

MicroLink ISDN/PCFpro

MicroLink ISDN/PCF

User's Manual



Data Communications
Computer Graphics

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1 Introduction

About this manual	<p>This manual describes the installation, the features and the operation of the <i>MicroLink ISDN/PCFpro</i> and <i>MicroLink ISDN/PCF</i> ISDN adapter boards.</p>
Symbols and conventions	<p>Symbols and icons are used throughout this manual to highlight pertinent sections of text:</p> <p>◊ NOTE ◊ denotes important information</p> <p>A list of items is indicated by bullet symbols:</p> <ul style="list-style-type: none">■ ... <p>Procedures consist of numbered steps:</p> <ol style="list-style-type: none">1. ... <p><CR> (Carriage Return) means that the Return or Enter key should be pressed</p>
S ₀ interface S/T interface	<p>In this manual, the interface between the ISDN Network Terminator (NT) and the terminal devices is generally referred to as "S₀ interface" or "S₀ bus". In other countries other names may be common, such as "S/T interface" which is commonly used in the USA.</p>
Changes to this manual	<p>ELSA <i>MicroLink</i>® products are subject to continual development. Thus it is possible that the printed documentation does not correspond to the latest release. You will always, however, find the latest information on the <i>ELSA ONLINE</i> Support BBS. See page 48 for contact numbers.</p>
Package contents	<p>Before you start installing your ELSA <i>MicroLink</i>® ISDN adapter board, please make sure that your package is complete:</p> <ul style="list-style-type: none">■ <i>MicroLink</i> ISDN adapter board■ ISDN line connection cable■ Printed manuals■ <i>MicroLink</i> CD■ Proof of license (yellow label)
◊ NOTE ◊	<p>If any item is missing or damaged, please contact your dealer. ELSA reserves the right to make changes to the package contents without prior notice.</p>

1.1 Brief Description

MicroLink ISDN/PCFpro and *MicroLink ISDN/PCF* from ELSA's family of ISDN products are expansion boards for IBM Personal Computers and compatibles. They allow your PC to be connected to an S₀ interface, making it suitable for the operation at an ISDN Basic Rate Interface or a private automatic branch exchange with an S₀ interface.

MicroLink ISDN/PCFpro and *MicroLink ISDN/PCF* are integrated ISDN/fax/modem solutions for data transfer in today's most important areas of communication. These ISDN PC boards link your PC to the ISDN interface and allow data transfers at up to 64,000 bps, fax transfers at up to 14,400 bps (9600 bps receive speed with *MicroLink ISDN/PCF*), and analog modem communications at up to 28,800 bps (2400 bps with *MicroLink ISDN/PCF*).

CAPI interface	The CAPI driver (C ommon I SDN A pplication P rogramming I nterface) is a standardized software interface between your <i>MicroLink ISDN/PCFpro</i> or <i>MicroLink ISDN/PCF</i> and any standard ISDN communications software (e.g. for fax class 3 and 4, data transfer, remote computing and file transfer).
FOSSIL interface	The supplied FOSSIL (F ido/ O pus/ SE Adog S tandard I nterface L ayer) driver cFos allows non-ISDN, cFos-compatible communications programs (such as <i>Telix</i> or <i>Telix for Windows</i>) to be used with your ISDN adapter board.
ISDN operation	Using the CAPI interface, <i>MicroLink ISDN/PCFpro</i> and <i>MicroLink ISDN/PCF</i> can transfer data according to various transmission standards at speeds of up to 64,000 bps on each B channel. Both B channels (data channels) can be used simultaneously.
Fax operation	<p>In addition to the ISDN operating modes, your ISDN adapter board also gives you universal access to modems and fax class 3 devices in analog telephone networks, even though you are communicating via an ISDN interface.</p> <p>Fax software such as <i>ELSA-RVS-COM</i> allows you to send and receive text and image documents under Windows. <i>MicroLink ISDN/PCFpro</i> supports fax transmission and reception at bit rates of 14,400..2400 bps (V.17, V.33, V.29 and V.27ter). <i>MicroLink ISDN/PCF</i> can send faxes at up to 14,400 bps (V.17, V.33, V.29 and V.27ter) and can receive faxes at up to 9600 bps (V.29 and V.27ter).</p> <p>Your ISDN adapter board works entirely in the background, even in analog fax mode. This means that while your PC is sending or receiving faxes, you can continue to work uninterrupted with other Windows applications.</p> <p>The fax mode makes use of the CAPI interface, which means any CAPI-supporting fax software can be used.</p>
Modem operation	Supporting all common analog transmission standards like V.34, V.Fast Class, V.32bis, V.32, V.22bis, V.21, V.23, MNP5 and V.42bis, the modem mode of <i>MicroLink ISDN/PCFpro</i> guarantees the highest possible compatibility for all kinds of connections in the speed range of 300..28,800 bps. <i>MicroLink ISDN/PCF</i> supports modem rates up to 2400 bps (V.22bis, V.21).

Status display for
diagnostics

The mounting bracket of your ISDN adapter board has two color-coded LEDs which allow you to monitor the ISDN interface and the line connection status. See Appendix for more details. These LEDs help with diagnostics and trouble shooting if problems arise such as errors in installing the ISDN interface.

Notes:

2 Hardware Installation

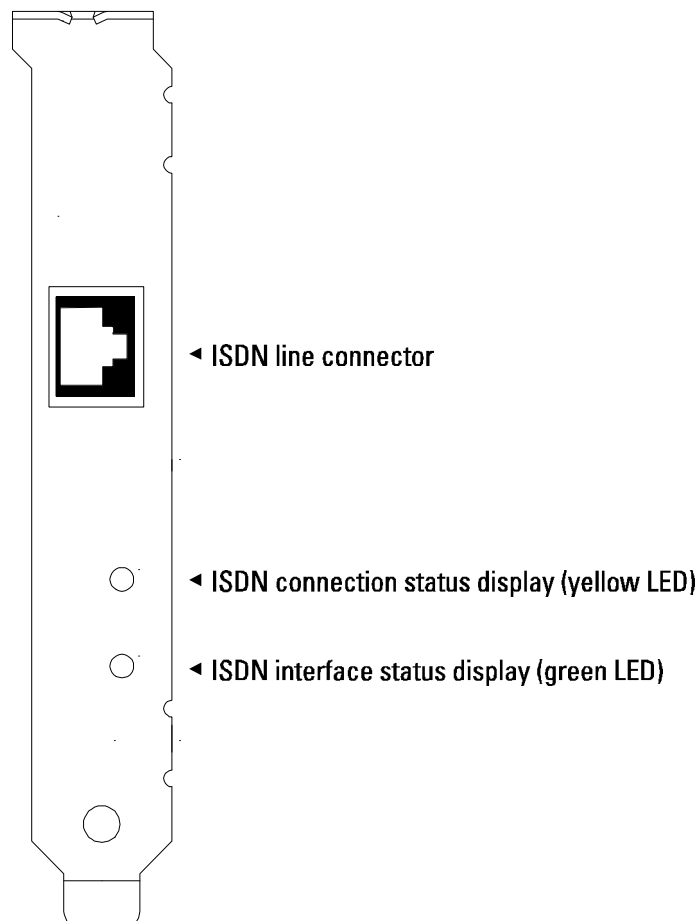
2.1 For Your Safety

In the interests of your safety and the correct operation of your ELSA *MicroLink*® ISDN adapter board and computer system, please regard the following:

- Use only the ISDN line connection cable supplied.
- Please follow the installation instructions in this chapter.

