41<Enter>`(*HDLC SLIP)*

You should also set the DTE speed based on the bandwidth that the switches support.

Most of the time, you will only use this protocol for making calls to remote sites with ISDN LAN Routers. If the remote access site you are calling uses a Terminal Adapter such as the Omni TA128, you can use V.120 (see next chapter), as it provides data compression.

Before making the call, check which protocol is set for the ISDN mode using the &V command to view the settings.

Type:

```
AT&V<Enter>
```

The Omni TA128 responds:

```
Current Settings...

Switch Type: Northern Telecom DMS

ISDN Outgoing Service: PPP Async-to-Sync Conv 64K
```

If the settings displayed match your current setup, you are ready to place the call.

Type:

```
ATDI<remote_access_number><Enter>
```

Omni TA128 will respond:

```
Connect 115000/64000 PPP/None
```

Keeping a Line Connection During Idle Time

If you are using the PPP to access a Server, more often than not, the Server will have a watchdog timer to monitor the line activity. If the idle time exceeds some time interval (usually 1 minute), the Server will release the connection for other clients to dial in. As a user, you could be very annoyed in some circumstances since, once disconnected, you have to dial to the server again and repeat the login procedure. The value in register S124 (in seconds) is used as the idle time gauge. If the idle time exceeds this guarding period, the Omni TA128 will send out a dummy PPP packet to the Server to keep it from disconnecting the line.

Example: If the server you are calling disconnects after 1 minute of inactivity, issue the following command before connecting:

`ATS124=59<Enter>` (send dummy PPP packet after 59 sec of inactivity)

Setting S124=0 will disable this function.

Answering Async to Sync PPP calls

There is no need to configure the ISDN mode to the protocol of an incoming call. If it is set to auto-answer or an answering command is issued, the Omni TA128 will be able to determine the correct protocol to use by examining the data coming in from the remote site. One exception to this is when the ISDN data call is carried through a Speech bearer. In this case you would need to set up an MSN entry for the phone number of the calling party, so calls from this number will be answered properly. To do this, use **AT&ZI3=*xxx***; where '*xxx*' is the number that the call is expected to come in from. Please refer to the section entitled "Data over Speech Channel" in Chapter 4 for details.

To allow the Omni TA128 to automatically answer the incoming call, you need to set S0 to a value greater than 0 (i.e. ATS0=1). Omni TA128 will answer the call and use asynchronous to synchronous conversions to and from the DTE. If S0 is not set (S0=0), the DCE will report "RING" and will also make an audible ring notification.

Multilink PPP

Multilink PPP (MPPP) is a protocol that allows virtual bundling of the two B channels, for connection speeds of 128Kbps. MPPP support is a standard feature of Omni TA128 models.

Making a call using Multilink PPP

A Multilink PPP connection is initiated at the calling site when **ATB40** (B channel protocol HDLC PPP) has been selected and the Multilink PPP mode has been enabled by an **AT&J*n*** command:

AT&J0	Disables Multilink PPP
AT&J1	Enables Multilink PPP in answer mode only
AT&J2	Enables Multilink PPP in call mode only
AT&J3	Enables Multilink PPP in both call and answer modes

By default, the Omni TA128 dials the same number for both Multilink PPP connections. If the destination you are dialing requires two different telephone numbers to establish a two channel Multilink PPP connection, then the following command can be used:

```
ATDIphone_number_1+phone_number_2
```

where phone_number_1 and phone_number_2 are the phone numbers of the destination.

If the destination refuses the Multilink PPP during the LCP negotiation, a single B channel PPP connection will be established. Whether or not the Multilink PPP connections have be establish, the connection message will be the same.

Dialing Pre-stored Phone Numbers

Use ATDSn, n=0,1,..,39, to dial the (n+1)th phone number twice for both the Multilink PPP connections. Use ATDSn+Sm, (n and n=0,1,...,39) to dial the (n+1)th phone number for the first connection and the (m+1)th phone number for the second connection.

For example, ATDIS0+S1<Enter> will dial the number stored in location ‘0’ , and the number stored in location ‘1’ for the MPPP connection.

Endpoint Discriminator

The Endpoint Discriminator option represents identification of the system transmitting the packet. This option advises a system that the peer on this link could be the same as the peer on another existing link. Some Multilink PPP implementations require the use of the Endpoint Discriminator option.

The Endpoint Discriminator consists of two components: Class and Address.

The Class field is one octet as stored in S-register S85 and indicates the identifier address space. Valid values of S85 are assigned as follows:

0 - Null Class (by default)
1 - Locally Assigned Address
2 - Internet Protocol (IP) Address
3 - IEEE 802.3 Globally Assigned MAC Address
4 - PPP Magic-Number Block
5 - Public Switched Network Directory Number

The Endpoint Discriminator Address field is of variable length from 0 to 20 octets and can be assigned by the ATEPD command:

```
ATEPD = <Octet_1,Octet_2,Octet_3,..,Octet_n>
```

Each Octet_i is in the range from 0 to 255. The angle brackets '<' and '>' are part of the this command. The command ATEPD? can be used to view current setting of the Endpoint Discriminator Address.

Note : *The Endpoint Discriminator option is not required in most cases, thus users don't have to change the default settings. The system administrator of your corporate or the Internet service provider will provide these values if the Endpoint Discriminator option is required.*

Dynamic Bandwidth Allocation

When dynamic bandwidth allocation (DBA) is enabled (by default), you can place or answer a voice call (and only one) from a device that is attached to one of the a/b adapters while a Multilink PPP call is active. The Omni TA128 automatically removes one of the Multilink PPP connections and uses it for the voice call. Once the voice call ends, the Omni TA128 automatically reestablishes that channel for Multilink PPP operation. The dynamic bandwidth allocation function can only be effective when the Omni TA128 is in the calling site (the client site). The following command can be used to select the DBA function:

ATCE0	Disable the DBA function
ATCE1	Enable the DBA function (default)

Chapter 7 - V.120 ISDN Communications

This chapter describes how to set-up and configure your Omni TA128 with the V.120 ISDN protocol.

Placing outgoing calls

Some switches transmit all network signals through the D channel, 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'll need to set your Omni TA128 to 56K mode using the AT&E1 command (AT&E0 to set it back to 64k mode.) If your Omni TA128 is on the receiving end, you can keep the setting at AT&E0, 64k data mode. The Omni TA128 will automatically switch between the two speeds in answer mode.

Configuring the V.120 mode

To configure for a 56K V.120 call, type:

`ATB20<Enter>` *(Select V.120 for communication)*

Omni TA128 responds:

`OK`

Type:

`AT&E1<Enter>` *(Select 56K data mode)*

Omni TA128 responds:

`OK`

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

Type:

`AT&W0<Enter>` *(Save the settings to profile 0) [Profiles available: 0-3]*

Omni TA128 responds:

`OK`

Type:

`ATZ0<Enter>` *(Save stored settings as the power on settings to profile 0) [Profiles available: 0-3]*

Omni TA128 responds:

```
OK
```

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

```
AT&B20&E1&WZ0<Enter>
```

Dialing in V.120 mode

Finally, use the **ATD*n*** 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.

```
CONNECT 115200/V120 56000/LAPD
```

This indicates that the connection is made with:

DTE speed of 115,200bps
Protocol V.120
Data Speed 56,000bps
Error Control LAPD

Answering incoming calls

In most cases, there is no need to configure the Omni TA128 to properly answer calls. The Omni TA128 is able to decide which protocol to use by detecting the type of data that is coming in. All you need to do is set S0 to greater than or equal to 1, so the Omni TA128 will automatically answer an incoming call. If S0=0, the DCE will simply report "RING" to your terminal and sound a ring notification.

One exception to this is when the ISDN data call is carried through Speech bearer. In this case, you would need to make an MSN entry for the phone number that you are expecting the Data-over-Speech-bearer call to be coming for V.120 protocol. Use **AT&ZI2=*n***. Please refer to the section entitled "Data over Speech Channel" in Chapter 4 for details.

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 (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). It is called a "Bundle Connection" (different from BONDING).

The type of channel bundling described in the V.120 section is supported between two ZyXEL Omni TA128's or Elite 2864I's only, and uses Multiple Link Protocol (MLP).

To make bundled connections to other ISDN TA's as well as ZyXEL TA's, refer to the section entitled "Multilink PPP" in the preceding chapter.

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.

Making a Bundled Call with V.120

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.

Type:

`ATB20<Enter>` *(Set B channel protocol to V.120)*

`AT&J3<Enter>` *(Set the Omni TA128 to make a bundled call)*

Type:

`AT&WZ<Enter>` *(If you want to save the setting)*

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:

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

The answering Omni TA128 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 the 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)*

If you are not using American ISDN, you can have a choice between Multiple Link Protocol (MLP) or "cFos" channel bundling (CCB) two bundle protocols. You can set it by the following commands:

```
ATS100=0  MLP channel bundling
ATS100=1  CCB channel bundling
```

Dialing pre-stored phone numbers

Use ATDSn, n=0,1,..,39, to dial the (n+1)th phone number twice for both the bundle connections. Use ATDSn+Sm, (n and n=0,1,...,39) to dial the (n+1)th phone number for the first connection and the (m+1)th phone number for the second connection.

For example, ATDIS0+S1<Enter> will dial the number stored in location '0' , and the number stored in location '1' for the bundle connection.

Dynamic Bandwidth Allocation

When dynamic bandwidth allocation (DBA) is enabled (by default), you can place or answer a voice call (and only one) from a device that is attached to one of the a/b adapters while a CCB call is active. The Omni TA128 automatically removes one of the CCB connections and uses it for the voice call. Once the voice call ends, the Omni TA128 automatically reestablishes that channel for CCB operation. The dynamic bandwidth allocation function can only be effective when the Omni TA128 is in the calling site (the client site). The following command can be used to select the DBA function:

ATCE0	Disable the DBA function
ATCE1	Enable the DBA function (default)

The availability of DBA for the various bundle protocols is outlined below:

	Multiple Link Protocol (MLP)	**'cFos' Channel Bundling (CCB)**	**Multilink PPP**
Enable Channel-Bundling	*AT&J3*	*AT&J3*	*AT&J3*
Applicable Data Protocols	*X.75 (ATB0n), V.120 (ATB20)*	*X.75 (ATB0n), V.120 (ATB20)*	*PPP (ATB40)*
Dynamic Bandwidth Allocation	*No*	*Yes (ATCE1)*	*Yes (ATCE1)*
Bundle Type Selection	*S100=0*	*S100=1*	*N/A*
V.42bis	*Yes (AT&K44)*	*Yes (AT&K44)*	*No*
In-band Bundle Negotiation	*No*	*No*	*Yes*
End Point Discrimination	*N/A*	*N/A*	*Optional*

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

- **AT&K44** enable V.42bis on ISDN call
- **AT&K00** disable V.42bis on ISDN call

With the &K44 setting, the Omni TA128 will try to connect using V.42bis data compression. If the remote device doesn't 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 would be better to issue the AT&K00 command beforehand in order to get a quick connection.

V.42bis is an international data compression standard commonly used in modem communications. This standard provides real time data compression. ZyXEL's expertise in data compression has been brought into ISDN applications, which are much faster in speed than modem communications.

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. The 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.

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 connection. 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 128K bps, then the DTE speed may reach 512K bps. This makes the DTE's normal RS-232 serial port unsuitable for bundle applications. Special I/O card on the computer side is required in this situation for external models.

Selecting V.120 for European ISDN (DSS1) switch

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 mid way.

If the called TA doesn't get any B channel protocol information from the incoming SETUP message and the remote device is a ZyXEL ISDN device, the Omni TA128 will be able to identify the V.120 protocol automatically with the Multi Auto-answer routine. Otherwise, the handshake will fail.

Selecting V.120 for Germany National ISDN (1TR6)

With 1TR6 switch, data connections are achieved by setting the **Service Indicator** to 7 (Daten_bertragung 64Kbps) and the **Additional Information** octet is used to select B channel protocols. Since there is no pre-defined code for asynchronous V.120, Omni TA128 uses the synchronous V.120 code to fill in the additional information octet. This approach might not work all the time.

Chapter 8 - X.75 ISDN Communications

This chapter will describe how to set-up and configure your Omni TA128 with X.75 protocols. It will also describe Data Encryption Standard (DES) and its application within a growing market of companies and individuals who are concerned with sending and receiving secured messages.

X.75 was originally designed for packet-switched signaling systems in public networks to provide data transmission services. But 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 3-1 shows the specifications of different ISDN protocols.

	V.110	**V.120**	**X.75**
Layer 1	80 Bits Framing	HDLC	HDLC
Layer 2	None	LAPD	LAPB Transparent
Layer 3	None	V.120	ISO8208T.70 NL
Error Control	No	Yes	Yes
V.42bis	No	Yes	Yes
Async or Sync if used with V-Series DTE	Async and Sync	Async Only	Async Only
Bundle	No	Yes	Yes
Max. Line Speed	Async: 38.4 Kbps Sync: 64 Kbps	64Kbps 128Kbps	64Kbps 128Kbps
AT-Command Configuration	ATB10	ATB20	ATB0: Transparent ATB01: T.70 NL

Table 8-1

Answering an X.75 call

There is no need to configure the ISDN mode to the protocol of an incoming call. The Omni TA128 will be 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 answering command is issued.

One exception to this is when the ISDN data call is carried through Speech bearer. In this case, you would need to make an MSN entry for the phone number from which you are expecting the Data-over-Speech-bearer call to be coming, for X.75 protocol. Use **AT&ZI0=*n***. Please refer to the section entitled “Data over Speech Channel” in Chapter 4 for details.

To allow the Omni TA128 to answer the incoming call, you need to set S0 to a value greater than 0 (i.e. ATS0=1). The Omni TA128 will answer the call and use asynchronous to synchronous conversions to and from the DTE. If S0 is not set (S0=0), the DCE will report “RING” and will also make an audible ring notification.

Making an X.75 Call

CAPI 1.1a specifies X.75 with T.70 NL as its default.

CAPI 2.0 specifies X.75 with transparent layer 3 as its default.

The default data protocol of the Omni TA128 is ATB20 (V.120). X.75 protocols can be chosen using the following AT commands:

- **ATB00** X.75 with transparent layer 3
- **ATB01** X.75 with T.70 NL
- **ATB04** BTX (Datex-J)

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 Omni TA128 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. There is no provision for 1TR6 switch to specify the layer 3 protocol for X.75 type of calls.

Making a Bundled Call with X.75

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&J*n* 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

The bundle protocol can be selected as follows.