2.2 Inserting the Board

The following illustration shows the mounting bracket of your ISDN adapter board:



Installation

Proceed as follows to install the ISDN adapter board in your PC:

1. Configuring the interface

Use the DIP switches 1..5 on the board to select the I/O address and IRQ line of the ISDN adapter board:

S1	S2	I/O address of the ISDN adapter board
OFF	OFF	0x160h (default setting)
OFF	ON	0x170h
ON	OFF	0x260h
ON	ON	0x360h

S3	S4	S5	IRQ line of the ISDN adapter board
OFF	OFF	OFF	IRQ2
OFF	OFF	ON	IRQ3
OFF	ON	OFF	IRQ5
OFF	ON	ON	IRQ10* (default setting)
ON	OFF	OFF	IRQ11*
ON	OFF	ON	IRQ15*

* only if a 16-bit slot is used

◇ NOTE ◇

Make sure that the selected IRQ line is not used by any other device in your PC, as a conflict may result in a malfunction of the ISDN adapter board. It is common for IRQ2 and IRQ3 to be in use, and in some systems IRQ5 and IRQ15 can also be occupied.

2. Switching the PC off

Switch your PC off and unplug its power line from the power socket. This is very important for your safety!

3. Inserting the adapter board

Remove the cover of the PC housing. Most PCs require some screws on the rear side to be removed first, while others have a cover which opens up when you press two locking buttons on both sides of the housing. Refer to the manual of your PC for detailed instructions.

Select an empty slot of the required length, remove the blind bracket and insert your the ISDN adapter board into the slot. If you are using an 8-bit slot (*MicroLink ISDN/PCC-16* only), you can only use the IRQ lines 2, 3 and 5. If you are using a 16-bit slot, you can use any IRQ line (see table above).

Screw the mounting bracket of the ISDN adapter board tight, close the cover of the PC housing. You can now reconnect your PC's power cable.

4. Connection to the ISDN

To connect your ISDN adapter board to the ISDN, plug the supplied cable into both the ISDN line connector in the mounting bracket of the board and the S₀ wall socket of your ISDN line.

5. Switching the PC on

You can now switch your PC on.

3 ISDN Driver Installation

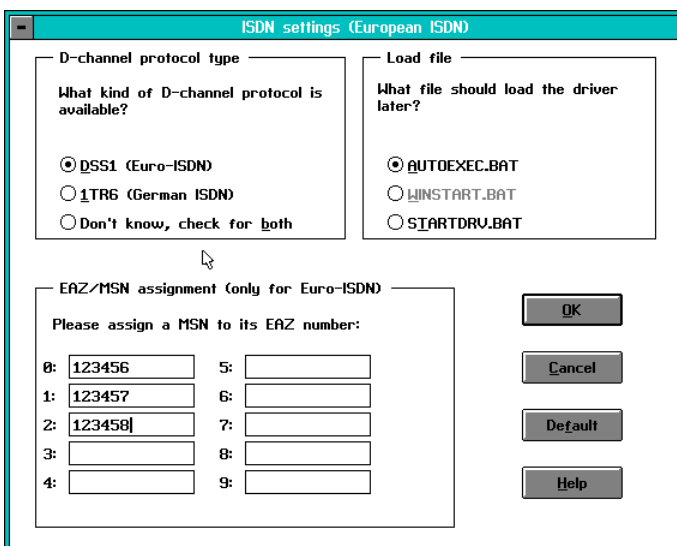
Before starting with the installation of your ISDN adapter board, check which protocol your ISDN connection uses. This information should have been supplied by your ISDN provider. In Europe, the protocol Euro-ISDN (DSS1) is wide spread, though in Germany some lines still use the older 1TR6 national ISDN protocol. With Euro-ISDN, you will require information about the Multiple Subscriber Numbers (MSNs) assigned to your ISDN line. In the USA, you should have information about your SPID and DN.

3.1 Installation under DOS

Installing the CAPI driver for DOS is simplicity itself with ELSA *COMman*, the menu-driven program for driver installation. Run *COMman* direct from the **ELSAWARE\COMMANDOS** directory on the CD supplied by starting **INSTALLD.EXE** and follow the on-screen instructions. Please note that the README file contains important information for the driver installation.



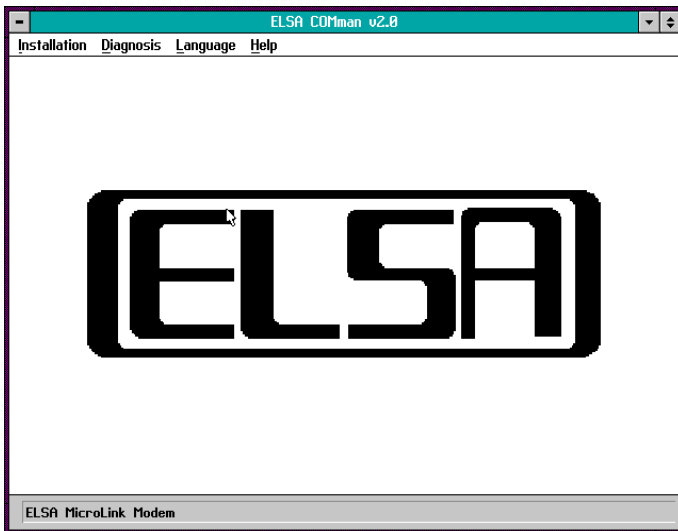
The program carries out an automatic diagnosis, after which you can use **Installation**, **ISDN Settings**, **User-defined** to define your parameters and phone numbers. The online Help is always available with useful advice and information about the various parameters.



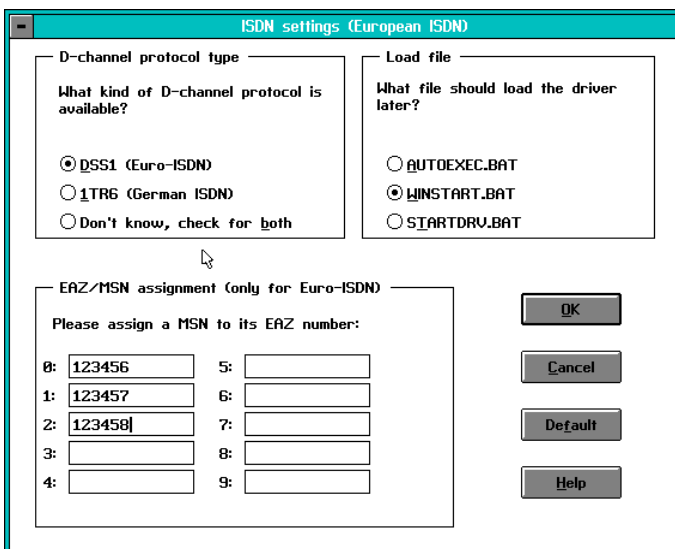
After successfully installing the ISDN drivers the computer must be restarted.

3.2 Installation under Window 3.x

Installing the CAPI driver for Windows 3.x is simplicity itself with ELSA *COMman*, the menu-driven program for driver installation. Run *COMman* direct from the `\ELSAWARE\COMMAN\WIN31` directory on the CD supplied by starting **SETUP.EXE** and follow the on-screen instructions. Please note that the README file contains important information for the driver installation.



The program carries out an automatic diagnosis, after which you can use **Installation, ISDN Settings, User-defined** to define your parameters and phone numbers. The online Help is always available with useful advice and information about the various parameters.



If you plan to work exclusively with Windows communications applications, we recommend that you activate the WINSTART.BAT option which ensures that the ISDN driver does not occupy any DOS memory. If you wish to make use of communications programs from within DOS boxes, then you will have to start the ISDN driver from the AUTOEXEC.BAT.

After successfully installing the ISDN driver, your computer should be restarted.

3.3 Installation under Windows 95

Requirements

To install the Windows 95 CAPI driver you will require the ELSA *MicroLink* CD and your Windows 95 CD.

Install Dial-Up Networking

Before installing the CAPI driver, the Dial-Up Networking in Windows 95 must be properly installed. Proceed as follows:

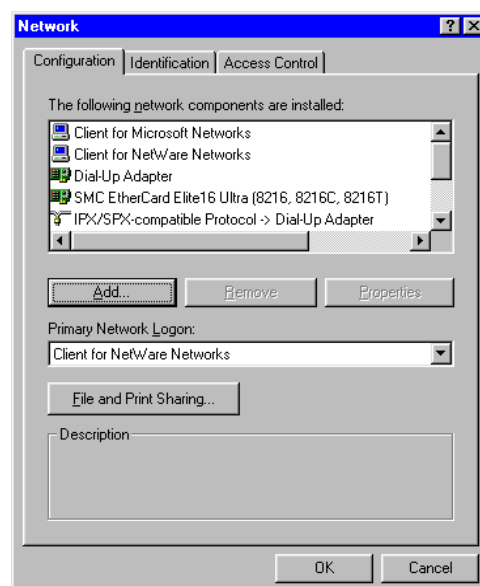
1. Start Windows 95 and double-click the symbols in the following series: **My Computer**, **Control Panel**, **Add/Remove Programs** and **Windows Setup**.
2. Select the component **Communications**.
3. Select **Details** and highlight the **Dial-Up Networking** component. Confirm with **OK**.
4. From the **Control Panel**, double-click on the **Network** icon. If there is no Dial-Up Adapter present, then select **Add...**, **Adapter**, **Add...**. Now select Microsoft from the Manufacturer dialog, select the Network Adapter, and click on **OK**.

The Dial-Up Networking should now be properly installed and ready for operation. In case you require further help, please refer to the Windows 95 documentation.

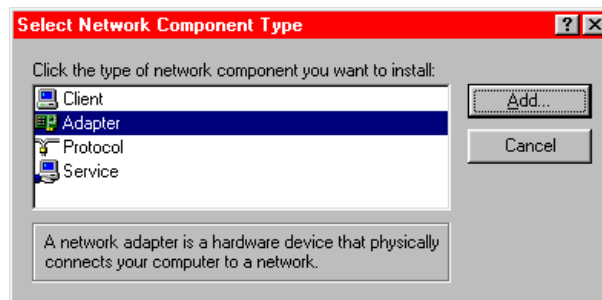
Install the Network Adapter

The installation of the ISDN CAPI 2.0 drivers under Windows 95 is performed via the CAPI Subsystem which is supplied on your ELSA *MicroLink* CD. You should also have your Windows 95 diskettes or CD ready. The installation is described as follows:

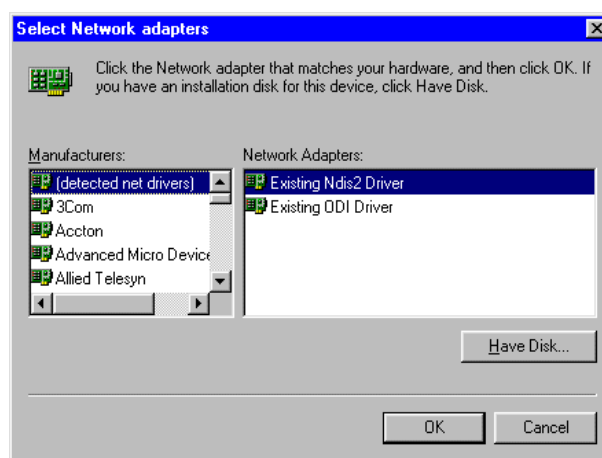
1. Insert your ELSA *MicroLink* CD into your CD-ROM drive (e.g. drive d:)
2. In Windows 95, double-click on the symbols **My Computer**, **Control Panel**, and **Network**. The **Network** dialog will be opened; click on **Add**:



3. In the **Select Network Component Type** window, select the **Adapter** component and then click on **Add**:



4. The **Select Network Adapters** window will be displayed; click on **Have Disk**:



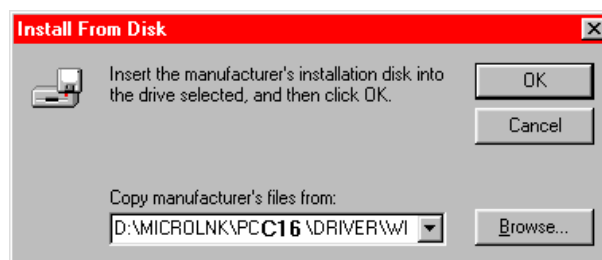
5. The dialog for **Install From Disk** will follow. Use **Browse** to select the CD-ROM drive and go to the drivers directory for your ISDN adapter, e.g.

\\MICROLNK\PCF\DRIVER\WIN95

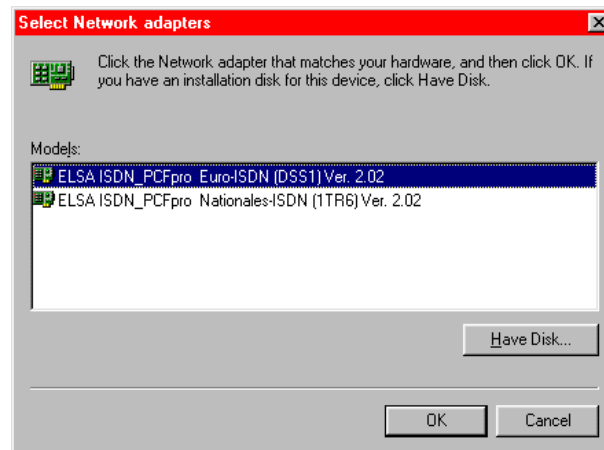
or

\\MICROLNK\PCFPRO\DRIVER\WIN95

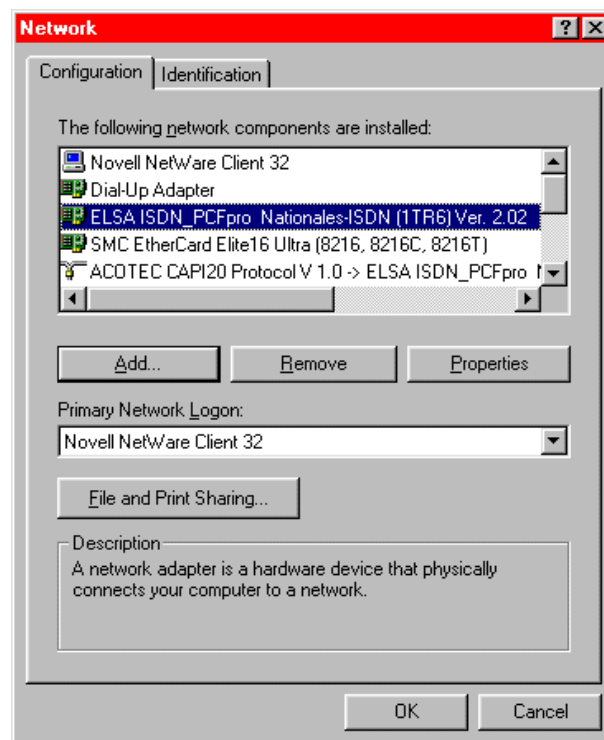
and confirm with **OK**:



6. In the **Select Network Adapter** window, select your ISDN connection protocol and click on **OK**:



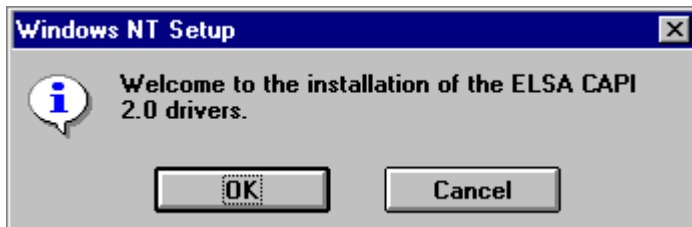
7. The ISDN protocol and the ACOTEC CAPI 2.0 driver are now installed as network components. After closing the windows by clicking on **OK**, the files will be copied to your hard disk:



After the driver files have been copied, a restart of Windows 95 will be required. At this time, insert your Windows 95 CD into the CD-ROM drive and confirm with **OK** to copy the files. Restart Windows 95.