- **ATS100=0** MLP channel bundling
- **ATS100=1** CCB channel bundling

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.

```
ATDIphone_number_1+phone_number_2
```

If the called site receives two consecutive SETUP messages with the same Calling Party Number and Bearer Capability *(or Origination Address for and Service Indicator for*

1TR6) 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 TAs in the two sites then use **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 any B channel is unavailable in any 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
```

Dialing Pre-stored Phone Numbers

The 40 phone numbers stored in the NVRAM can also be used to placing a bundle call.

- Use **ATDS*n*,** (*n*=0-39), to dial the (n+1)th phone number twice for both the bundle connections.
- Use **ATDS*n*+,** (*n*=0-38), to dial the (n+1)th phone number for the first connection and to dial the (n+2)th phone number for the second connection.
- Use **ATDS*n*+S*m***, (*n*=0-39; *m*=0-39), to dial the (n+1)th phone number for the first connection and the (m+1)th phone number for the second connection.

Dynamic Bandwidth Allocation

When dynamic bandwidth allocation (DBA) is enabled (by default), you can place or answer a voice call (and only one) from a device that is attached to one of the a/b adapters while a CCB call is active. The Omni TA128 automatically removes one of the CCB connections and uses it for the voice call. Once the voice call ends, the Omni TA128 automatically reestablishes that channel for CCB operation. The dynamic bandwidth allocation function can only be effective when the Omni TA128 is in the calling site (the client site). The following command can be used to select the DBA function.

- **ATCE0** *(Disable the DBA function)*
- **ATCE1** *(Enable the DBA function)* ***Default***

The availability of DBA for the various bundle protocols is outlined below:

	Multiple Link Protocol (MLP)	**'cFos' Channel Bundling (CCB)**	**Multilink PPP**
Enable Channel-Bundling	*AT&J3*	*AT&J3*	*AT&J3*
Applicable Data Protocols	*X.75 (ATB0n), V.120 (ATB20)*	*X.75 (ATB0n), V.120 (ATB20)*	*PPP (ATB40)*
Dynamic Bandwidth Allocation	*No*	*Yes (ATCE1)*	*Yes (ATCE1)*

Bundle Type Selection	*S100=0*	*S100=1*	*N/A*
V.42bis	*Yes (AT&K44)*	*Yes (AT&K44)*	*No*
In-band Bundle Negotiation	*No*	*No*	*Yes*
End Point Discrimination	*N/A*	*N/A*	*Optional*

Invoking 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.

- **AT&K44** (enable V.42bis on ISDN call)
- **AT&K00** (disable V.42bis on ISDN call)

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 either reply to an XID frame with V.42bis request. If it is able to execute V.42bis; it will ignore the XID or reply an XID frame with 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 would be better 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 being used in V.42/V.42bis. In addition to the compression parameters, XID can be used to negotiate the packet parameters as window size, packet size, and so on. Thus we appeal to other vendors to use this scheme to make X.75 more compatible. Any suggestion on this issue is highly appreciated.

If you are interested in the V.42bis negotiation procedure, you can use the embedded protocol analyzer to capture and analyze the exchanged XID frames.

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 connection. 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 128K bps, then the DTE speed may reach 512K bps. This makes the DTE's normal RS-232 serial port unsuitable for bundle applications. Special I/O card on the computer side is required in this situation for external models.

Data Encryption

PLEASE NOTE:

In response to customer needs and requirements, ZyXEL has taken the initiative to implement Data Encryption into the Omni TA128. Implementation of this public DES algorithm has been arranged exclusively by ZyXEL, without violation of any patents. Its use with the Omni TA128 is free for all. ZyXEL however, will not be responsible for any contrary rules that apply in the countries where the Data Encryption feature is being used. It is the sole responsibility of the user to be aware of established rules and regulations in their respective countries regarding the use of Data Encryption. Users intending to export the Omni TA128 should investigate and adhere to local export laws.

For many years, the cryptographic protection of data communication has been a matter of importance only to military or government security agencies. But during the last two decades, with the advance of microelectronics and computer-communication technology, the following trends may change its significance and application:

1) Companies and individual users rely more on data communication to exchange sensitive information. Specifically, more and more people are using ISDN for LAN-to-LAN interconnection and Internet services.

2) Inexpensive but powerful equipment makes the interception job of wire-tapers or hackers easier than before.

3) It is possible now for civilians to employ security practices that can protect against powerful adversaries.

***Note**: ZyXEL does not assume any liability arising out of the application or use of any of the security functions described in this chapter. Neither does it convey any license under its patent rights nor the rights of others.*

Data Encryption Standard (DES)

DES is a Federal Information Processing Standard in the United States. DES is a block cipher - that means it encrypts data in 64-bit blocks. A 64-bit block of plain text goes in one end of the algorithm, and a 64-bit block comes out of the other end. Both encryption and decryption use the same algorithm. The key length is 56 bits. Some of the 56-bit numbers are considered to be weak keys. But the weak keys will be automatically avoided by Omni TA128. One major criticism of the DES standard is that its key is too short to survive the brute force (exhaustive search) attack of today's technology.

Triple DES, which uses two DES keys, has been adopted to improve the DES algorithm in the ISO 8732 standard. This way, the equivalent key length is 112 bits, and the resultant cipher text is much harder to break using an exhaustive search : 2^{112} attempts instead of 2^{56} attempts.

The table below is an estimation of security, depending on key length using the 1990s' technology: (Please refer to Dr. Dobb's Journal, April 1994 for more detailed information):

Key Length	Time Required for a $1M Machine to Break	Time for a $1B Machine to Break
56Bits	3.5 hours	13 seconds
100Bits	7 billion years	7 million years
128Bits	10^{18} years	10^{15} years

Manual DES Key Generation

The Omni TA128 currently supports encryption with X.75 protocol. The key used by DES can be manually entered via an AT command before each connection is made (the Omni TA128 will not remember the Key you used).

Type:

```
ATCK<DES_Key><Enter>
```

Example: **ATCK<678901234567890>**<Enter>

Note: The "<" and ">" are required characters for the DES_Key parameter

Use the above example to preset the DES key. The DES_Key is a string of printable characters. The number of characters in the string should be larger than 15 and less than 65. The AT command interpreter will convert the string DES_Key to a real DES key. The Omni TA128 will check to see if the converted key is a weak key for DES, if so, it modifies the key according to a predetermined algorithm to get a non-weak key.

Both ends of an ISDN link should key in the same DES_Key before a DES ISDN call can be established. Failure to do so will cause either an immediate disconnection or an unintelligible connection.

You can combine the DES_Key with your dialing string when you are making a call or combining it with your answering string when you are answering a call. For example:

When dialing type:

```
ATCK<678901234567890>D6931111<Enter>
```

When answering type:

```
ATCK<678901234567890>A<Enter>
```

This way, the encryption key is given to Omni TA128 just before it is needed.

Control of Data Encryption

The AT commands to control the data encryption are as follows :

S Register setting	Description
ATS89.0 = 1	DES is desired
ATS89.0 = 0	DES is disabled (Default)
ATS89.1 = 1	Triple DES is preferred
ATS89.1 = 0	Single DES is preferred (Default)
ATS89.2 = 1	Use a manually generated key

The DES request as well as any key distribution parameters, are exchanged via XID frames in the same way as V.42bis negotiation. Interested users can use the embedded protocol analyzer to examine the structure of XID frames. Both V.42bis and the data encryption functions can be invoked simultaneously for an ISDN data call. But the DES can not be used for bundle connections, due to the limitation of computing resources.

LED Indicators For Data Encryption

The B channel LED indicator (B1 or B2) lights up when the B channel is connected. A single blinking LED indicates that data transmission is protected by Data Encryption Standard (DES). A triple blinking LED indicates that data is protected by triple DES.

Chapter 9 - V.110 ISDN Communications

V.110 is most popular in Japan. This table shows the specifications of different ISDN protocols.

	V.110	**V.120**	**X.75**
Layer 1	80 Bits Framing	HDLC	HDLC
Layer 2	None	LAPD	LAPB Transparent
Layer 3	None	V.120	ISO8208T.70 NL
Error Control	No	Yes	Yes
V.42bis	No	Yes	Yes
Async or Sync if used with V-Series DTE	Async and Sync	Async Only	Async Only
Bundle	No	Yes	Yes
Max. Line Speed	Async: 38.4 Kbps Sync: 64 Kbps	64Kbps 128Kbps	64Kbps 128Kbps
AT-Command Configuration	ATB10	ATB20	ATB0: Transparent ATB01: T.70 NL

Table 9-1

There are two modes of V.110 synchronous operation :

1) **Asynchronous commands, synchronous data (AT&M1):** The Omni TA128 accepts AT commands in asynchronous mode. Once the call is connected, it enters synchronous mode for data transmission.

2) **Synchronous mode (AT&M3):** The Omni TA128 accepts synchronous commands **(V.25 bis)** and exchanges data synchronously with a remote TA.

Answering a V.110 call

Once you set the proper V.110 communication mode, either asynchronous or synchronous mode there is no need to configure the ISDN mode to the protocol of an incoming call. The Omni TA128 will be 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 answering command is issued.

One exception to this is when the ISDN data call is carried through Speech bearer. In this case, you would need to make an MSN entry for the phone number from which you are expecting the Data-over-Speech-bearer call to be coming, for X.75 protocol. Use **AT&ZI1=*n***. Please refer to the section entitled “Data over Speech Channel” in Chapter 4 for details.

To allow the Omni TA128 to answer the incoming call, you need to set S0 to a value greater than 0 (i.e. ATS0=1). Omni TA128 will answer the call and use asynchronous to

synchronous conversions to and from the DTE. If S0 is not set (S0=0), the DCE will report “RING” and will also make an audible ring notification.

Making V.110 Calls

Asynchronous V.110 Calls

Before ATDIxxx command is issue to make the dialing, you need to make sure that the Omni TA128 is in the asynchronous mode (AT&M0). Then use the following commands to configure V.110:

AT Command	Description
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 (Japanese version only)

Table 9-2

The highest Async V.110 user rate depends on bit 4 of S119 as follows:

- **S119.4=0** 19200 bps
- **S119.4=1** 38400 bps for areas other than Japan
- **S119.4=1** 57600 bps for Japanese version

If the DTE speed is higher than what has been set, the user rate on above table will be used.

The X bits in the 80-bit frame will be used for remote flow control.

Synchronous V.110 calls

Omni TA128 does not support synchronous operation currently. The following information is provided for future when the upgrade is available.

Use the following commands to configure V.110 for synchronous operation :

Command	**Function**
ATB10	64K or 56Kbps transparent mode
ATB13	User rate = 2400bps
ATB14	User rate = 4800bps
ATB15	User rate = 9600bps
ATB16	User rate = 14400bps
ATB17	User rate = 19200bps

ATB18	User rate = 48000bps
ATB19	User rate = 56000bps
ATB11	User rate = 64000bps

Table 9-3

***Note**: The Omni TA128 does not support network independent clock compensation. The synchronous timing source must be supplied by the Omni TA128, which is phase locked to the network synchronous clock.*

Chapter 10 - Handling Analog Calls

The analog adapters enable you to connect analog devices (e.g. telephone, fax, PBX, or modem) to an ISDN Basic Rate line. Any conventional analog telephony equipment which supports DTMF tone/pulse dialing can be plugged into any one of the **two** RJ-11 sockets (labeled phone 1 and phone 2) of the Omni TA128.

This chapter will outline the steps you need to take to place and answer analog calls via your ISDN line.

The analog adapters use RJ-11 phone jacks. The pin assignment of the jacks are shown in a later chapter.

Note for 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.

The following table shows some of the most frequently used AT commands for your reference:

AT Command	Description
ATDAs	Automatically dials out for device connects to Phone 1, “s” represents the number string to dial
ATDBs	Automatically dials out for device connects to Phone 2
AT&V6	View current setting of analog adapter, Phone 1
AT&V7	View current setting of analog adapter, Phone 2
AT&L0 or ATS84.5=0	Assigns analog calls to Phone 1 if the line is not in use
AT&L1 or ATS84.5=1	Assigns analog calls to Phone 2 if the line is not in use
AT&ZIn=s	MSN setting, assigns Called phone number, “s,” to be answered by “n” port (where n=6 for Phone 1 and n=7 for Phone 2):
AT&ZI6=s	Assign the Called phone number for analog adapter, Phone 1
AT&ZI7=s	Assign the Called phone number for analog adapter, Phone 2
ATS56=n	Flash timer, in 100 ms unit, to set maximum duration of ON-OFF hook transition to be recognized as “Flash”
	European switch specific
ATS89.6=0	To disable the metering pulse for analog adapter, Phone 1
ATS89.6=1	To enable the metering pulse for analog adapter, Phone 1
ATS89.5=0	To disable the metering pulse for analog adapter, Phone 2
ATS89.5=1	To enable the metering pulse for analog adapter, Phone 2

Table 10-1

Placing a Call from the Analog Adapter

Making a call from the analog adapter is as easy as picking up the telephone connected to the analog port and dialing. With a terminal program's assistance you can also use the Omni TA128 to dial the number for you.

Type:

```
ATDB714-693-0808<Enter>
```
(Dial the number)

Omni TA128 returns:

```
CONNECT
```
(Dialing is complete)

Now, just pick up the phone handset and wait for the remote device to answer.

Use **ATDAs** (**ATDBs**) to place a call for the analog adapter 1 (analog adapter 2)

The way the analog ports work for Omni TA128 is: once the analog adapter's hook sensor detects that the telephone device's handset is picked up (off hook), it sends a **SETUP** message to the ISDN central exchange to request a connection. One B channel, if available, will be assigned to this connection and the exchange will wait for the dialed number to route the call. At the same time, a dial tone is presented to the adapter port to prompt the user to dial. Both tone and pulse dialing are accepted.

A busy tone will be heard on the handset if:

1) B channel is unavailable

2) the dialed number is undeliverable

3) the called party is busy

This indicates the failure of the attempt to connect. To place another call, hang up the phone, then pick it up again. If the called party is being alerted, a ring-back tone will be heard.

Accepting an Incoming Call

Incoming ISDN calls are directed to one of the analog adapters if:

1. Voice call will be send to one of the two analog adapters automatically when it received. As the manufacture default, the call will be send to analog adapter, Phone 1 first, then Phone 2 if Phone 1 is busy.
2. The MSN is set (AT&ZIn=s, as shown in Table 4-1) where you specify the phone number, "s", the remote user dialed to be send to specific analog adapter, "n".
3. The MSN setting for the phone number in the incoming SETUP message is acceptable to both the analog adapters, the ambiguity resolution bit (Bit 5 of S84, or &Ln) is set to 0 (analog adapter 1 has the higher priority) or 1 (analog adapter 2 has the higher priority).

***Note**: The default MSN Sub-address(or EAZ for 1TR6) of the analog adapter is 4. For a detailed description of the call addressing scheme, please refer to later chapter , Advanced ISDN Call Control.*

Chapter 11 - Advanced ISDN Call Control

Call Control for DSS1 (Digital Subscriber Signaling #1)

In order to initiate an DSS1 ISDN call, two information elements are necessary:

1) The **Bearer Capability** element indicates what kind of bearer service is desired. It is also used for compatibility checking in the addressed entity.

2) The **Called Party Number** element provides necessary information for the telephone company Central Office (CO) to direct the call to the destination.

Other optional information elements which are pertinent to call control include:

- High-Layer-Compatibility
- Low-Layer-Compatibility
- Calling-Party-Number
- Called-Party-Number
- Calling-Party-SubAddress
- Called-Party-SubAddress

Control of Outgoing Service Indicator

The **High-Layer-Compatibility** and **Low-Layer-Compatibility** information provides a means for compatibility checking by the called party. They are transferred transparently by the ISDN network between the call originating entity (e.g. the calling user) and the addressed entity.

The outgoing **High-Layer-Compatibility** can be controlled by setting the value of S-register S(108+n) as follows

n=0 (**S108**) Setting for analog adapter 2
n=2 (**S110**) Setting for ISDN data calls
n=3 (**S111**) Setting for analog adapter 1

S(108+n=)	Function
0	No High-Layer-Compatibility info element will be sent (default)
1	Telephony
4	Facsimile Group 2/3
40	Teletex service (Rec. F.220)
49	Teletex service (Rec. F.200)
50	International interworking for video services (Rec. F.300 and T.110)
53	Telex service (Rec. F.60)
56	Message Handling Systems (MHS) (Rec. X.400 series)
65	OSI application (Rec. X.200 series)

Example: AT**S111=4** sets Fax compatibility message for Analog Port 1.

Bearer-Capability and **Low-Layer-Compatibility** information elements will be determined when you configure the B channel protocols using the command **ATBnn**. The outgoing Low-Layer-Compatibility information element can be turned on or off by setting **S80 bit '*n*'** as follows:

n = 4 for the analog adapter 2
n = 6 for ISDN data calls
n = 7 for the analog adapter 1

S80.*n*=0	Disable outgoing Low-Layer-Compatibility (default)
S80.*n*=1	Enable outgoing Low-Layer-Compatibility

Example: AT**S80.4=0** disables Low-Layer-Compatibility message for Analog Port 2.

Control of ISDN Phone Number and Sub-address

The **Calling-Party-Number** information element identifies the *origin* of a call, and the **Called-Party-Number** information element identifies the *destination* of a call.

The **Calling-Party-Subaddress** information element identifies the Subaddress associated with the *origin* of a call. The **Called-Party-Subaddress** information identifies the Subaddress of the *destination* of a call.

Each type of outgoing call can be assigned with one Number/Subaddress pair by using the command **AT&ZO*x*=s.** The possible values for ***x*** are as follows.

x = **I** for ISDN data calls

x = **A** for the analog adapter 1

x = **B** for the analog adapter 2

The number-Subaddress-string '***s***' is defined as:

s = **[[Y*n*][N*n*]own-number][/[[Z*n*]own-Subaddress]/]**

where **Y*n*** specifies the type of number:

Y0	unknown (default if Y*n* is omitted)
Y1	international number
Y2	national number
Y3	network specific number
Y4	subscriber number

N*n* is the identifier of numbering plan:

N0	unknown (default if N*n* is omitted)
N1	ISDN numbering plan (Rec. E.164)
N3	data numbering plan (Rec. X.121)
N4	telex numbering plan (Rec. F.69)
N8	national standard numbering plan
N9	private numbering plan

Z*n* specifies the Subaddress type:

Z0	NSAP (Rec. X.213) with AFI=0x50, IA5 characters (default if Z*n* is omitted)
Z2	user specified, IA5 characters

The command **AT&ZO*x*=//** will remove the Number/Subaddress assignment.

The number and Subaddress assigned by **AT&ZO*x*=*s***, if any, will be used for Calling-Party-Number and Calling-Party-Subaddress information elements respectively while dialing.

The default settings of the Phone Number and Subaddress of all the types of calls are **UNASSIGNED -** meaning the SETUP message sent by the Omni TA128 contains neither Calling-Party-Number nor Calling-Party-Subaddress information elements.

The command **AT&ZO?** can be used to browse the current settings of the own numbers and subaddresses.

Call Control for 1TR6 (Old German ISDN)

In order to initiate an 1TR6 ISDN call, two information elements are necessary:

1) **Service Indicator**
2) **Destination Address**

The **Service Indicator** determines what kind of bearer services are desired. The **Destination Address** provides necessary information for the telephone company Central Office (CO) to direct the call to the remote party.

Control of Outgoing Service Indicator

The **Outgoing Service Indicator** will be assigned when you configure the B channel protocols using the command **ATBnn**. (See Chapter 7 for a more detailed description.)

Since there are a number of combinations of voice or voice-band-data services on the analog adapters, users may want to control the outgoing Service Indicator themselves for some specific applications.

The following table is recommended to configure **S104/S107** (Service Indicator) and **S108/S111** (Additional Information Octet) according to the terminal types :

	Service Indicator **S107 : analog adapter, Phone 1** **S104 : analog adapter, Phone 2**	**Addi. S. I.** **S111 : analog adapter, Phone 1** **S108 : analog adapter, Phone 2**
Telephone	1 (*Fernsprechen*)	1 (*3.1 KHz*)
Modem	2 (*analog - dienste*)	3 (*Daten Über Modem*) or 4 (*Btx Über Modem*)
G3 Fax	3 (*analog - dienste*)	2 (*Fax Gruppe 3*)

Control of ENDGERÄTEAUSWAHLZIFFER (EAZ)

EAZ (or Terminal Selection Code) is the last digit of an ISDN phone number in 1TR6. Usually EAZ=0 indicates that a global call (any terminal on the S0 interface) which is service-compatible with the incoming call, can answer the call.

Other values of EAZ (1,2,....,9) provides the possibility for assigning multiple ISDN numbers to a single ISDN BRI line. A calling user can select, via the public network, one or more distinct terminals on a single BRI line.

With its highly integrated, multi-function features, the Omni TA128 can be imagined as a "black box" containing multiple distinct terminals. Each of these "internal terminals" can be assigned one EAZ using the command **AT&ZI*n*=*m*,** where *n*=0-7 and *m*= 0-9.

Command	Function
&ZI0=*m*	assigns EAZ for X.75
&ZI1=*m*	assigns EAZ for V.110
&ZI2=*m*	assigns EAZ for V.120
&ZI3=*m*	assigns EAZ for PPP, MPPP
&ZI4=*m*	assigns EAZ for ISDN data, protocol auto-detection
&ZI5=*m*	assigns EAZ for PPP, MPPP
&ZI6=*m*	assigns EAZ for Phone 2
&ZI7=*m*	assigns EAZ for Phone 1

Table 11-1

The default EAZ of each protocol is as follows :

&ZI**0=1**	for **Data;**
&ZI**4=2**	for **Data;**
&ZI**6=3**	for the **analog adapter, Phone 2;**
&ZI**7=4**	for the **analog adapter, Phone 1.**

AT&ZI? can be used to display the EAZ numbers assigned by the AT&ZI*n=m* commands.

The EAZ (last digit) of the destination address in an incoming SETUP message will be checked with each protocol's EAZ. If there is a match and the service indicated is compatible with this protocol, the call will be accepted using the protocol.

Note: *The EAZs must be assigned precisely in order to accept calls accordingly.*

The suffix digit to an ISDN phone number in a dial out command will be used as the destination EAZ (in the Destination Address W-element) in the SETUP message sent to the destination. If this suffix digit is omitted, the switch will assume the EAZ as 0.

Each type of outgoing call of the Omni TA128 can be assigned with one origination EAZ by using the command **AT&ZO*x*=Origination_EAZ**, (where *x* = **I** for ISDN data calls, **A** for the analog adapter 1, and **B** for the analog adapter 2).

The command **AT&ZOx=//** removes the assignment of the origination EAZ.

The number assigned by **AT&ZOx=Origination_EAZ**, if any, will be used for the Origination Address W-element while dialing. The default settings of origination EAZ of all the types of calls are **UNASSIGNED,** meaning the SETUP message sent by the Omni TA128 contains no Origination Address W-element.

The command **AT&ZO?** can be used to list the current settings of the origination EAZs.

Answering a Call

The incoming call will first be identified as either an ISDN data call or a voice call (including the voice-band-data). ISDN data calls will be routed to the digital communications portion of the Omni TA128. Voice calls or voice-band-data calls will be assigned to the analog adapters.

Answering a Call for DSS1

The Multiple Subscriber Number (MSN) supplementary service provides the possibility for assigning multiple ISDN numbers to a single ISDN BRI line. Calling users can select, via the public network, one or more distinct terminals on a BRI line.

In some areas however, it is very expensive to get additional subscriber numbers. The Subaddress, which is transferred transparently by the ISDN network between the call originating entity (e.g. the calling user) and the addressed entity, can be used for the same purpose as the MSN. Since the Omni TA128 is highly integrated and multi-functional, it can be imagined as a “black box” that contains multiple distinct terminals. Each of these "internal terminals" can be assigned one ISDN number using the **AT&ZIn=xxxx**... command.

The number assigned by AT&ZIn=xxxx... can be interpreted as either the MSN or the Subaddress. This is determined by the bit 5 of S119 as follows.

S119.5=0 number is treated as the MSN (default)

S119.5=1 number is treated as the Subaddress

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 or the called party Subaddress), this address will be compared with the MSN/Subaddress numbers assigned by the AT&ZIn=xxxx... commands. The call will be accepted using the specific protocol if the assigned number of this protocol matches with the received called party number or called party Subaddress.

Note : *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 of the shorter string. Usually one digit is enough to distinguish the various protocols.*

Answering a Call for 1TR6

If an incoming **SETUP** message is offered with addressing information (i.e. the destination address W-element). This address will be compared with the EAZ numbers

assigned by the AT&ZI*n=m* commands. The call will be accepted using the specific protocol if the assigned number of this protocol matches with the received address.

Best-effort Call Answering

If some numbers have been set using &ZI command (as can be seen by the AT&ZI? command) and they are not matched with the address of the incoming call, the Omni TA128 will, by default, ignore the call as it may be intended for other devices that share the same S/T interface (S0 bus) with the Omni TA128.

If you want the Omni TA128 to answer inbound calls as often as possible, you can set the best-effort call answering bit as follows:

S119.3=0 Answer call only when number matched (by default)

S119.3=1 Best effort call answering

Ambiguity Resolution Switch for Voice Calls

For a voice or voice-band-data call, if the &ZI number assignment can tell which of the analog adapters is being addressed, then the call will be delivered to the proper destination. But sometimes, ambiguity of address matching may exist. This may happen if the &ZI numbers of the various protocols are either unassigned or not matched or the address information is absent in the incoming SETUP message. In this case, users may wish to set the priority of answering a call by the analog adapter, Phone 1, or the analog adapter, Phone 2. The AT&Ln command sets the address ambiguity resolution flag :

AT&L0 The analog adapter 1 has the higher priority to answer a voice or voice-band-data call; if the analog adapter 1 is busy, the call will be routed to the analog adapter, Phone 2.

AT&L1 The analog adapter 2 has the higher priority to answer a voice or voice-band-data call; if the analog adapter 2 is busy, the call will be routed to the analog adapter, Phone 1.

Multi-Auto-Answering of Data Calls

For an ISDN data call, if the Omni TA128 can exclusively determine the protocol to be used by means of the information conveyed by the SETUP message (for DSS1, these include the Bearer-Capability, Low-Layer-Compatibility, or High-Layer-Compatibility information elements; for 1TR6, these include the Service Indicator as well as the Additional Octet of Service Indicator), then the indicated protocol will be used. Otherwise, the Multi-Auto answering process will be invoked. The Omni TA128 can monitor the B channel signal sent by the calling site.

The data call can be identified by the Omni TA128 to be X.75, V.110, V.120, or PPP Async-to-Sync, conversion and MPPP.

Data Call Indication

Data calls are accepted the same way as in any modem. When alerting, the Omni TA128 will send the first RING message to the DTE with a format as follows:

```
RING <CR><LF>
[FM:[[Prefix]Calling-Party-Number][/Subaddress/]]
[TO:[Called-Party-Number][/Subaddress/]] <CR><LF>
RING <CR><LF>
RING <CR><LF>
......
```

The display of address information between the first RING and the second RING can be disabled by setting **ATS84.4=1**. The term [Prefix] is a predefined number string to be added in front of the Calling-party-number before indicating it to the DTE. This is useful for some automatic dial-back-up systems. The number string can be assigned as follows:

ATCI<Prefix>	When and only when the type-of-number denotes an international number will this "Prefix" be added to the Calling-party-number before indicating it to the DTE.
ATCI<>	Disables the international number prefix-adding function. (Default)
ATCN<Prefix>	When and only when the type-of-number denotes a national number will this "Prefix" be added to the Calling-party-number before indicating it to the DTE.
ATCN<>	Disable the national number prefix-adding function. (Default)

***Note**: The angle brackets '<' and '>' are part of this command.*

Disable inbound call connection

In some cases, the user may require the Omni TA128 **not** to answer any incoming calls. This can be done by setting the bit 0 of S-register S118:

S118.0=0	Enable the TA128 to answer a call (by default)
S118.0=1	Disable the TA128 to answer any call

Point-to-Point Configuration

In some areas, since the Direct-Dial-In (DDI) number is less expensive than the MSN, users may want to subscribe to point-to-point ISDN to employ the DDI function. In this case, only one TA can be connected to the ISDN line and the TEI (Terminal Equipment Identifier) is always ZERO. This can be done by setting the bit 1 of S-register S119:

S119.1 = 0	Disable point-to-point DDI function (default)
S119.1 = 1	Enable point-to-point DDI function

Placing a Call

To initiate a call, configure the Omni TA128 according to the Bearer Service (or protocol) you want to use.

ATBnn for ISDN data call

Placing a call for DSS1

The **ATD*x*** command is used for dialing as follows.

ATD*x*[Y*n*][N*n*]called_party_number[/[Z*n*]called-party-subaddress/]

x = **I** (for ISDN data calls), **A** (for the analog adapter 1), or **B** (for the analog adapter 2).

Y*n* specifies the type of number:

Y0	unknown (default if Yn is omitted)
Y1	international number
Y2	national number
Y3	network specific number
Y4	subscriber number

N*n* is the identifier of numbering plan:

N0	unknown (default if Nn is omitted)
N1	ISDN numbering plan (Rec. E.164)
N3	data numbering plan (Rec. X.121)
N4	telex numbering plan (Rec. F.69)
N8	national standard numbering plan
N9	private numbering plan

Z*n* specifies the type of the Subaddress:

Z0	NSAP (Rec. X.213) with AFI=0x50, IA5 characters (default if Zn is omitted)
Z2	user specified, IA5 characters

The **called_party_number** or an appropriate part of it, will be sent to the addressed entity. The **called_party_subaddress** will be transferred transparently by the ISDN network to the destination.

Use **ATDL** to redial the last dialed telephone number (and/or Subaddress).

Placing a call for 1TR6

The **ATD*x*[Y*n*][N*n*]destination_address** command is used for dialing as follows.

x = **I** (ISDN data), **A** (the analog adapter 1), or **B** (the analog adapter 2)

Yn specifies the type of address:

Y0	unknown (default if Yn is omitted)
Y1	international number
Y2	national number

Nn is the identifier of numbering/addressing plan:

N0	unknown (default if Nn is omitted)
N1	ISDN numbering plan (Rec. E.164)

The **destination_address** is the ISDN phone number of the called party. The last digit of this number is the EAZ. Use **ATDL** to redial the last dialed ISDN phone number.

***Note**: For those users who like to look into ISDN communications and the communications between Omni TA128 and computer system, it is recommended that you use the **Embedded Protocol Analyzer, please refer to the chapter "**Diagnostics and Protocol Analyzer**"** The Analyzer gives you a complete detail of ISDN call control and allows you to see your activities on the Omni TA128.*

User-To-User Information

Omni TA128 supports user-to-user information exchange via the D channel. To transmit a message, use **ATT4<message.....>** command. The angle brackets '<' and '>' are part of the this command. The message will be included in an User-To-User Information Element which is sent with the first valid MESSAGE that follows.

If the **ATT4<message.....>** command is issued before dialing, the User-To-User Information Element will be sent in the SETUP message. Whether the Information Element can be sent to the called party or not is switch dependent. If it does, the called party can see the message before the call is answered.

During a call connection session the D channel can still be used to exchange user-to-user information. For the single stream configuration, both sides must be in 'Escaped' state, because only so can they send the AT commands and view the responses.

The user-to-user information is a supplementary service that has to be invoked on a per-call basis.

Chapter 12 - Security Functions

Password Security Functions

Security Types and Levels

The Omni TA128 provides security functions that may be enabled to prevent unauthorized connections. Two types of security functions are provided.

- **Type 1** security is to be used when the remote TA is a ZyXEL ISDN TA
- **Type 2** security is to be used when the remote TA is non-ZyXEL.

With a **Type 1** connection, the dial-in (remote) TA will send in its supervisor password for matching with local Omni TA128's 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 TA128 will match the entered password with the pre-stored password list.

The two types of security are summarized in the table below:

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

- **Level 1 security**

Will only perform password checking. With Level 1 security, the local TA will maintain the connection if the password is matched, the line will be disconnected otherwise.

- **Level 2 security**

Provides extra Calling Party Number checking and call-back, the call-back 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 TA will check the Calling Party Number (CPN) (or Origination Address for 1TR6) 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 TA will disconnect the call. If CPN is unavailable in the SETUP message, the local TA will disconnect the call and then call back using the pre-stored number corresponding to the dial-in password.

- **Level 3 security**

Once the password is matched the local TA will prompt the remote user to enter a call back number.

The three levels of security are summarized in the table below:

	Level 1	**Level 2**	**Level 3**
Password Check	*Yes*	*Yes*	*Yes*
CPN Check OK and S119.6=0	*N/A*	*Call back*	*N/A*
CPN Check OK and S119.6=1	*N/A*	*Keep the connection*	*N/A*
CPN unmatched	*N/A*	*Disconnect*	*N/A*
CPN not Available	*N/A*	*Call back using the corresponding pre-stored number*	*Prompts the remote user to enter call back number for calling back.*
AT Commands	**G1 for Type 1* **G3 for Type 2*	**G2 for Type 1* **G4 for Type 2*	**G5 for Type 2*

Setting and Modifying Passwords

40 user passwords may be defined by **AT*H*n*** command, where "*n*" represents the index to the entry, numbers between 0-39 are accepted.

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

The security functions are only accessible through AT commands in terminal mode. Supervisory password is required for adding or to modify the entries. The default supervisor password is **ZyXEL** when Omni TA128 is shipped from the factory. This supervisory password is send to remote if Type 1 security is set at remote end.

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

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

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

Use command **AT*H*n*** to modify the "*n*"th user password. You will be prompted to enter the supervisory password first and then the user's password for this entry will be requested and verified. The command **AT*V** will list the 40 user passwords and the supervisor password on the 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 TA128 provides another simpler call back function. 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 rejected (without connection, hence without any charge) and the TA128 will automatically call back using the matched phone number.

This function can be controlled by the following command:

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 command:

AT*HCn=xxxx, n=0,1,..,4

You will be prompted to enter the supervisory password first.

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

Chapter 13 - Upgrading Your Omni TA128

This chapter describes how to upgrade flash EPROM firmware when it is available.

Upgrading with Flash EPROM

Your Omni TA128 modem employs a flash EEPROM that lets you conveniently download updated firmware and program the modem with new features and enhanced functions.

1) Obtain the new firmware from ZyXEL's BBS, WWW, or FTP site. (Refer to the chapter entitled "Contacting ZyXEL.") The firmware is distributed in a file "**TA128*d.vvv***", where the extension **vvv** denotes the version of this firmware. The modifier ***d*** in the filename has the following definitions:

   G German national ISDN (1TR6)

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

   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 power-on test, it checks the hardware configuration and follows the initialization procedures of the specific interface.*

2) Make sure your Omni TA128 is turned ON.

3) Start any communications program that supports the Xmodem protocol, and type:

   ```
   ATUPX<Enter>
   ```

   Omni TA128 responds:

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

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

4) Press Y. The following message then appears:

   ```
   Start programming, please upload
   ```

5) Use the Xmodem protocol to upload the file TA128d.vvv to your modem. This step updates the modem's flash EEPROM with the new firmware. When installation is complete, the modem will restart automatically.

In the unlikely event that your modem fails to respond to AT commands after upgrading the EEPROM follow the procedure below.

1) Power cycle the Omni TA128. The Cold reset will prompt the TA to check the integrity of the codes in the flash EEPROM.

2) If proper valid firmware can not be verified, the Omni TA128 will initiate Kernal Mode. Once it is in Kernal mode, you can issue limited “AT” commands. From this point, you can start from item 3 or our upgrading procedure.

Chapter 14 - Usage of DTE Port 2

This chapter describes how to set the TA128 into Two-DTE Port and One Analog Port mode in which two users can use the TA128 simultaneously to place two independent calls to access the Internet. The two-DTE-port feature is also ideal for Service Providers in that two users can be serviced concurrently through two COM ports, one TA128, and one ISDN BRI line.

Selection of the Two DTE Port Mode

By default, one DTE port and two POTS ports of the TA128 are operable. But more often than not, since there are two B channels for your ISDN line, two users may want to share the TA128 to access the Internet simultaneously. To make use of the second DTE port, please set bit 0 of the S125 **via DTE port 1**.

ATS125.0=0	One DTE port and two POTS port mode (default)
ATS125.0=1	Two DTE ports and one POTS port mode

The mode selection command must be followed by the following procedures:

1. **AT&Wn** to save the configuration as a user profile **n,** where n=0,1,2, or 3.
2. **ATZn** to select the said user profile **n** as the power-on default settings.
3. Turn off the TA128 for a while and then turn it on again.

Now the DTE port 2 is ready to be used.

Note: (1) *Once the two-DTE-port mode is selected, the POTS port marked "Phone 2" is disabled, i.e. it can neither be used to place a call nor to answer a call. The POTS port marked "Phone 1" is operable as usual.*

Mode	*DTE Port 1*	*DTE Port 2*	*POTS Port 1*	*POTS Port 2*
ATS125.0=0 *One DTE Port and Two POTS Ports (by default)*		✘		
ATS125.0=1 *Two DTE Ports and One POTS Port*				✘

Configuration of the DTE Port 2

The functions of DTE port 2 is quite simple compared with those of DTE port 1. Major differences between DTE port 1 and DTE port 2 are listed in the table below:

Functions	**DTE Port 1**	**DTE Port 2**
DTE Speed (Baud)	Up to 460.8 Kbps	Up to 115.2 Kbps
Auto Bauding	Yes	No (Rate must be set via DTE port 1)
B Channel Protocols	PPP/MP, X.75, V.110, V.120, and Bundle	PPP Async-to-Sync Conversion
AT Commands and S-registers	Fully configurable	Only a few commands can be used
User Profiles in NVRAM	Four User Profiles	Not Available
Flow Control	Software(XON/XOFF), or Hardware(RTS/CTS)	Hardware(RTS/CTS) only
Serial Port Async Format	Configurable	Fixed at No Parity, 8-bit data character, and one STOP-bit
Plug-and-Play for Windows	Yes	No
RS-232 Connector	DB25 Female	DB9 Female

The following tables list all of the AT commands for DTE port 2 supported by the Omni TA128. An asterisk * following a command option or value indicates that it is a default setting when the modem is shipped.

Notes for techies: *To maximize the TA128's compatibility among various systems, DTE port 2 will, by default, ignore all unrecognized AT commands such that they will be responded to with "OK" without any action. This conforms to the SIMPLICITY principle of DTE port 2. You can set ATS128.7=1, however, to resume the normal operation mode in which any unrecognized commands will cause an "ERROR" indication.*

Basic "AT" Command Set

Command	**Options**	**Function & Description**	**Ref.**
<any key>		Terminate current connection attempt when entered in handshaking state.	
+++		Escape sequence code, entered in data state, wait for the Omni TA128 to return to command state.	
All the Following Commands Require an "AT" Prefix			
A		Go on-line in answer mode.	
B*nn*		Select ISDN Teleservice 'B' must be followed by two digits.	
	B40 *	PPP async to sync conversion	
		All other values are invalid	
D*s*		Dial s (numbers and options) that follows. The options of s are listed as follows:	
	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	
	Format of "s"	[[Yn][Nn]called_party_number] or [[Yn][Nn]called_party_number][/[Zn]called_party_subaddress/]	
DI*s*		Same as **D*s***	
DL		Repeat last ATD command	
DM*s*		Same as **D*s***	
E*n*		Command mode local echo control	S128.1
	E0	Echo off	
	E1 *	Echo on	
H		Hang up (on-hook) the ISDN connection	
I*n*		Display inquired information	
	I0	Display product code, same as 'ATI' Results: 1281 (USA) 1282 (DSS1) 1283 (1TR6)	
	I1	Display product information and ROM checksum Results: Omni TA128 <switch>: V x.xx where <switch>= USA, DSS1, or 1TR6	
	I9	Display Microsoft PnP code	
O		Return to on-line state	
S0=*n*		Set S-register s0. 'n' must be a decimal number between 0 and 255	S0
	n=0	Non-automatic call answering	
	n!=0	Automatic call answering after n times of ringing	
Vn		Sets display type for Result Codes	S128.6
	V0	Display result code in numeric form.	
	V1 *	Display result code in verbose form.	

Xn	n=0-7 5 *	Result code options, see the Options Table in Chapter 16 “AT Command Set Reference”	S131.3-5

Extended "AT&" Command Set

Command	Options	Function & Description	Ref.
&Cn		Carrier Detect (CD) options	
	&C1 *	CD tracks presence of carrier	
		All other values are invalid	
&Dn		Data Terminal Ready (DTR) options.	
	&D2 *	108.2, Data Terminal Ready, DTR OFF causes the TA to hang up.	
		All other values are invalid	
&En		B channel line speed for ISDN data call	S128.2
	&E0 *	64Kbps	
	&E1	56Kbps (Default for American ISDN)	
&F		Load factory settings to RAM as the active configuration.	
&Hn		Data flow control, DTE/DCE.	
	&H3 *	Hardware (CTS/RTS) flow control	
		All other values are invalid	
&On		Set default call type for conventional dialing commands	
	&O2 *	ATDs, ATDPs, and ATDTs default to make ISDN data calls	
		All other values are invalid	
&Sn		Data Set Ready (DSR) function selection.	
	&S0 *	DSR overridden, DSR always ON.	
		All other values are invalid	
&Vn		View profile settings.	
	&V0	View current active settings.	
	&V5	View factory default settings.	
	&V6	View analog adapter, Phone 1 setting	
	&V7	View analog adapter, Phone 2 setting	
&ZIn=s	s=phone number	MSN setting.	
	n=5	Assign the phone number for DTE port 2	
		All other values are invalid	
&ZI?		Display the phone number for various B channel protocols	
&ZO?		Display the &ZOn setting	

&ZOn=x		Write own phone number (including subaddress, if any). The number specified will be used as the calling party number while dialing. Value for "n" I = ISDN data A= analog adapter, Phone 1 B= analog adapter, Phone 2	

Setting of DTE port 2 Speed

The DTE speed of DTE port 2 can be configured **ONLY through DTE port 1**. The command **AT*An** can be used for this purpose:

***A1** 115200 bps (by default)
***A2** 76800 bps
***A3** 57600 bps
***A4** 38400 bps
***A5** 19200 bps
***A6** 9600 bps
***A7** 2400 bps

Call Control of the DTE Port 2

To place a call through DTE port 2, please use the ATDxxxx command. If the Calling Party Number (the original address) is required in the outgoing SETUP message, it can be pre-stored using the AT&ZOI=xxxx command. Once the PPP connection is established, the TA128 will indicate the connection message with DTE speed as follows:

CONNECT 115200 PPP

Use ATV0, if numerical result code is required.

To answer a call through the DTE port 2, the MSN(or subaddress) must have been set by the **AT&ZI5=xxxx** command and the number **xxxx** must be matched with the Called Party Number (the destination address) of the incoming call. Please refer to the section entitled "Answering a Call using MSN" in Chapter 4 for more information.

Chapter 15 - Diagnostics and Protocol Analyzer

This chapter provides quick easy-reference diagnostic tables for the Omni TA128. The Omni TA128 can perform its own diagnostic tests, which can provide invaluable information about each of its functions.

Diagnostics

The Omni TA128 ISDN TA provides several diagnostic capabilities:

- Embedded Protocol Analyzer
- Power-on Self-test
- Local Digital Loopback Test
- Diagnostic Command
- Omni TA128 Reset

Power-on Self-test

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

The following table is a summary of the Omni TA128's self-test:

Test Seq.	LED LNK	LED B1	LED B2	LED AA	Test Description
1	on*	off	off	off	Memory test
2	off	on*	off	off	ISDN chip interface test
3	off	off	on*	off	ISDN chip functional test
4	off	off	off	on*	HDLC functional test

**** Note :*** *The LED lights up while test is going and blinks if test fails.*

The LNK LED will light up for half a second to indicate the success of the Omni TA128's power- on self-test. After this, 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) or the U interface chip (Siemens 2091 chip) just behind the line transformers, thus it checks almost every part of the ISDN TA and RS-232 cable except the passive front-end of the ISDN S/T or U interface.

During this test, data from the terminal or computer is sent through the DTE interface to the ISDN TA's transmitter and is packetized to the proper frame format according to the B channel protocol selected and then loop-backed to the receiver, de-packetized, and sent through the DTE interface back to the terminal or computer's screen. You can tell if anything is wrong by looking at the screen. The screen should show the data you have sent to the 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 ISDN TA and will go through the same path as the above Loopback Test does. 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 happen, the LNK LED will start to flash. Send any character through the DTE interface to the ISDN TA will discontinue the test.

The Diagnostic Command (ATCG)

The ATCG command can be used to test and isolate fault if there is any the hardware problem of the Omni TA128. Some of the tests are interactive operations, just follow the indications prompted on the screen to carry out the tests. If the Omni TA128 is in the normal condition, the test results will be 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
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 prompt signal of the Internal Speaker and then press the button
switch.......!!
Button switch is pushed (Button Interrupt) ..........              OK
```

Resetting The Omni TA128

If you have modified the Omni TA128's setting and cannot get it back because of the unit is locking up, or you just want to reset it back to the factory default state, the following reset procedure will help you to reset the Omni TA128 back to the factory default state.