3.4 Installation under Windows NT

The installation of the CAPI driver under Windows NT 3.51 and 4.0 is simplicity itself with the menu driven installation program supplied. This program is started with the **SETUP.EXE** file on your CD in the directory **\MICROLINK\PCF\DRIVER\WINNT** or **\MICROLINK\PCFPRO\DRIVER\WINNT** respectively. Follow the on-screen instructions.



Select your D channel protocol used by your ISDN connection.



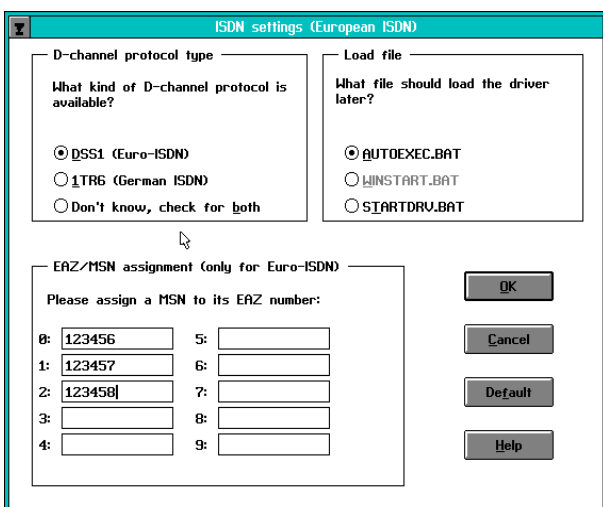
After a successful installation, you must restart Windows NT.

3.5 Installation under OS/2

The CAPI driver installation for OS/2 is simplicity itself with the menu-driven installation program *ELSA COMman*. Start the file **INSTALL.EXE** from the **\\ELSAWARE\\COMMAN\\OS2** directory on your CD. Follow the on-screen instructions. Please take note of the **README** files, which contain important information about the installation.



The program carries out an automatic diagnosis, after which you can use **Installation**, **ISDN Settings**, **User-defined** to define your parameters and phone numbers. The online **Help** is always available with useful advice and information about the various parameters.



As an alternative, the OS/2 driver can also be installed via OS/2's System Configuration.

1. Insert the CD-ROM into the drive (e.g. d:).
2. Run the object **Device Driver Installation**, which is to be found in the **System Configuration** folder.
3. Enter the source subdirectory on drive d:
\\MICROLINK\\PCF\\DRIVERS\\OS2
or
\\MICROLINK\\PCFPRO\\DRIVERS\\OS2
respectively

4. Enter the target directory where you want to install the ISDN drivers (e.g. c:\elsaisdn).
5. Click on "**Installation**".
6. Select the desired CAPI driver for your adapter board from the list of available drivers, depending on your D channel protocol (DSS1 or 1TR6).

◇ NOTE ◇

The required entries in your CONFIG.SYS file are made automatically and will only become effective after OS/2 is shut down and restarted. The driver software will automatically detect the adapter board and its current configuration. The conversion between Multiple Subscriber Numbers (MSN) and EAZ digits is done in the same way as with the DOS drivers.

4 Operation in AT Mode

The AT command set, well known in the world of analog communications, can be used in ISDN communications with the help of the FOSSIL driver cFos/DOS Lite, included in your package, when used with a DOS terminal program supporting INT 14 or FOSSIL output.

With the driver cFos/WIN Lite, common Windows data communications software such as *Telir for Windows* can be used with ISDN adapter boards. The cFos driver enables the use of virtual COM port emulation under Windows 3.1, meaning no additional FOSSIL- or INT 14 mode software is necessary.

4.1 Installing the cFos Driver



To install cFos on your computer, please proceed as follows:

1. Insert the CD or floppy disk into the appropriate disk drive. If you are installing from CD, select the directory for your adapter board, i.e. **MICROLINK\PCF\DRIVER\ CFOS** or **MICROLINK\PCFPRO\DRIVER\ CFOS** respectively.

2. Enter the command

```
install <CR>
```

to start the installation. Choose the language you wish to work with.

3. Either accept the suggested target directory for the installation or enter the path of your choice. Confirm your entries with <CR> and follow the program instructions.

If you require cFos for COM port emulation under Windows 3.x or Windows 95, call **SETUP** and follow the program instructions. To enable the automatic loading of cFos when Windows starts, the changes to the file **WIN.INI** must be confirmed with Yes (the computer will be started anew).

If you have problems during installation, please refer to the file README.WIN.

4. After the installation is ended, start the configuration program with <CR> and choose the desired language.
5. The final step is to run the **Software Adjustment** program. Confirm the ELSA modem settings (the program knows these already!) with **Yes** and choose the software (e.g. *Telir*) that you will be using. Finish the configuration with = and exit the program with **End**.

4.1.1 Starting cFos

Requirements for cFos Before starting cFos, you must first load the required **CAPI driver**. To start cFos in DOS, call the file STARTFOS.BAT from the cFos directory, or enter

```
cfos i <CR>
```

Entering STOPCFOS.BAT will stop cFos, as will the alternative

```
cfos d <CR>
```

In Windows, cFos is automatically started if the **WIN.INI** file was updated during installation.

◇ NOTE ◇

To load these drivers automatically at startup, these drivers can be called from the AUTOEXEC.BAT

cFos does not support the same AT command user interface as ATCAPI. Thus, some AT commands familiar to ATCAPI users may not be recognized or executed. Please refer to the cFos driver documentation. Further information to this subject is to be found in the files CFOS.DOC, MODEM.DOC AND CFOS.FAQ.

The following options, or combinations thereof, are available:

Option	Meaning
i	Loading cFos driver
d	Unloading cFos driver
-cn	Load FOSSIL port n, e.g. COM3 is loaded with -c2
none	Display help

4.2 General

AT command set The **AT command set** has established itself as the world-wide standard for modem control command syntax (AT = command prefix **AT**tention).

Two operating states The two general operating states of the ISDN adapter board in the AT mode are the **command state** and the online state (transmission state).

Command input, execution After the drivers have been loaded, the ISDN adapter board is in the **command state**. Commands can be accepted, interpreted and executed in this state only. After a successful connection with the other party, the ISDN adapter board automatically changes to the online state.

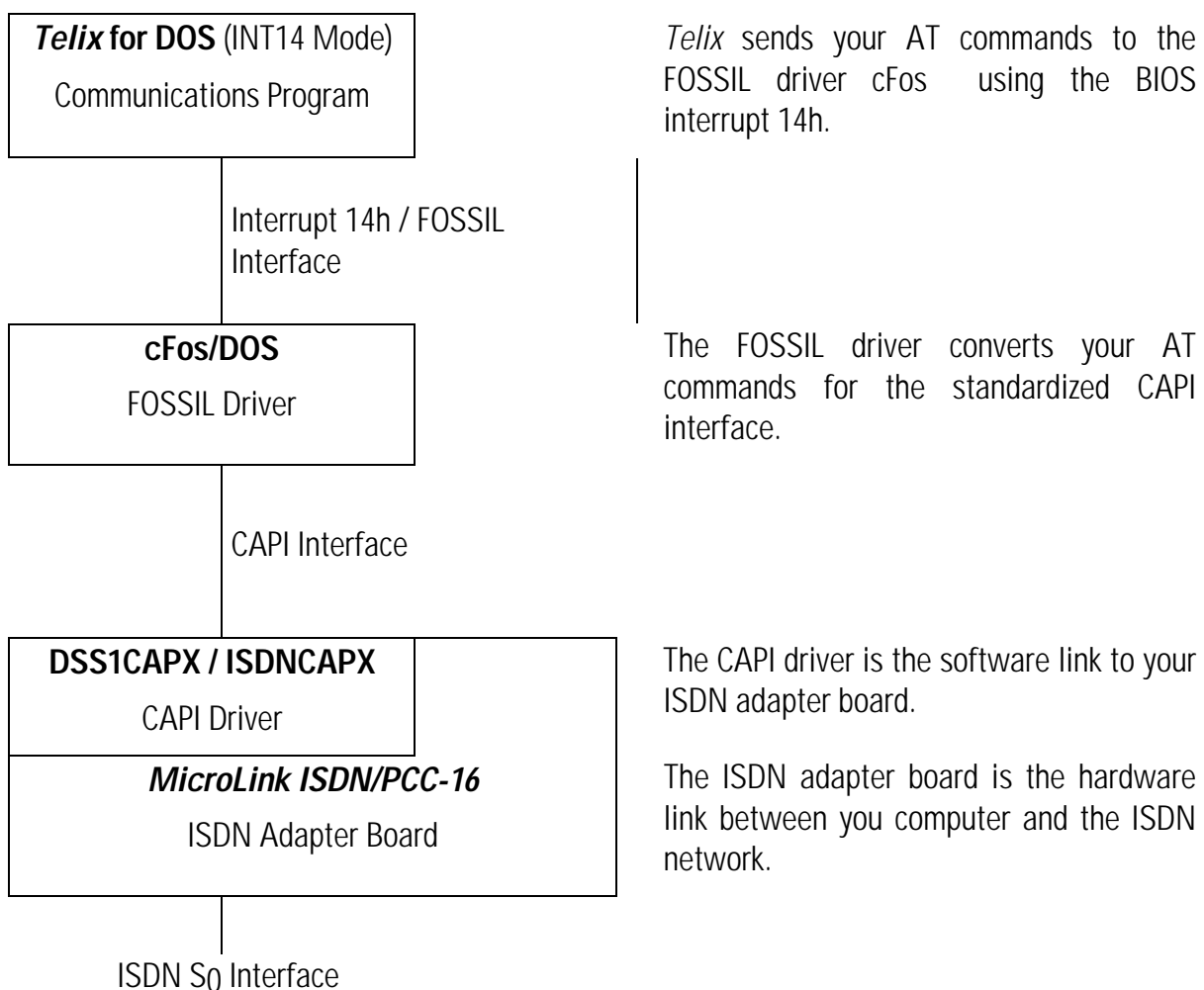
Data transmission **Online state** signifies that a connection to another party exists. The ISDN adapter board is "online" either with a successful connection (outgoing call) or with the acceptance of an incoming call. In this state data exchange is possible between the two connected stations.

4.2.1 Entering AT Commands in a Terminal Program

If you want to use the AT command set known from analog modems, you must load a suitable FOSSIL (*Fido/Opus/SEAdog Standard Interface Layer*) driver, e.g. cFos, in addition to the CAPI driver. The cFos/DOS driver shipped with your ISDN adapter board allows the use of communications programs supporting Interrupt14h or FOSSIL output (such as *Telix* or *Telix for Windows*) and must be loaded **in addition** to the CAPI 1.1 driver. The FOSSIL driver emulates the AT command interface in order to allow FOSSIL-supporting communications programs, which are normally used with analog modems, to work directly with ISDN adapter boards.

We will use *Telix* as an example to demonstrate how to enter AT commands in a terminal program. For operation with your ISDN adapter board, *Telix* must be set to INT14 mode. This is a special mode in which *Telix* directs data output not to the serial COM port, but via the BIOS interrupt 14 which enables the use of passive ISDN adapter boards via suitable driver software. Note that *Telix* versions older than 3.50 do not support the INT14 mode (except for *Telix INT14*, a special variant of *Telix 3.15*, which works in INT14 mode only).

The cooperation between *Telix* and the ISDN adapter board can be shown as follows:



4.2.2 Instructions for Your First ISDN Connection

To establish a test connection, for example to our Support BBS *ELSA ONLINE*, please proceed as follows:

- Start the CAPI driver DSS1CAPX.EXE (for Euro-ISDN), US__CAPX.EXE (for US protocols) or ISDNCAPX.EXE (for 1TR6).
- Start the FOSSIL driver cFos by calling STARTCFOS.BAT or by entering `c f o s i`.
- Start *Telix* and enable the INT14 mode. The COM port must be set to **COM 2**. This port is the default link to the FOSSIL driver via the interrupt 14h (if you have started cFos with a different port setting, you must set this port in *Telix* as well). In INT14 mode the COM ports are not related to physical serial interfaces, therefore you need not set any bit rate or data format. In ISDN operation, *Telix* always uses the highest possible bit rate.
- To establish the connection, type **ATD 0241 606 9820** (from within Germany, otherwise enter your international access code (+49) and omit the first **0**) in terminal mode and press <CR>. *Telix* will establish an ISDN connection with the Support BBS *ELSA ONLINE*. You can terminate the connection at any time with the *Telix* command <Alt><H>.

Appendices

A Technical Specifications

Power supply		+ 5 V from the PC bus
Operating current	<i>MicroLink ISDN/PCFpro</i>	Stand-by/ISDN: 250 mA approx. Modem/fax: 440 mA approx.
	<i>MicroLink ISDN/PCF</i>	Stand-by: 120 mA approx. Operation: 125 mA approx.
Design and dimensions	<i>MicroLink ISDN/PCFpro</i>	Expansion board for 8-/16-bit PC bus slot 157 x 105 x 18 mm (L x W x H)
	<i>MicroLink ISDN/PCF</i>	Expansion board for 8-/16-bit PC bus slot 157 x 90 x 18 mm (L x W x H)
Environment	Temperature	5..40°C (41..104°F)
	Relative humidity	0..80%, non-condensing
ISDN interface		S ₀ bus, D channel protocol DSS1 or 1TR6, AT&T 5ESS or NI-1 (National ISDN) point-to-multipoint configuration point-to-point configuration (<i>MicroLink ISDN/PCFpro</i> only with DSS1 or AT&T 5ESS) semi-permanent connections with 1TR6
Transfer protocol	ISDN operation layer 2	V.120, X.75, bit transparent, HDLC transparent (64,000 bps)
	layer 3	T.70NL, transparent, ISO 8208, T.90
<i>MicroLink ISDN/PCFpro</i>	Modem operation	V.34, V.Fast Class, V.32bis, V.32, V.23, V.22bis, V.21 (28,800..300 bps) V.42bis, MNP5
	Fax operation	V.17, V.33, V.29, V.27ter (14,400..2400 bps)
<i>MicroLink ISDN/PCF</i>	Modem operation	V.22bis, V.21 (2400..300 bps)
	Fax operation	SendFax: V.17, V.33, V.29, V.27ter (14,400..2400 bps) ReceiveFax: V.29, V.27ter (9600..2400 bps)
I/O addresses and IRQ		Four 16-byte addresses, starting at 160h, 170h, 260h or 360h One interrupt, configurable to 2, 3, 5, 10, 11 and 15
Status display		Two LEDs for monitoring the ISDN line and connection status

Interfaces	ISDN Common API (CAPI)	Version 1.1, profile A (September 07, 1990) Version 2.0 (February, 1994)
	FOSSIL	Fido/Opus/SEAdog Standard Interface Layer
Operating systems		
DOS 3.3 or later Windows 3.1x (CAPI.DLL) Windows 95 Windows NT 3.51 and 4.0 OS/2 2.1 or OS/2 Warp		
CE approval		
Compliance with EN 50082/part1, EN 55022, EN 60950		
BZT approval		
Germany Switzerland		
<i>MicroLink ISDN/PCFpro</i>	BZT A117933F	BAKOM 95.0336.I.N
<i>MicroLink ISDN/PCF</i>	BZT A114693E	BAKOM 94.0015.I.N

CE Approval and FCC Rules



The CE seal indicates the compliance with rules laid down by the European Community on April 29, 1991 for the alignment and mutual recognition of the member states' laws concerning telecommunications devices.