Holding the DATA/VOICE key down while turn the unit ON, keep holding down the switch for 3 seconds after the power switch is turned ON then release the switch. Omni TA128 will reset itself back to the factory setting and it will also run a continuous loop-back self-test. Printable characters will show on the terminal screen if it is connected to one.

Using The Embedded Protocol Analyzer

Setting up the Embedded EPA

The embedded protocol analyzer (hereafter abbreviated as EPA) records and analyzes various protocols on the B channel, D channel and DTE-DCE interface. The results are displayed with ANSI color. This professional tool is designed for hobbyists as well as users with technical backgrounds. The EPA enables you to examine messages exchanged between your Omni TA128 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. You can also check the AT commands issued from an application software program. 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 the TA at the remote site, the EPA will be your first aid resource. According to the EPA's analysis, you may decide to fix the problem yourself (e.g. 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's Tech 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 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 Omni TA128 and your Central Exchange.

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 (e.g. T.70, T.90, and ISO8208), only the first 8 octets of the information field are recorded as the layer 3 header, and are displayed in raw data form. The analysis of the protocol data will be carried out by ZyXEL's Technical Support department.

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 ZyXEL CAPI driver. The ZyXEL CAPI driver communicates with the Omni TA128 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 0.01 second.

The following commands determine the kind of protocol data to be captured by the EPA:

AT Command	Description
ATCD*n*	
n=0	Disable the capture of D channel protocols
n=1	Enable the capture of D channel protocols (default)
ATCB*n*	
n=0	Disable the capture of B channel protocols (default)
n=1	Enable the capture of B channel protocols
ATCC*n*	
n=0	Disable the capture of DTE-DCE interface protocols (default)
n=1	Enable the capture of DTE-DCE interface protocols

The EPA starts to capture data when the command ATCT is issued. This capturing process will continue 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:

AT Command	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.

The analyzed results can be viewed as if it were 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 functions of the control keys follow:

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

Any other key will pop up this control menu.

Chapter 16 - AT Command Set Reference

Operation Modes of the DTE Interface

There are two operation modes for the DTE interface :

- **Simplex mode** is used for conventional AT Command operation.
- **Multiplex mode** is used as an internal interface for ZyXEL CAPI drivers.

Simplex mode

In simplex mode, the Omni TA128 is used just like an ordinary modem. The DTE interface will be either in the command state or in the data state. At most, only one data connection session is possible at any time.

To invoke various functions of the Omni TA128, a number of different AT Commands can be used. The simplex mode is designed for the 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 purpose.

Conceptually, there are four DTE channels :

DTE channel 0	for the analog adapter 2
DTE channel 1	for ISDN data
DTE channel 2	for ISDN data
DTE channel 3	for the analog adapter 1

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

Since it is not intended for all users, the specifications and manual for the multiplex mode will be available in a separate text file, and will only be available in the electronic format upon request.

Note : *To use the CAPI driver, please refer to the file "CAPIMENU.TXT" in the attached floppy disk.*

AT Command Descriptions

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

Exceptions to this are A/, A>, and +++. These commands are not preceded by AT, or followed by any more characters.

A/ re-executes the last command once

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

+++ is the escape sequence code that is entered in data state to return the modem to command state. The modem will accept AT commands only while it is in command state.

The AT command prefix may be typed in either upper 'AT' or lower case 'at'. 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 TA128. An asterisk * following a command option or value indicates that it is a default setting when the modem is shipped.

Basic "AT" Command Set

Command	Options	Function & Description	Ref.
A/		Re-execute the last command once	
A>		Re-execute the last command once or repeat the last call up to 9 times. (See also S8)	
<any key>		Terminate current connection attempt when enter in handshaking state.	
+++		Escape sequence code, entered in data state, wait for modem to return to command state.	
All the Following Commands Require a "AT" Prefix			
A		Go on-line in answer mode. (See also S39.2, S43.6)	
B*nn*		Select ISDN Teleservice 'B' must be followed by two digits.	S82 S102
	B00	X.75 Transparent	
	B01	X.75 T.70	
	B04	BTX (Data X-J)	
	B10	V.110 user rate follows DTE speed (async.) or V.110 user rate determined by in-band negotiation (sync.)	
	B13	V.110 user rate = 2400 bps	S117
	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 = 384000 bps (sync only)	
	B19	V.110 user rate = 576000 bps (sync only)	
	B20	V.120	
	B40	PPP async to sync conversion	

Command	Options	Function & Description	Ref.
	B41	SLIP async to sync conversion	
CB*n*		Configuration of embedded protocol analyzer	S84.1
	CB0	Disable the capture of B channel protocols	
	CB1	Enable the capture of B channel protocols	
CC*n*		Configuration of embedded protocol analyzer	S84.0
	CC0	Disable the capture of DTE-DCE interface protocols	
	CC1	Enable the capture of DTE-DCE interface protocols	
CD*n*		Configuration of embedded protocol analyzer	S84.2
	CD0	Disable the capture of D channel protocols	
	CD1	Enable the capture of D channel protocols	
CE		Dynamic bundling function for cFos	
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 international.	
CK<DES_key>		Set the key for DES (Data Encryption Standard)	
CL*n*	n=0-2048	Maximum size of user data in a packet (number of bytes)	
CL?		Inquire current setting of ATCLn	
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	S83.0
	CP0	Disable Loopback 4	
	CP1	Enable Loopback 4	
CR*n*	n=0-3 0 *	Resumes a previously suspended call, n is the call identifier(Europe)	
CS*n*	n=0-3 0 *	Suspend a call, n is the call identifier (Europe)	
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 follow (see also S38.0, S35.4). The options of s are listed as follows:	
	,	Pause for a time specified in S6. Remaining digits will be dialed as in-band DTMF.	
	+	Prefix for the second number string, to be used in making bundling or MPPP calls	

Command	Options	Function & Description	Ref.
	W	Wait for second dial tone. Remaining digits will be dialed as in-band DTMF. <ISDN numbering options>	
	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	
	Format of “s”	[[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 Analog adapter, Phone 1	
DB*s*		Dial s (number and options) that follows for the Analog adapter, Phone 2	
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	
DS*n*	n=0-39	Dial number stored in non-volatile RAM at location 'n'; use “+” to dial two consecutive numbers for bundling or MPPP calls	S44.3
E*n*		Command mode local echo of keyboard commands	S23.0
	E0	Echo off	
	E1 *	Echo on	
H*n*		On/off hook control	
	H0 *	Hang up (on-hook) the modem or ISDN, same as 'ATH'	
	H3	Hang up the analog adapter, Phone 1	
	H4	Hang up the analog adapter, Phone 2	

Command	Options	Function & Description	Ref.
I*n*		Display inquired information	
	I0	Display product code, same as 'ATI' Results: 1281 (USA) 1282 (DSS1) 1283 (1TR6)	
	I1	Display product information and ROM checksum Results: Omni TA128 <switch>: V x.xx where <switch>= USA, DSS1, or 1TR6	
	I3	Display link status report	
	I9	Display Microsoft PnP code	
L*n*	n=0-3 2 *	Speaker volume control. The higher the value, the higher the volume	S24.4-5
M*n*	M=0-2	Speaker control	S21.1-2
	M0	Speaker always OFF	
	M1 *	Speaker ON until call is answered	
	M2	Speaker always ON	
N*n*	n=0-3 3 *	Ring volume control.'N0' will disable the audio ring function	S24.0-1
O		Return to on-line state	
P*n*	n=0-6	D channel protocol selection (USA) for American Version	S86
	P0 *	Northern Telecom proprietary ISDN	
	P1	National ISDN 1 (1 SPID)	
	P2	National ISDN 1 (2 SPID)	
	P3	Reserved	
	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=0-1	Result code displayed	S23.7
	Q0 *	Modem returns result code	
	Q1	Modem does not return result code	
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'	
SPIDn=m		User enters Service Profile ID “m” (SPID), for USA switches	
	SPID0	First SPID number	
	SPID1	Second SPID Number, if any	
SPID?		Display the SPID setting(s)	
T		Repeat last user-to-user information (Europe)	

Command	Options	Function & Description	Ref.
T*n*<*string*>		The <string> will be sent to the called party via a user-to-user information element in the next message. Characters other than the alpha-numeric values can be represented by <nnn> in the string, where nnn is the unsigned value of the character. The maximum number of characters in the string is 31 for ETSI.	
	T0	User-specific protocol	
	T1	OSI high layer protocol	
	T2	X.244	
	T3	Reserved for system management convergence function	
	T4 *	IA5 characters	
	T7	ITU-TS recommendation V.120 rate adoption	
	T8	Q.931 user-network call control message	
UPX		Download firmware to the Flash EPROM using Xmodem protocol	
V*n*		Sets display type for Result Codes	S23.6
	V0	Display result code in numeric form. (See also S35.7 and the result code table of 'ATXn')	
	V1 *	Display result code in verbose form.	
X*n*	n=0-7 5 *	Result code options, see the Options Table	S23.3-5
Z*n*	n=0-4	Reset modem and set power-on profile.	S15.5-7
	Zn	Reset modem and load user profile n (0-3).	
	Z4	Reset modem and load factory settings.	
$		Basic command summary help	

Description of ATI3 Output:

The Link Status Report output appears as follows:

```
ZyXEL ISDN MODEM LINK STATUS REPORT

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

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
Bytes Received	Number of data bytes received from remote
Bytes Sent	Number of data bytes 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 were many FCS Errors, you may have experienced problems on the line)
HDLC Transmit Under-run	For modem's processor power measurement.
HDLC Receive Over-run	For modem's processor power measurement.

Extended "AT&" Command Set

Command	Options	Function & Description	Ref.
&C*n*		Carrier Detect (CD) options	S21.4
	&C0	CD always ON (See also S42.7)	
	&C1 *	CD tracks presence of carrier (See also S38.3, S42.7)	
&D*n*		Data Terminal Ready (DTR) options. (See also S25)	S21.6-7
	&D0	Ignore DTR signal, assume DTR is always ON.	
	&D1	108.1, DTR OFF-ON transition causes dial of the default number. (See also 'AT*Dn' and S48.4)	
	&D2 *	108.2, Data Terminal Ready, DTR OFF causes the modem to hang up.	
	&D3	Same as &D2 but DTR OFF causes the modem to hang up and reset from profile 0.	
&E*n*		B channel line speed for ISDN data call	S118.2
	&E0 *	64Kbps	
	&E1	56Kbps (Default for American ISDN)	
&F		Load factory settings to RAM as active configuration.	

Command	Options	Function & Description	Ref.
&H*n*		Data flow control, DTE/DCE.	S27.3-5
	&H0	Flow control disabled.	
	&H3 *	Hardware (CTS/RTS) flow control	
	&H4	Software (XON/XOFF) flow control.	
&J*n*		Bundle selection (See also S100)	S87.5-6
	&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	
&K*nn*		V.120/X.75 compression control. &K must be followed by two digits.	S83.2
	&K00	Disable V.42bis	
	&K44	Enable V.42bis	
&L*n*		Analog port selection during call answering	S84.5
	&L0	Set priority to analog port, Phone 1	
	&L1	Set priority to analog port, Phone 2	
&O*n*		Set default call type for conventional dialing commands	S83.4-5
	&O0	ATDs, ATDPs, and ATDTs default to make calls for analog adapter, Phone 2	
	&O2	ATDs, ATDPs, and ATDTs default to make ISDN data calls	
	&O3	ATDs, ATDPs, and ATDTs default to make calls for the analog adapter, Phone 1	
&S*n*		Data Set Ready (DSR) function selection.	S21.3
	&S0 *	DSR overridden, DSR always ON.	
	&S1	DSR according to CCITT (ITU-TSS). (See also S41.5, S44.4)	
&T*n*		TA testing.	
	&T9	Initiate ISDN Loopback test	
	&T10	Initiate ISDN Loopback with self test	
&V*n*		View profile settings.	
	&V0	View current active settings.	
	&V1-4	View the (n-1)th user profile settings	
	&V5	View factory default settings.	
	&V6	View analog adapter, Phone 1 setting	
	&V7	View analog adapter, Phone 2 setting	
&W*n*	n=0-3	Write current settings to user profile n in non-volatile RAM. (See also S35.6)	
&Z?		Display all the phone numbers stored in non-volatile RAM.	

Command	Options	Function & Description	Ref.
&Z*n=s*	n=0-39	Write phone number/s to NVRAM at location n (n=0-39) use AT*Dn or ATS29=n to set the default dial pointer.	
&ZI*n=s*	n=0-7 s=phone number	MSN setting. 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.	
	n=0	assigns MSN 's', phone number for X.75	
	n=1	assigns MSN 's', phone number for V.110	
	n=2	assigns MSN 's', phone number for V.120	
	n=3	assigns MSN 's', phone number for PPP, MPPP	
	n=4	assigns MSN 's' for ISDN data, protocol auto-detection	
	n=5		
	n=6	Assign the phone number 's' for analog adapter, Phone 1	
	n=7	Assign the phone number 's' for the analog adapter, phone 2	
&ZI?		Display the phone number (including subaddress , if any) for various B channel protocols	
&ZO?		Display the &ZOn setting	
&ZO*n=x*		Write own phone number (including sub-address, if any). The number specified will be used as the calling party number whiling dialing. Value for "n" I = ISDN data A= analog adapter, Phone 1 B= analog adapter, Phone 2	

Extended "AT*" Command Set

Command		Function & Description	Ref.
*A*n*	n=0-7	DTE speed for second DTE port	S43.0-2
	*A0	230400	
	*A1	115200	
	*A2	76800	
	*A3	57600	
	*A4	38400	
	*A5	19200	
	*A6	9600	
	*A7	2400	
*C*n*	n=0-3	Character length, including start, stop and parity bit.	S15.3-4
	*C0 *	10-bit character length.	
	*C1	11-bit character length.	
	*C2	9-bit character length.	
	*C3	8-bit character length.	
*D*n*	n=0-39	Set default dial pointer at telephone directory location n.	S29
	*D0 *	(See also S35.4 and S38.0)	
*GC*n*	n=0-1	Call-back function selection	
	*GC0	Disable call-back function	
	*GC1	Enable call-back function	
*HC*n=s*	n=0-4	Assign call-back phone number, “s” to storage location, “n”	
*H*n*	n=0-39	Modify user password table at location n.	
*HS		Modify supervisory password (Default: “ZyXEL”)	
*M*n*	M=0-2	Second DTE port flow control	
	*M0	Flow control disabled	
	*M1	Hardware flow control, RTS/CTS	
	*M2	Software flow control, XON/XOFF	
*N*n*	n=0-2	Second DTE port line setting	
	*N0	No parity, 8 data bit, 1 stop bit	
	*N1	Even parity, 7 data bit, 1 stop bit	
	*N2	Odd parity, 7 data bit, 1 stop bit	
*T		Recall the last CND (Caller ID) information.	
*V		View the Password table	
*VC		View the Call-back Number table	

Chapter 17 - Status Registers and Result Codes

S-registers (Status Registers) contain values that determine and reflect how your Terminal Adapter (TA) operates and executes commands. You can read the values and change them, either using terminal commands or the modem'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 this manual was written, Omni TA128 was equipped with 124 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’ with AT Commands, use:

```
ATSr?
```

To view all of the S-resister settings use the &Vn command:

```
AT&Vn
```

`n=0`	View S-register settings for current active profile
`n=1-4`	View settings for user profile number (n-1)
`n=5`	View the factory default settings
`n=6`	View the analog adapter’s setting, Phone 1
n=7	View the analog adapter’s setting, Phone 2

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.

```
ATS84.3=0 (for decimal format)
```

```
ATS84.3=0 (for Hex format)
```

To display the value of bit b of S-register r, type:

```
ATSr.b?
```

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 (b) of S-register r, use:

```
ATSr.b=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 b 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 **`ATS38.3=1`** (simple) or use the following (difficult):

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

Read the value from S38 using ATS38?
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

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

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

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

Finally, using the ***result*** decimal value, issue an **ATS38=n** to set the register.

S-Register Descriptions

The descriptions for each S-register. In most bit-mapped S-registers, the default bit value is 0 (which is the normal situation) and 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 default settings.

Basic S-Registers "ATSn=x"

Command	Function & Description	Ref.
S0=	Set the number of rings on which the modem will answer. 0 value disable auto-answer	+000
S1=	Counts and stores number of rings from an incoming call	+000
S2=	Define escape code character, default <+> (43 dec.)	+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, modem waits for a carrier	+060
S8=	Set duration, in seconds, for pause (,) option in Dial command and pause between command re-executions for Repeat (>)command	+002

Extended S-Registers "ATSn=x"

Command	bit	dec	hex	Function and description	Ref.
S15=	bit	dec	hex	Bit-mapped register	+130
	0,1	0	0	Even parity	
		1	1	Odd parity	
		2	2 *	No parity	
	2	0	0 *	1 stop bit	
		4	4	2 stop bits	
	4,3	0	0 *	10 bit character length	*C0
		8	8	11 bit	*C1
		16	10	9 bit	*C2
		24	18	8 bit	*C3
	7-5	0	0	Profile 0 as active settings after power ON	Z0
		32	20	Profile 1 as active settings after power ON	Z1
		64	40	Profile 2 as active settings after power ON	Z2
		96	60	Profile 3 as active settings after power on	Z3
		128	80 *	Factory default as active settings after power ON	Z4
S16=		dec	hex	Test status register	+000
		0	0	No test in progress	&T0
		1	1	Loopback test in progress	&T1
		9	9	Loopback test in progress	&T9
		10	A	Loopback with self test in progress	&T10

Command	bit	dec	hex	Function and description	Ref.
S18=		dec		Force modem or TA to fix baud rate when idle	+000
		0 *		Disable fixed baud function	
		n+1		Enable baud rate fixing at idle, n=0-15 baud rate value settings (n) the same as S20 value	
S20=		dec	hex	DTE speed (bps). Auto detected from AT Command	+003
		0	0	921600 bps	
		1	1	460800 bps	
		2	2	230400 bps	
		3	3	115200 bps	
		8	8	57600 bps	
		9	9	38400 bps	
		10	A	19200 bps	
		11	B	9600 bps	
		12	C	4800 bps	
		13	D	2400 bps	
		14	E	1200 bps	
S21=	bit	dec	hex	Bit mapped register	
	1-2	0	0	Speaker always Off	M0
		2	2	Speaker On until carrier is detected	M1
		4	4	Speaker always On	M2
	3	0	0	DSR always On	&S0
		8	8	According to CCITT (see also S44.4, S41.5)	&S1
	4	0	0	CD always On	&C0
		16	10	CD tracks presence of data carrier (see also S38.3)	&C1
	6-7	0	0	Assume DTR always On	&D0
		64	40	108.1, DTR Off-On transition causes dial of the default number	&D1
		128	80	108.2 Data Terminal Ready, DTR Off causes the modem to hang up and return to command state	&D2
		192	C0	108.2, DTR off causes the modem to hang up and reset the modem to profile #0 after DTR dropped	&D3
S23=	bit	dec	hex	Bit mapped register	+105
	0	0	0	Command echo disabled	E0
		1	1	Command echo enabled	E1
	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	

Command	bit	dec	hex	Function and description	Ref.
	6	0	0	Display result code in numeric format (see S35.7)	V0
		64	40	Display result code in verbose format	V1
S24=	bit	dec	hex	Bit mapped register	
	0-1	0-3	0-3	Ring volume control, increments of 1 in decimal	N0-3
	2	0	0	Ignore S21.1-2 when Phone 1 key pad dialed	
		4	4	Do not ignore S21-2 when Phone 1 key pad dialed	
	3	0	0	Ignore S21.1-2 when Phone 2 key pad dialed	
		8	8	Do not ignore S21-2 when Phone 2 key pad dialed	
	5-4			Speaker volume control, in increments of 16 in decimal value	L0-3
S25=		0-255	0-FF	Specify the time delay that DTR signal needs to be OFF before it will be recognized, in 10 ms units. If S25=0, the delay time is set to 4 ms	+000
S27=	bit	dec	hex	Bit mapped register	
	3-5	0	0	Flow control disabled	&H0
		24	18	Hardware (RTS/CTS) flow control	&H3
		32	20	Software (XON/XOFF) flow control	&H4
		40	28	Reserved	&H5
S29=		0-39	0-39	Set default dial phone number pointer, use AT&Zn=s to store phone numbers	+000 *D
S31=		0-255	0-FF	Holds the ASCII decimal value of the XON	+017
S32=		0-255	0-FF	Holds the ASCII decimal value of the XOFF	+019
S35=	bit	dec	hex	Bit mapped register	
	4	16	10	When Data/Voice with is pressed, modem will dial the default number.	*Dn S29
	7	128	80	Enable extended numerical result codes from 50-71 when an error corrected connection is made. Use with ATV0. (see result code table)	V0 S23.6
S38=	bit	dec	hex	Bit mapped register	+000
	0	1	1	Repeatedly dialing default number	*Dn S29
	3	8	8	DCD on/off sequence follows UNIX standard, DCD high before connect message is sent, DCD off after last DCE response is sent	&C1 S21.4
S40=	bit	dec	hex	Bit mapped register	+000
	1	2	2	No result code displayed in answer mode	Q2
S41=	bit	dec	hex	Bit mapped register	+000

Command	bit	dec	hex	Function and description	Ref.
	3	8	8	Enable CCITT signals 140 and 141 on EIA-232D interface	
S42=	bit	dec	hex	Bit mapped register	+000
	3	8	8	Disable escape sequence code in answer mode	
	5	32	20	Disable Data/Voice button	
	6	64	40	Disable <RINGING> result code	Xn
S43=		dec	hex	Second DTE port speed setting	+003
		0		230400	
		1		115200	
		2		76800	
		3		57600	
		4		38400	
		5		19200	
		6		9600	
		7		2400	
S44=	bit	dec	hex	Bit mapped register	+000
	3	8	8	ATDSn initiates auto-dial of the stored numbers consecutively until connection is made	DSn
	4	16	10	DSR follows DTR (see also S41.5)	&S1
S45=	bit			Second DTE port flow control	+001
	1-0	0	0	Flow control disabled	*M0
		1	1	Hardware (RTS/CTS) flow control	*M1
		2	2	Software (XON/XOFF) flow control	*M2
S46=	bit	dec	hex	Second DTE port line setting	+000
	1-0	0	0	None parity, 8 data bit, 1 stop bit	*N0
		1	1	Even parity, 7 data bit, 1 stop bit	*N1
		2	2	Odd parity, 7 data bit, 1 stop bit	*N2
S56=		0-255	0-FF	Hook flash detect time for Analog Adapter (POTS port); units 10ms	+050
S80=	bit	dec	hex	Bit-mapped register:	+000
	4	0 *	0	Do not send Low Layer Compatibility information for Phone 2 (TA128) or internal fax/modem (2864I)	
		16	10	Send Low Layer Compatibility for Phone 2 (TA128) or internal fax/modem (2864I)	
	6	0 *	0	Do not send Low Layer Compatibility information for ISDN data call	
		64	40	Send Low Layer Compatibility for ISDN data call	
	7	0 *	0	Do not send Low Layer Compatibility information for Phone 1 (TA128) or analog adapter (2864I)	
		128	80	Send Low Layer Compatibility for Phone 1 (TA128) or analog adapter (2864I)	
S82=		dec		ISDN B channel protocol	Bn
		60		V.120 64000	

Command	bit	dec	hex	Function and description	Ref.
		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
	0	0	0	Disable loopback 4 test	CP0
		1	1	Enable loopback 4 test	CP1
	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 ATDMs	&O0
		32	20	ATDs, ATDPs, and ATDTs is mapped to ATDIs	&O2
		48	30	ATDs, ATDPs, and ATDTs is mapped to ATDBs	&O3
S84=	bit	dec	hex		
	0-2			Embedded protocol analyzer control	CCn
		1	1	Capture DTE-DCE interface protocol information	
		2	2	Capture the B channel (X.75 or V.120) frames	
		4	4	Capture the D channel protocol information	
	3	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	Phone 1 (TA128) or analog port (2864I) has higher priority for answering an analog call	&L0
		32	20	Phone 2 (TA128) or Internal device (2864I) has higher priority for answering an analog call	&L1
S86=		dec	hex	D channel protocol selection (USA) The following number is valid only for American version:	Pn
		0	0	Northern Telecom proprietary ISDN	
		1	1	National ISDN 1 (1 SPID mode)	
		2	2	National ISDN 1 (2 SPID mode)	
		3	3	Reserved	

Command	bit	dec	hex	Function and description	Ref.
		4	4	AT&T proprietary point-to-point	
		5	5	AT&T proprietary point-to-multi-point (1 SPID mode)	
		6	6	AT&T custom point-to-multipoint (2 SPID mode)	
S87=	bit	dec	hex		
	5-6	0 *	0	Bundle connection is disabled	&Jn
		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	Bit-mapped register	
	5	0	0	Disable the metering pulse of analog adapter, Phone 2	
		32	32	Enable the metering pulse of analog adapter, Phone 2	
	6	0	0	Disable the metering pulse of analog adapter, Phone 1	
		64	40	Enable the metering pulse of analog adapter, Phone 1	
S100=		dec	hex	B channel bundling protocol selection	
		0 *	0	Multiple Link Protocol (MLP)	
		1	1	cFossil channel bundling, for European Switches only (cFos)	
S102=				Outgoing ISDN data type. Value has the same definition as S82	Bnn
S104+n=		dec	hex	Outgoing Service Indicator (for 1TR6 only), n=0, analog adapter, Phone 2 n=2, ISDN data n=3, analog adapter, Phone 1	
		1	1	Fernsprechen	
		2	2	a/b - Dienste	
		7	7	Daten bertragung 64 Kbps. The defaults are : * s104=1 - for a/b adapter 2 * s105= - reserved * s106=7 - for ISDN data * s107=1 - for a/b adapter 1	
S108+n=		dec	hex	Outgoing Service Additional (for 1TR6 only) Information n=0, analog adapter, Phone 2 n=2, ISDN data n=3, analog adapter, Phone 1	
	SI=1	1	1 *	ISDN-Fernsprechen 3.1 kHz	
		2	2	Fernsprechen analog	

Command	bit	dec	hex	Function and description	Ref.
	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	
		10101111		In band negotiation	
S108+n=		dec	hex	High Layer Compatibility (Non-1TR6) n=0, analog adapter, Phone 2 n=2, ISDN data n=3, analog adapter, 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)	

Command	bit	dec	hex	Function and description	Ref.
S117=				V.110 user rate	B1n
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
	4	0 *	0	Use 3.1KHz Bearer service whenever possible for analog adapter, Phone 2	
		16	10	Use Speech Bearer service whenever possible for analog adapter, Phone 2	
	5	0 *	0	Use 3.1KHz Bearer service whenever possible for analog adapter, Phone 1	
		32	20	Use Speech Bearer service whenever possible for analog adapter, Phone 1	
	6	0 *	0	Enable analog adapter to accept global calls	
		64	40	Forbid the analog adapter to accept global calls with MSN unmatched (see AT&ZIn=s)	
	7	0 *	0	Enable analog incoming calls	
		128	80	Reject analog incoming calls	
S119=	bit	dec	hex		
	0	0 *	0	Disable call-back function	*GC
		1	1	Enable call-back function	
	1	0 *	0	Disable point-to-point signaling DDI function	
		2	2	Enable point-to-point signaling DDI function	
	2	0 *	0	Disable point-to-multipoint signaling DDI function	
		4	4	Enable point-to-multipoint signaling DDI function	
	3	0 *	0	Inbound call ignored when no MSN (EAZ) is matched	
		8	8	Inbound call accepted using default protocol when no MSN (EAZ) is matched	
	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	
	5	0 *	0	Enable normal MSN function	&ZIn
		32	20	Treat the number assigned by &ZI=n... as sub-address, and match with the called_party_subaddress for inbound call routing	

Command	bit	dec	hex	Function and description	Ref.
S120=				Accumulated charging unit (MSB byte) for B1 channel	
S121=				Accumulated charging unit (LSB byte) for B1 channel	
S122=				Accumulated charging unit (MSB byte) for B2 channel	
S123=				Accumulated charging unit (LSB byte) for B2 channel	
S124=		dec	hex	Empty IP packet interval for PPP	+000
		0-255	0-FF	Units of 1 sec.	