All CE approved ISDN devices may be connected to the Euro-ISDN in all EU countries except for Germany and France. In these countries an additional national approval certificate is required.

The *MicroLink ISDN/PCFpro* and *MicroLink ISDN/PCF* have been approved by the German BZT according to the new European procedure and may therefore be connected to the Euro-ISDN in all EU countries. These ISDN adapter boards therefore comply with:

- NET 3 (ISDN Basic Rate Access)
- Electromagnetic compatibility standards
- Safety standards

FCC Rules This equipment has been tested and found to comply with limits for a Class B computing device according to the specifications in the FCC (Federal Communications Commission) rules Part 15.

Interference This equipment, like other electronic equipment, generates and uses radio frequency energy. If not installed and used according to the instructions in this manual, this equipment may cause interference to radio and television reception.

If interference with radio or television reception is apparent, turn the modem equipment off. If the interference problems stop, then the equipment is probably the cause. One or more of the following may solve the problem:

- Adjust the position of the radio or TV antenna.
- Move the device away from the radio or TV.
- Plug the power adapter of the device into a different outlet than the radio or TV uses.
- Consult the dealer or an experienced radio/TV technician for help.

If this device is malfunctioning, it may also be causing harm to the ISDN network. This device should be disconnected until the source of the problem can be determined and until repair has been made.

B ISDN Driver Overview

The following table provides an overview of the various drivers which are supplied, along with a description of the ISDN connections and functions which are supported:

	ISDN Connection (D Channel Protocol)				CAPI Interface		Function (B Channel Protocol)			
	German ISDN (1TR6)	Euro- ISDN (DSS1)	US (NI-1, AT&T 5ESS)	Point- to-point conn- ection ¹	CAPI 1.1	CAPI 2.0	Data Trans- fer ²	Btx ³	Mode m and Fax ⁴	Euro- File- Trans- fer ⁵
DOS										
ISDNCAPI.EXE	■				■		■	■		
ISDNCAPA.EXE	■				■		■	■	■	
ISDNCAPX.EXE	■				■		■	■	■	■
ISDNCAPP.EXE	■			■	■		■	■	■	■
ISDNC20I.EXE	■					■	■			
ISDNC20A.EXE	■					■	■		■	
ISDNC20X.EXE	■					■	■	■	■	■
DSS1CAPI.EXE		■			■		■	■		
DSS1CAPA.EXE		■			■		■	■	■	
DSS1CAPX.EXE		■			■		■	■	■	■
DSS1CAPP.EXE		■		■	■		■	■	■	■
DSS1C20I.EXE		■				■	■			
DSS1C20A.EXE		■				■	■		■	
DSS1C20X.EXE		■				■	■	■	■	■
US__CAPI.EXE			■		■		■	■		
US__CAPA.EXE			■		■		■	■	■	
US__CAPX.EXE			■		■		■	■	■	■
US__C20I.EXE			■			■	■			
US__C20A.EXE			■			■	■		■	
US__C20X.EXE			■			■	■	■	■	■
Windows 3.x										
CAPI.DLL	■	■	■		■		■	■	■	■
CAPI20.DLL	■	■	■			■	■	■	■	■
OS/2										
ISDNCAPX.SYS	■				■		■	■	■	■
DSS1CAPX.SYS		■			■		■	■	■	■
US__CAPX.SYS			■		■		■	■	■	■
CAPI.DLL	■	■	■		■		■	■	■	■
Windows 95										
CSS1TPFP.VXD/.INF	■					■	■	■	■ ⁶	■
CSSELPFP.VXD/.INF		■				■	■	■	■ ⁶	■
Windows NT 3.51/4.0										
ISDNCAPX.SYS	■					■	■	■	■	■
DSS1CAPX.SYS		■				■	■	■	■	■
CAPI2032.DLL	■	■				■	■	■	■	■

¹ Point-to-point connection, *MicroLink ISDN/PCFpro* only

² X.75, V.120, HDLC transparent, bit transparent

³ T.70NL

- ⁴ Fax Group 3 (V.17, V.33, V.29, V.27ter, *MicroLink ISDN/PCF* : Fax receive V.29, V.27ter only), T.30, Modem (V.34, V.Fast Class, V.32bis, V.32, V.23, V.22bis, V.21, V.42bis, MNP5, *MicroLink ISDN/PCF* : V.22bis, V.21 only)
- ⁵ ISO 8208
- ⁶ *MicroLink ISDN/PCFpro* only

C The CAPI Drivers

The CAPI interface (***C**ommon **I**SDN **A**pplication **P**rogramming **I**nterface*) is a standardized software interface between ISDN adapters and ISDN application software. As this interface is completely handled by the application software, its details need not be explained (unlike the AT command interface described elsewhere in this manual).

◇ NOTE ◇

A detailed documentation of the CAPI-Interface can be downloaded from the *ELSA ONLINE* Support BBS (see page 48 for ISDN/modem numbers) or from the ELSA forum in CompuServe. The following section only describes some specific details of this implementation.

Operation in CAPI 1.1 Mode

Implementation
details

The supplied CAPI 1.1 drivers support CAPI version 1.1, profile A, release date September 07, 1990, with the following limits:

- Two input buffers for request and responses with 384 bytes each.
- Both B channels can be used simultaneously and independent of one-another for ISDN communications, not only within a single application but also by different applications.

However, only one analog connection can be established at a time.

- One B3 connection (NCCI) can be established per B channel (PLCI).
- Up to 64 B3 data buffers (per data direction) can be requested.
- Up to 8 applications can be registered simultaneously.
- Up to 64 received messages per application.
- Up to 24 Tx/24 Rx buffers per B3 connection. ¹⁾
- Up to 2051 bytes per B3 data buffer.

¹⁾ If more B3 data buffers are specified in the installation, this maximum value is used instead.

CAPI error codes

The following additional error codes have been implemented:

31FFh No more connection possible for this application

32FEh No more B3 connection available

32FFh No more B channel available

Implemented B channel protocols Depending on the driver used, the following protocols are available:

B channel layer 2:

X.75, V.120, HDLC transparent, bit transparent

With *MicroLink ISDN/PCFpro* :

Fax Group 3, T.30, Modem V.34, V.Fast Class, V.32bis, V.32, V.22bis, V.21, V.23, V.42bis, MNP5, fax send and receive comply with V.17, V.33, V.29, V.27ter

With *MicroLink ISDN/PCF* :

Fax Group 3, T.30, Modem V.22bis, V.21, fax send complies with V.17, V.33, V.29, V.27ter and fax receive with V.29, V.27ter

B channel layer 3:

Transparent, T.70NL, ISO 8208, T.90

An up-to-date overview is to be found in the README file accompanying the driver.

Additional B channel protocols

Additional to the B channel protocols defined by the CAPI 1.1, the following B2 protocols are supported:

B2 Protocol No.	B2 Protocols
8	HDLC transparent 56,000 bps
12	<i>MicroLink ISDN/PCFpro</i> modem operation only (automatic negotiation of the maximum bit rate with V.42bis and V.42)
21	X.75 with 56,000 bps
22	V.120 asynchronous with 64,000 bps (max. block length 259 Bytes)
23	V.120 asynchronous with 56,000 bps (max. block length 259 Bytes)
24	V.120 asynchronous with 64,000 bps, 7 bit/character (max. block length 259 Bytes)
25	V.120 asynchronous with 56,000 bps, 7 bit/character (max. block length 259 Bytes)

Multiple Subscriber Number conversion for Euro-ISDN

Multiple Subscriber Numbers (MSN) are supported by the CAPI interface (version 1.1) via an internal conversion procedure. The configuration is performed according to the parameters /e and /n<eaz>=<msn> (see page 37).

Semi-permanent connections (1TR6)

Semi-permanent connections are supported by the German 1TR6 protocol only. To establish a semi-permanent connection, an 's' or a hyphen '-' must be appended to the subscriber number.

Fax and modem operation

The fax and modem modes are implemented via the CAPI interface. The fax support is based on the CAPI expansion of June 07, 1993. This means that only CAPI-based fax software can be used (e.g. *ELSA-RVS-COM*).

The modem mode is also realized via the CAPI interface. To use this mode, protocol No. 12 must be selected as the layer 2 protocol. The modem establishes connections with the highest possible speed and data compression (*MicroLink ISDN/PCFpro* only).

The CAPI 2.0 Driver

Implementation details

The supplied CAPI 2.0 drivers support CAPI version 2.0, release date February, 1994, with the following limits:

- Two input buffers for request and responses with 384 bytes each.
- Both B channels can be used simultaneously and independent of one-another for ISDN communications, not only within a single application but also by different applications.
- One B3 connection (NCCI) can be established per B channel (PLCI).
- Up to 64 B3 data buffers (per data direction) can be requested.
- Up to 8 applications can be registered simultaneously.
- Up to 64 received messages per application.
- Up to 24 Tx/24 Rx buffers per B3 connection. ¹⁾
- Up to 2051 bytes per B3 data buffer.

¹⁾ If more B3 data buffers are specified in the installation, this maximum value is used instead.

B channel protocols

B channel layer 1:

64,000 bps, HDLC framing

64,000 bps, transparent

B channel layer 2:

ISO 7776, (X.75 SLP)

Transparent

V.120

B channel layer 3:

Transparent

T.90NL ²⁾

ISO 8208 (X.25, DTE-DTE) ²⁾

²⁾ T.90NL/ISO 8208 and X.25 is only supported by DSS1CAPX and ISDNCAPX.

CAPI 1.1 Error Codes

CAPI error code	Meaning	Reason and possible solution
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CAPI error code	Meaning	Reason and possible solution
Incorrect parameters		
3101h	Error in B channel coding	Your application software is using a CAPI function which is not supported by the ISDN adapter board or not contained in the CAPI 1.1 specification Please contact the manufacturer of your application software or your dealer
3102h	Wrong value in reserved bit of info. mask	
3103h	Wrong value in reserved bit of EAZ mask	
3104h	Wrong value in Service Indicator mask	
3105h	Wrong value in layer 2 protocol	
3106h	Wrong value in layer 2 DLPD	
3107h	Wrong value in layer 3 protocol	
3108h	Wrong value in layer 3 NCPD	
3109h	Wrong value in layer 3 NCPI	
310Ah	Wrong value in flag data	
Requested operating mode not supported		
3201h	Invalid ISDN controller	Application software must be set to ISDN controller 0
3202h	More than one LISTEN_REQ with overlapping service mask and EAZ mask is addressed to a controller	Check your application software for unique Service Indicator and EAZ
3203h	Function not supported by CAPI 1.1	Please contact the manufacturer of your application software or your dealer
3204h	PLCI not yet active	
3205h	NCCI not yet active	
Requested operating mode not supported		
3206h	B channel protocol layer 2 not supported	The operating mode requested by the application software is not supported by the CAPI driver Please contact the manufacturer of your application software or your dealer
3207h	B channel protocol layer 2 cannot be switched in this operating mode	
3208h	B channel protocol layer 3 not supported	
3209h	B channel protocol layer 3 cannot be switched in this operating mode	
320Ah	DLPD layer 2 not supported	
320Bh	NCPD layer 3 not supported	
320Ch	NCPI layer 3 not supported	
320Dh	Data block length in Data B channel layer 3 REQ not supported	
Local error messages		
3301h	D channel layer 1 establishment error	Check the cable connection to the ISDN S ₀ socket and disconnect other ISDN devices from the S ₀ bus to exclude possible error sources. Test the adapter board directly at the NT (Network Terminator)
3302h	D channel layer 2 establishment error	
3303h	B channel layer 1 establishment error	Check the B channel protocol of the remote side
3304h	B channel layer 2 establishment error	
3305h	D channel layer 1 disconnection	Check the cable connection to the ISDN S ₀ socket and disconnect other ISDN devices

CAPI error code	Meaning	Reason and possible solution
3306h	D channel layer 2 disconnection	from the S ₀ bus to exclude possible error sources. Test the adapter board directly at the NT (Network Terminator)
3307h	D channel layer 3 disconnection	Check the D channel protocol of the loaded CAPI driver (DSS1 or 1TR6)
3308h	B channel layer 1 disconnection	Disconnected by the remote side or connection error.
3309h	B channel layer 2 disconnection	
330Ah	B channel layer 3 disconnection	Re-establish the connection
330Bh	B channel layer 2 disconnection	Connection error caused connection restart - data loss possible
330Ch	B channel layer 3 disconnection	
Error messages from the ISDN (DSS1 protocol)		
3400h	Disconnection by the network, or no reason specified	Try to call again
3480h	Normal disconnection	Both sides have terminated the connection properly
3483h	Data transfer service not available	Check the remote number and the availability of the desired services (this applies also to private branch exchanges)
34B5h	Wrong remote number, service or service attribute	
34B8h	Remote number has changed	Ask for the new number of the remote side
34B9h	Remote terminal device not ready	Check whether the remote side is ready for operation
34Bah	No remote device has answered the call	Check whether the remote side is ready for operation and check the MSN or EAZ used
34BBh	Remote terminal device busy	Try to call again later
34Beh	Call refused by remote side	Contact the remote side
34D9h	Network busy	Try to call again later
34F1h	Remote error	Try to call again and check the CAPI driver
Error messages from the ISDN (1TR6 protocol)		
3400h	Disconnection by the network, no reason specified or reason not translatable	Try to call again
3480h	Normal disconnection	Both sides have terminated the connection properly
3483h	Service not available on local or remote side, or wrong number	Check the remote number and the availability of the desired services (this applies also to private branch exchanges)
348Ah	Own line busy	Your line is occupied by other terminal devices. Terminate other connections first
3490h	Semi-permanent connections not supported by the network	Apply to your network operator for semi-permanent connections
3491h	Semi-permanent connections not supported by local or remote side	
34A0h	Outgoing calls locked	Ask your network operator to unlock your line for outgoing calls
34A1h	Remote side busy	Try to call again later