Bit	S-register bit number, 'b', used in 'ATSr.b=n' and 'ATSr.b=?'
dec	Decimal value, 'x', used in 'ATSn=x'
hex	Equivalent Hexadecimal value.
+nnn	Factory default when listed in 'Reference' column.

"ATXn" Result Code Option Table

The following table shows the different options available when setting the ATXn command. The default value for ‘n’ is 5 when the Omni TA128 is shipped.

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
0	OK	V	V	V	V	V	V	V	V
1	CONNECT	V	V	V	V	V	@	$	#
2	RING	V	V	V	V	V	V	V	V
3	NO CARRIER	V	V	V	V	V	V	V	V
4	ERROR	V	V	V	V	V	V	V	V
5	CONNECT 1200		%	%	%	%	@	$	#
6	NO DIAL TONE			V		V	V	V	V
7	BUSY				V	V	V	V	V
8	NO ANSWER				V	V	V	V	V
9	RINGING*				V	V	V	V	V
10	CONNECT 2400		%	%	%	%	@	$	#
11	CONNECT 4800		%	%	%	%	@	$	#
12	CONNECT 9600		%	%	%	%	@	$	#
14	CONNECT 19200		%	%	%	%	@	$	#
15	CONNECT 7200		%	%	%	%	@	$	#
16	CONNECT 12000		%	%	%	%	@	$	#
17	CONNECT 14400		%	%	%	%	@	$	#
18	CONNECT 16800		%	%	%	%	@	$	#
19	CONNECT 38400		%	%	%	%	@		
20	CONNECT 57600		%	%	%	%	@		
21	CONNECT 76800		%	%	%	%	@		
22	CONNECT 115200		%	%	%	%	@		
23	CONNECT 230400		%	%	%	%	@		
24	CONNECT 460800		%	%	%	%	@		
25	CONNECT 921600		%	%	%	%	@		
26	CONNECT 307200		%	%	%	%	@		
27	CONNECT 153600		%	%	%	%	@		
28	CONNECT 102400		%	%	%	%	@		
29	CONNECT 61440		%	%	%	%	@		

ATV0	ATV1	X0	X1	X2	X3	X4	X5	X6	X7
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 S42.6 to disable 'RINGING' result code

Result Code Chart Symbol Reference:

V	Supported
%	Reports the DTE Speed as: <cr><lf>CONNECT DTE_Speed<cr><lf>
@	CONNECT DTE_Speed/Protocol DCE_Speed/Error_Control ** Example: `CONNECT 115200/V120 64000/LABD`
$	<cr><lf>CONNECT DCE_Speed[/Error_Code]<cr><lf> Example: `CONNECT 64000/ARQ`
#	CONNECT DCE _Speed/Error_Code/Error_Control Example: `CONNECT 64000/ARQ/V42b`

Result Code Field Descriptions

Field Name	Possible Values
Error_Code	NONE, ARQ
Error_Control	LAPB, LAPD, V42 (This field will not show if no error control is negotiated)
Data_Compression	V42b
DCE_Speed	All possible DCE speeds supported
DTE_Speed	All possible DTE speeds supported
Protocol	Only ISDN protocols are listed here X.75 X.75M (X.75 with MLP Bundle) X.75C (X.75 with cFos Bundle) V110 V120 V120M (V.120 with MLP Bundle) V120C (V.120 with cFos Bundle) SLIP PPP

BTX

Connect Strings for Error Corrected Connections

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

```
ATS35.7=1<enter>
```

ATV0	ATV1	ATV0	ATV1
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

Chapter 18 - ISDN General Reference

This chapter is designed to get you acquainted with ISDN. It includes explanations of all the technical terms you need to know and will even take the guess-work out of setting up ISDN communications with your local telephone company.

ISDN or **Integrated Services Digital Network** is a global system that provides a variety of high speed digital communication solutions, while maintaining compatibility with existing analog voice, modem, data and fax protocols.

ISDN is based on various standards that define communications between switches and the equipment that connects to them. These standards allow most types of equipment to communicate across different types of switches in every part of the world.

The implementation of "network switches" by telephone companies differs from country to country. We will focus our discussions to the North American continent. If you plan to use the Omni TA128 in an area other than North America, please contact your local ZyXEL distributor for specific documentation and firmware and hardware upgrades to ensure proper operation of the ZyXEL Omni TA128 with your local ISDN switch and network.

In North America, a separate ISDN standard called National ISDN (NI-1) is currently being adopted by network providers and equipment manufacturers. When fully deployed, NI-1 will make the installation of ISDN equipment much easier. Currently, many different types of custom signaling protocols are used. Therefore, you will need to configure your ZyXEL Omni TA128 for the type of signaling that is used by the network it is connected to.

Terminal Adapter

A Terminal Adapter (TA) allows users to send and receive data over the ISDN network. Users can send and receive both data and voice simultaneously by using both B channels. The analog adapters in the Omni TA128 allows users to connect an analog devices to the TA to make out-going calls as well as receive in-coming calls. With its auto detect feature, the Omni TA128 monitors incoming calls from both analog or digital devices. It monitors these calls without user intervention and makes connections accordingly.

Basic Rate Interface (BRI)

When you order a Basic Rate Interface (BRI) ISDN line, you receive what is known as the "2B+D" service. This provides two B channels that can transmit at 64Kbps per channel for user information and a D channel that can communicate between the user and the ISDN network at 16Kbps.

D channel Protocol

The D channel is used to manage communication between the equipment and the switch. It is used mainly to exchange signal messages with the switch, and for setting up and releasing calls. In most cases, if there is any incompatibility issue raised, it is the D

channel signaling protocol that is causing the problem. Currently, the Omni TA128 does not allow the user to use the D channel for sending and receiving user data.

The Omni TA128 currently supports the following switch types and D channel protocols:

- AT&T 5ESS Custom and National ISDN-1 protocol
- Northern Telecom DMS-100 Custom and National ISDN-1 protocol
- Siemens EWSD National ISDN-1 protocol

Rate Adaptation & B channel Protocol

The Omni TA128 currently supports the following Protocols:

- V.120
- X.75
- V.110
- Async to Sync. PPP, MPPP or SLIP

The B channels are used for carrying user communication information. This information can be data, voice or fax. Voice and analog data must be sent on the B channels. Unlike the asynchronous communications between most PC computers and your Omni TA128, the B channel operates in synchronous mode. In order to convert the asynchronous communication to synchronous communication, it is necessary to use a Rate Adaptation protocol.

In North America, V.120 is the most popular rate adaptation Protocol used. V.120 is an ITU-T protocol that supports synchronous and asynchronous rate adaptation and provides link-layer error control. ZyXEL also implements V.42bis data compression and/or channel bundling on top of V.120, allowing the user to achieve even higher data communication throughput.

Channel Bundling combines two B channels' bandwidth for one communication session. This combination establishes a 128Kbps or 112Kbps communication link.

The Omni TA128 also supports HDLC asynchronous to synchronous conversion for Point-to-Point Protocol (PPP) and Serial Line Internet Protocol (SLIP). These protocols are very popular for Internet access and Remote Access applications.

Currently, most of us still use Plain Old Telephone Service (POTS) for our regular communication needs. The Omni TA128 provides 2 analog ports for you to connect analog devices. This lets you continue to use analog communications. You can connect phones, fax machines, or modems to the analog ports, while using one of the idle B channels (even if the Omni TA128 is busy doing data communications).

Out-of-band signaling

Some switches transmit all the network signals through the D channel, allowing both B channels to be used exclusively for your communication. This allows a throughput of 128Kbps (64Kbps per channel. For the switches that do not support out-of-band signaling, network signals are transmitted through the B channels only, which reduces the useable bandwidth to 56Kbps.

ISDN Basic Rate Interface Points

In the interest of supporting deregulated Customer Premises Equipment (CPE), the Exchange Carrier Standard Association in the United States established a basic rate transmission standard for CPE. These standards are defined for equipment to connect to different reference points of the ISDN link. Some of these reference points are S, T, and U. They have very specific definitions and provide standard interfaces for equipment connected to them. The following diagram shows these interface points.

Not all the interfaces must exist in actual implementations. For example, not all the houses are equipped with a PBX (NT2) - in this case, the U interface is provided by the NT-1. The Omni TA128 connects to the NT-1.

An ISDN terminal adapter can be constructed with the functionality of a NT-1. In this case, the terminal adapter will connect directly to the U-interface. The Omni TA128U connects you directly to a U-interface without an NT-1, which can sometimes be quite expensive.

The Omni TA128 comes with a choice two different interface options:

- The Omni TA128 comes with a S/T interface
- The Omni TA128U comes with a U interface

You can connect the Omni TA128-U direct to the ISDN jack installed by the phone company. The Omni TA128 requires an NT-1 interface in between.

Chapter 19 - Ordering Your ISDN Line

Phone companies have significantly simplified the ordering process for ISDN lines. In Table 19-1, you will find a list of all the regional RBOC's and a telephone number to call to order your ISDN line.

Phone Company	Phone Contact	World Wide Web
Amertiech	800-TEAM-DATA	www.ameritech.com
Bell Atlantic	800-570-ISDN	www.bellatlantic.com
Bellsouth	800-858-9413	www.bellsouth.com
Nynex	800-GET-ISDN	www.nynex.com
Pacific Bell	800-4PB-ISDN	www.pacbell.com
Southwest Bell	800-734-7630	www.swbell.com
US West	800-603-6000	www.uswest.com

Table 19-1

ISDN Service Ordering Information

The following guidelines can be used to order basic BRI-ISDN service from the telephone company.

Local ISDN Switch

The Omni TA128 series supports the switch types and protocols listed below. Before you order your ISDN line you will need to call your local phone company and find out what switch they use. After you have got this information simply fax them the appropriate order form created below. Ordering an ISDN line through your local phone company will generally take 10 to 15 working days.

Select the switch type that your local phone company uses and fax them the appropriate order sheet:

- ☐ AT&T 5ESS - Point-to-Point
- ☐ AT&T 5ESS - Multipoint
- ☐ Northern Telecom DMS-100
- ☐ Siemens EWSD

ZyXEL ISDN Order Form - Switch: AT&T 5ESS

NI-1, Point-to-Point or Multipoint

To order ISDN service for the AT&T switch, simply provide the table below to your local phone company. You can normally photocopy and fax this order form to them.

General Information:

First Name:_____ Last Name:_____

Address: _____

City: _____ State: _____ Zip:_____

Tel (Analog): _____

ISDN Line Configuration Table:

Line Type	Standard (2B+D) NI-1 or Custom
Data Line Class	Point-to-Point(PP) or Multipoint
Line Code	2B1Q
Interface Type	U interface with RJ45 jack
B1 Service	On Demand (DMD)
B2 Service	On Demand (DMD)
Access Rate	64Kbps
Maximum B Channels	2
Circuit-switched Voice	2
Circuit-switched Voice Channel	Any
Circuit-switched Data	2
Circuit-switched Data Channel	Any
D Channel Packet	No
Electronic Key Telephone Sets (EKTS)	No
Terminal Type	Type A

Information the phone company must provide:

Switch Protocol: ☐ NI-1 ☐ Point-to-Point ☐ Multipoint
Number of SPIDs: ☐ 0 ☐ 1 ☐ 2
ISDN Number 1 _____ SPID #1_____
ISDN Number 2 _____ SPID #2_____

ZyXEL ISDN Order Form - Switch: DMS-100

NI-1 or Custom

To order ISDN service for the DMS-100 switch, simply provide the table below to your local phone company. You can normally photocopy and fax this order form to them.

General Information:

First Name:_____ Last Name:_____

Address: _____

City: _____ State: _____ Zip:_____

Tel (Analog): _____

ISDN Line Configuration Table:

Line Type	Standard (2B+D) NI-1 or Custom
Line Code	2B1Q
Interface Type	U interface with RJ45 jack
Access Rate	64Kbps
Directory Numbers, Logical Terminals	2
Bearer Service	Circuit Switch Voice and Data on any B Channel
Circuit Switched Service	Yes
Packet Switched Service	No
Terminal Endpoint Identifier (TEI)	Dynamic
Electronic Key telephone sets (EKTS)	No
Call Appearance Handling (CACH)	No

Information the phone company must provide

Switch Protocol: ☐ NI-1 ☐ Custom

ISDN Number 1 _____ SPID #1_____

ISDN Number 2 _____ SPID #2_____

ZyXEL ISDN Order Form - Switch: EWSD

NI-1 only

To order ISDN service for the EWSD switch, simply provide the table below to your local phone company. You can normally photocopy and fax this order form to them.

General Information:

First Name:_____ Last Name:_____

Address: _____

City: _____ State: _____ Zip:_____

Tel (Analog): _____

ISDN Line Configuration Table:

Line Type	Standard (2B+D) NI-1
Line Code	2B1Q
Interface Type	U interface with RJ45 jack
Access Rate	64Kbps
Directory Numbers, Logical Terminals	2
Bearer Service	Circuit Switch Voice and Data on any B Channel
Circuit Switched Service	Yes
Packet Switched Service	No
Terminal Endpoint Identifier (TEI)	Dynamic
Electronic Key telephone sets (EKTS)	No

Information the phone company must provide:

Switch Protocol: ☐ NI-1 ☐ Custom
ISDN Number 1 _____ SPID #1_____
ISDN Number 2 _____ SPID #2_____

ISDN Service Ordering Checklist

1. Confirm the switch that has been installed. If it is an AT&T 5ESS switch, then the phone company must inform you whether it is Point-to-Point or Multi-point. Either option must then be programmed into the Omni TA128.

2. Note whether the switch is using a Custom protocol or National ISDN-1 (NI-1).

3. If the line is not an AT&T Point-to-Point, you should receive a unique SPID number for each of the B channels. Then both SPID numbers must be programmed into the Omni TA128. The configuration will be explained in the following chapters. Please take careful note of the prefixes and suffixes.

4. Confirm the 7-digit Local Directory Number (LDN) for each of the B channels.

Note: *These parameters are very important in installing the Omni TA128. They will allow the Omni TA128 to perform to its maximum potential.*

What are SPIDs?

The Service Profile Identifier (SPID), is a string of 3 to 20 numeric digits that is assigned to the user by the telephone company. The user must program the SPID into the terminal. The terminal will send this information (SPID) to the central office before it is initialized. When the switch receives the SPID, it will then allow the user to begin to dial out and receive calls.

Chapter 20 - Contacting ZyXEL

ZyXEL takes pride in it products and its customers. We are continually striving to improve our line by engineering them with your current and future needs in mind.

To help us in that effort, we encourage your comments. For your convenience, we have listed below various means by which you can contact ZyXEL directly.

ZyXEL Phone Numbers

Voice Telephone Numbers

You can reach ZyXEL in the U.S. between 8:00 am and 5:00 PM PST at (714) 693-0808

In Taiwan: 011-886-35-774848

Fax Numbers

ZyXEL provides the following 24-hour fax numbers for technical support and other comments.

In the U.S.: (714)693-8811

In Taiwan: 011-886-35-782439

ZyXEL BBS Number

ZyXEL operates a 4-node BBS 24 hours a day. This BBS contains updates to ZyXEL's ZFAX communications software, modem configuration guidelines, software set-up instructions, and the latest firmware. Sysop pricing information and order forms are also available from the BBS.

To call the ZyXEL analog BBS , configure your modem 8 data bits, no parity bit, and 1 stop bit. Then dial (714) 693-0762.

To call the ZyXEL ISDN BBS using one B channel, configure your modem and then dial (714)263-0398.

To call ZyXEL ISDN BBS using both B channels, configure your modem and then call (714)263-0398 + (714) 263-0498.

Online Access

You can also contact ZyXEL via the Internet using E-mail, our Web site, or FTP, and through CompuServe.

Internet

- **E-mail**
  Sales inquiries: sales@zyxel.com
  Technical support: support@zyxel.com ; in the U.S.
  or support@zyxel.hinet.net ; outside the U.S.

- **World Wide Web**
  ZyXEL has a home page on the World Wide Web(WWW). If you have a WWW browser, such as Netscape, you can access this page at the following location: http://www.zyxel.com

- **FTP**
  Information, such as ZyXEL software and ROM updates for the U.S. can be found at this FTP address: ftp.zyxel.com
  for European versions and related files, use the address: ftp.zyxel.co.at

CompuServe

CIS ID: 71333,2734
Forum: GO ZyXEL

Appendix A - Phone Jack Pinout Assignments

The Omni TA128 features one RJ-45 phone jack and two RJ-11 phone jacks. The RJ-45 labeled “ISDN S” jack is for ISDN line connection (S/T interface), and the RJ-11 jack labeled “PHONE” (also known as an analog adapter in European countries) is for an optional connection to analog telephone equipment such as a telephone set, answering machine, fax machine or analog modem.

RJ-45 Connector for the S/T Interface Model

1. Not Connected
2. Not Connected
3. RCV +
4. XMT +
5. XMT -
6. RCV-
7. -48V
8. -48V RTN

RJ-45 Connector for the U Interface Model

1. Not Connected
2. Not Connected
3. Not Connected
4. Ring
5. Tip
6. Not Connected
7. -48V
8. -48V RTN

RJ-11 Analog Adapter (Phone 1&2)

1. Not Connected
2. Ring
3. Tip
4. Not Connected

Appendix B - Serial Port Interface

EIA-232D 25 Pin Serial Port Interface

Pin Number	ITU-TSS Signal Name	EIA Signal Name	Signal/Pin Description	Signal Direction DTE -DCE
1	101	AA	Protective Ground (GND).	⇔
2	103	BA	Transmitted Data(TXD).	⇒
3	104	BB	Received Data(RXD).	⇐
4	105	CA	Request To Send (RTS).	⇒
5	106	CB	Clear To Send (CTS).	⇐
6	107	CC	Data Set Ready (DSR).	⇐
7	102	AB	Signal Ground (GND).	⇔
8	109	CF	Data Carrier Detected (DCD).	⇐
15	114	DB	Transmit Clock Signal (source: DCE).	⇐
17	115	DD	Synchronous Receive Clock.	⇐
18	141		Local Analog Loopback Test.	⇒
20	108/2 108/1	CD	Data Terminal Ready (DTR). Connect DCE to line.	⇒
21	140		Remote Digital Loop Test.	⇒
22	125	CE	Ring Indicator(RI).	⇐
24	113	DA	Transmit Clock Signal (source: DTE).	⇒
25	142		Test Indicator.	⇐

9 Pin Serial Port Interface

Pin Number	ITU-TSS Signal name	EIA Signal name	Signal/Pin Description	Signal Direction DTE -DCE
1	109	CF	Data Carrier Detected (DCD).	⇐
2	104	BB	Received Data(RXD).	⇐
3	103	BA	Transmitted Data(TXD).	⇒
4	108/2 108/1	CD	Data Terminal Ready (DTR). Connect DCE to line.	⇒
5	102	AB	Signal Ground (GND).	⇔
6	107	CC	Data Set Ready (DSR).	⇐
7	105	CA	Request To Send (RTS).	⇒
8	106	CB	Clear To Send (CTS).	⇐
9	125	CE	Ring Indicator(RI).	⇐

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 68,040 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			

Appendix C - Index

1

1TR6 11-4
  Answering a call 11-5
  Placing a call 11-3, 11-8

A

ambiguity resolution 10-2, 11-6
American ISDN 1-2, 7-3, 13-1, 14-4, 16-7
analog calls 10-1
  answering 10-2
  placing 10-2
analog ports 1-1, 10-2
ANSI 1-2, 15-3
Answering a call 11-5
  1TR6 11-5
  Best effort 11-6
  DSS1 11-5
  DTE Port 2 14-5
  Multi-Auto-Answer 11-6
  using MSN 4-4
  V.110 9-1
  V.120 7-2
  X.75 8-1
asynchronous 2-6
AT commands
  capture commands 15-4
  choose protocol 8-2
  communication modes 4-2
  DES 8-7
  descriptions 16-2
  DTE2 14-2
  EPA 15-4
  frequently used 10-1
  multiple 2-7
  register settings 17-1
  result codes 17-11
  result symbols 17-12
  security 12-1, 12-2
  S-Register 17-3
  Tips 2-7
  types 2-7
  understanding 2-6
  V.110 9-2
  V.42bis compression 7-4
AT&T
  5ESS
    Order Form 19-2
ATDI 8-2
auto answer 8-1
Automatic call detection 1-2
auto-switch 4-1, 4-3

B

B channel 7-5, 10-2, 11-6, 14-4, 15-3, 16-7, 17-9, 20-1
  Bunding 6-2
  Bundling 7-2, 7-3, 8-2, 17-8
  changing 4-2
  LED 8-7
  Multi Auto 4-5
  protocol 6-1, 7-6, 11-3, 14-4, 15-1, 15-3, 15-4, 16-3, 16-9, 17-6, 18-2
Best-effort 1-2, 4-5, 11-6
BONDING 7-2
BRI 1-5, 4-4, 7-2, 7-3, 8-2, 11-4, 11-5, 14-1
bundle connections 7-2, 8-3
  V.120 7-3
  X.75 8-2
BZT 10-1

C

Called Party Number 11-1, 14-5
Called-Party-Number 11-1
Called-Party-SubAddress 11-1
Calling-Party-Number .. 11-1, 11-2, 11-3
Calling-Party-SubAddress 11-1
CAPI 8-2
CCB 7-3, 7-4, 8-3
CCITT 14-3, 16-4, 16-8, 17-4, 17-5
Circuit Switched Data ..... *See* CSD
Command mode 2-6
Communication modes
  AT commands 4-2

Switching.....4-2
connecting.....2-1
Contacting ZyXEL.....20-1
CSD.....4-3
Customer Service.....20-1

D

D channel 2-5, 3-3, 11-9, 13-1, 15-3, 15-4, 16-5, 17-7, 18-1
Data call indication.....11-6
data encryption
control of.....8-7
LED indicators.....8-7
Data Encryption Standard.....*See* DES
Data-over-Speech bearer 7-2, 8-1
DBA.....6-4, 8-3
DDI.....11-7
DES 8-1, 8-5, 8-6, 8-7, 16-3
Diagnostics.....15-1
Dialing pre-stored numbers 7-3
Direct-Dial-In ..... *See* DDI
DMS-100
Order Form 19-3
DSS1.....8-2
Answering a call.....11-5
Placing a call.....11-8
DTE.....7-5
DTE Port 2.....**14-1**
Answering 14-5
Configuration..... 14-1, 14-5
Placing call 14-5
DTMF.....10-1
dynamic bandwidth allocation . *See* DBA

E

EAZ 11-4
assigning.....11-4
embedded protocol analyzer.....*See* EPA
ENDGERÄTEAUSWAHLZIFFER*See* EAZ
Endpoint Discriminator.....6-3
EPA 1-4, 1-2, 8-7, 15-1, 15-3, 15-4, 17-7
EPROM.....1-1, 1-2
error correction.....7-4
European ISDN..... 7-6, 8-2, 13-1
EWSD
Order Form 19-4

F

factory settings
restoring.....2-6
firmware 1-1, 1-2, 13-1, 13-2, 16-6, 18-1
Frame Reject Frame .....*See* FRMR
FRMR.....4-3
front panel switch 2-6

G

German national ISDN..... 13-1
Germany National ISDN 7-6

H

hardware reset..... 3-1, 3-5
HDLC 4-2, 6-1, 6-2, 8-1, 16-7, 18-2
High-Layer-Compatibility 4-5, 11-1, 11-6, 17-9

I

inbound calls ..... *See* Answering a call
Disabeling..... 11-7
ISDN protocols 9-1
ISO Standard 8-4

K

Kernal Mode..... 13-2

L

LAPD.....7-4
LDN..... 19-5
LED..... 1-2, 2-4
Described.....**2-5**
LNK.....2-4
PWR 2-4
Level 1 security..... 12-1
Level 2 security..... 12-1
LLC 8-2
Local Directory Number..... 19-5

Loopback 1-4, 15-1, 15-2, 16-3, 16-8, 17-3, B-1
Loopback test..... 15-1
Low-Layer-Compatibility 4-5, 7-6, 8-2, 11-1, 11-2, 11-6. *See* LLC

M

making a call .....*See* Placing a call
metering pulse 1-2, 10-1, 17-8
MLP 1-1, 7-2, 7-3, 7-4, 8-2, 8-3, 17-8, 17-12
MLP(Multiple Link Protocol).....7-3
mode
  command 2-6
  off-line 2-6
  on-line.....2-6
modes
  64k data 7-1
  answer6-2, 7-1, 8-2, 16-8, 16-9, 17-5, 17-6, 17-8
  asynchronous.....9-1
  channel bundling 7-3
  synchronous 9-1
  V.110.....9-1
  V.120.....3-6, 7-1
MPPP 4-2, 4-3, 4-4, 4-5, 6-2, 6-3, 11-4, 11-6, 16-4, 16-9, 18-2
MSN 4-4, 5-2, 8-1, 10-2, 11-5, 11-7, 14-4, 14-5, 16-9, 17-10
Multi-Auto-Answer 11-6
Multilink PPP..... 1-1, 6-2, 6-3, 6-4

N

NVRAM 2-6, 8-3, 14-2, 16-9

O

off-line mode.....2-6
on-line mode 2-6
operation modes
  Multiplex 16-1
  Simplex 16-1
Opgrading 13-1
Order Form 1-5, 19-2, 19-3, 19-4
  AT&T
    5ESS switch.....19-2
    DMS-100 19-3
    EWSD 19-4
Ordering Checlkist 19-5
outgoing calls..... *See* Placing a call
Outgoing Service Indicator..... 11-3
out-of-band signaling..... 7-1, 18-2

P

Passwords..... 12-2
Passworsd..... *See* Security
physical specs..... 1-2
Placing a call 11-8
  1TR6 .....11-3, 11-8
  Analog 4-2
  DSS1 11-8
  DSS1 11-1
  DTE Port 2 14-5
  Phone 1(Port 1)..... 4-1
  Phone 2(Port 2)..... 4-1
  using ISDN mode..... 4-1
  using Speech Bearer 4-1
  V.110..... 9-2
  V.120..... 7-1
    Bundled..... 7-3
  X.75 8-2
Point-to-Point protocol..... *See* PPP
power supply..... 2-1
PPP 1-2, 1-1, 3-4, 4-2, 4-3, 4-4, 4-5, 5-2, 5-5, 5-8, 6-1, 6-2, 6-3, 6-4, 8-3, 11-4, 11-6, 14-2, 14-5, 16-2, 16-4, 16-9, 17-7, 17-11, 17-12, 18-2
Pre-stored numbers..... 7-3
Protocall Anayzer 15-1
PSTN..... 1-1

R

registering 1-3
Remote Access.....5-7, 6-1, 18-2
restoring factory settings.....*See*

S

S/T interface 2-1, 2-3, 4-5, 11-6, 13-1, 18-3, A-1
S104/S107 11-3
S108/S111 11-3

Security
levels.....12-1
non passwords.....12-3
passwords.....12-2
types.....12-1
self test.....2-4
Service Profile Identifier *See* SPID
Speech bearer.....4-2, 8-1, 11-3, 11-8
SPID..... 3-1, 3-4, **19-5**
Support.....20-1
switches
AT&T 5ESS 1-1, 3-3, 3-4, 3-6, 13-1, 18-2, 19-5
AT&T 5ESS switch.....3-3
DMS 100.....1-1, 3-3
Northern Telecom 1-1, 3-3, 3-4, 3-5, 6-1, 7-3, 8-2, 13-1, 16-5, 17-7, 18-2, 19-1
Siemens EWSD 3-3, 15-1, 18-2, 19-1

T

TAE adapter.....10-1
TEI.....11-7
Terminal Adapter.....1-1
Terminal Equipment Identifier.....11-7
Terminal Selection Code.....11-4

U

U interface 1-2, 2-1, 2-3, 15-1, 18-3, 19-2, 19-3, 19-4
Updgrading.....13-1

V

V.110
Answering.....9-1
AT Commands.....9-2
Placing calls.....9-2
V.120
Bundled calls.....7-3
configuring.....7-1
error correction.....7-4
European ISDN.....7-6
Germany National ISDN.....7-6
Placing calls.....7-1
V.42bis data compression.....8-4
voice.....11-6
Voice Calls.....11-6

W

Windows 95.....1-1

X

X.75
Answering.....8-1
Bundled calls.....8-2
Placing a call.....8-2
XID.....8-4, 8-7
Xmodem.....13-1, 16-6

Z

ZyXEL.....20-1