CAPI error code	Meaning	Reason and possible solution
34A5h	Semi-permanent connection not allowed between these stations	Apply to your network operator for semi-permanent connections
34B5h	Wrong remote number, service or service attribute	Check the remote number and the availability of the desired services (this applies also to private branch exchanges)
34B8h	Remote number has changed	Ask for the new number of the remote side
34B9h	Remote terminal device not ready	Check whether the remote side is ready for operation
34Bah	No remote device has answered the call	Check whether the remote side is ready for operation and the remote EAZ or MSN used
34BBh	Remote terminal device busy	Try to call again later
34BDh	Incoming calls locked on the remote side	Ask the remote side to accept incoming calls
34Beh	Call refused by remote side	Contact the remote side
34D9h	Network busy	Try to call again later
34Dah	Call refused or disconnected by the remote side	Try to call again later or contact the remote side
34F0h	Local protocol error	Try to call again and check the CAPI driver
34F1h	Remote protocol error	
Fax operation		
4001h	Connection could not be established; no fax device detected on the remote side	Check the remote number or contact the remote side
4002h	Connection cannot be established; local fax module busy	Wait until the current fax/modem connection is finished
4003h	Line distortion during document transfer, remote side has refused the transfer due to poor line quality	Try to call again
4004h	Document transfer not possible due to line distortion	Try to call again
4005h	Error in document monitoring; data sent too slowly to fax module	Select a lower transfer speed for fax operation or close other active applications
4006h	Fax module locked; too many failed attempts	Try to call again later
4007h	Document transfer aborted on local side, canceled by user or software	Check why the fax software has aborted the connection
4008h	Disconnection due to misbehavior of the remote side; command repetition failed	Try to call again
4009h	Explicit logical disconnection by the remote side	Contact the remote side
400Ah	Unexpected disconnection during document receiving, line disconnected	Try to call again
400Bh	Transfer mode not supported by the remote side (e.g. file transfer or high resolution)	Check the operating mode and resolution setting of your fax software
400Ch	Error in document transfer; wrong data sent	Your fax software sends wrong data to the adapter board. Contact the manufacturer of your software or your dealer

New ELSA Error Codes

CAPI error code	Meaning	Reason and possible solution
Requested operating mode not supported		
31FFh	No further connection possible for this application	Resource problems, probably too many CAPI applications loaded simultaneously
32Feh	No further B channel layer 3 connection available	
32FFh	No further B channel available	

◇ NOTE ◇ Error codes not listed here are errors between the application and the CAPI interface. Please refer to the manual for this application or contact the manufacturer.

CAPI 2.0 Error Messages

CAPI error code	Meaning	Reason and possible solution
CAPI REGISTER Error Codes		
1001h	Too many applications	Close other applications
1002h	Logical block size too small (minimum 128 bytes)	
1003h	Buffer exceeded 64 kb	
1004h	Message buffer too small minimum 1024 Bytes)	
1005h	Maximum number of logical connections not supported	Configure your applications for a maximum of two connections, if applicable
1006h	reserved	
1007h	The message could not be accepted because of an internal overload	Repeat the call
1008h	Problem with the computer's resources (e.g. too little memory)	Close other applications
1109h	CAPI not installed	Install CAPI
110Ah	Controller cannot support external devices	
110Bh	Controller cannot support external devices	
Problems with the Protocol		
3001h	No support for this B1 protocol	

CAPI error code	Meaning	Reason and possible solution
3002h	No support for this B2 protocol	
3003h	No support for this B3 protocol	
3004h	No support for this B1 protocol parameter	
3005h	No support for this B2 protocol parameter	
3006h	No support for this B3 protocol parameter	
3007h	No support for this B protocol combination	
3008h	NCPI not supported	
3009h	Unknown CIP value	
300Ah	No support for this flag (reserved bits)	
300Ch	Data-block length not supported by the current protocol	
300Dh	Reset procedure not supported by current protocol	
No support for this mode of operation		
31FFh	Additional connections not possible with this application	System resources problem, possibly too many applications running at this time.
32FEh	No additional B channel level 3 connection available	
32FFh	No additional B channel available	
General causes of broken connections		
0000h	Normal break in the connection	The connection was ended properly at both ends
3301h	Protocol error, level 1 (line broken or B channel deactivated by D channel protocol)	
3302h	Protocol error, level 2	
3303h	Protocol error, level 3	
Error Codes from the ISDN		
3490h	Normal break in the connection	The connection was ended properly at both ends
3491h	Message from remote station: device busy	Redial later
3492h	No answer	Check that the remote station is operational, check that the access number is correct
3495h	Remote station has declined to the accept your call	To be discussed with the remote station
3496h	The number called has been changed	Determine the remote station's new number

CAPI error code	Meaning	Reason and possible solution
349Bh	Remote station not operational	Check the operational status of the remote station
349Ch	Invalid access number format	Check the access number
349Fh	Line broken by the ISDN, reason not given or could not be transmitted	Redial
34A6h	ISDN not operational	Redial
34A9h	Temporary defect	

◇ NOTE ◇

Error codes not listed here are errors between the application and the CAPI interface. Please refer to the manual for this application or contact the manufacturer.

D Options with the ISDN Drivers for DOS

Euro-ISDN Drivers

The following options are available for all Euro-ISDN drivers:

Option	Meaning
none	Driver software will be installed, if possible
/d	De-install driver software
/i	Inquiry about the current ISDN board installation
/q	Suppress the display of on-screen messages
/vxx	Set CAPI interrupt vector to xxh (instead of F1h) ¹⁾
/n<eaz>=<msn>	Convert EAZ to MSN ²⁾
/e	Use last digit of MSN as EAZ ²⁾
/l	Display connection status in the upper right screen corner ³⁾

¹⁾ Only if the CAPI driver has not been loaded previously

²⁾ CAPI 1.1 drivers only

³⁾ Please read the README file included with your ISDN adapter board

Euro-ISDN CAPI 1.1 Drivers – Assigning EAZs to MSNs

As the CAPI specification version 1.1 was originally developed for the national German 1TR6 protocol using EAZ digits (terminal selection digits), it does not directly support Multiple Subscriber Numbers (MSN) in the Euro-ISDN. However, the CAPI drivers can assign each MSN to an EAZ digit, as described below.

The parameters **/n** and **/e** allow EAZ digits (terminal selection digits) used by the CAPI interface to be converted to Multiple Subscriber Numbers (MSN) as used in the Euro-ISDN. This enables CAPI applications which support only EAZ digits to be operated at an Euro-ISDN line with Multiple Subscriber Numbers.

One of these parameters is required if, for example, several ISDN boards operated at one S₀ interface are to be distinguished by the Multiple Subscriber Number (MSN) of an incoming call.

/n<eaz>=<msn> The parameter **/n<eaz>=<msn>** can be used up to ten times.

Example: For example, the driver is called with:

```
DSS1CAPI /n1=929092 /n2=929094 <CR>
```

Incoming calls with the MSN 929092 will issue a '1' as EAZ, while calls with the MSN 929094 will issue a '2' as EAZ. All other MSNs will result in a '9' as EAZ.

With outgoing calls, an EAZ of '1' will result in an MSN of '929092', while an EAZ of '2' will result in an MSN of '929094'. Other EAZ digits will not be converted to a Multiple Subscriber Number (MSN).

◇ NOTE ◇ The correct setting for your MSN within a private branch exchange (PBX) depends on the type of exchange in use. It may be necessary to enter your complete telephone number, your extension number or even the last digit of your number as the MSN. If this is not clear from the PBX documentation, you can find the correct method by trial and error.

/e With the parameter **/e**, the last MSN digit of an incoming call is used as EAZ.

Example: The driver is called with:

`DSS1CAPI /e <CR>`

Incoming calls with an MSN of, for example, 929092 will result in an EAZ of '2', incoming calls with 929094 will result in an EAZ of '4'.

◇ NOTE ◇ The parameters **/e** and **/n<eaz>=<msn>** must not be used simultaneously.

All that remains now is to configure your ISDN application for the EAZs and their respective MSNs. This is done in the driver call.

1TR6 Drivers (Germany only)

The following driver options are available for all 1TR6 drivers:

Option	Meaning
none	Install driver software, if possible
/d	De-install driver software
/i	Display current installation of the ISDN adapter board
/q	Suppress screen messages
/vxx	Set CAPI interrupt vector to xxh (instead of F1h) ¹⁾
/l	Display connection status in the upper right screen corner ²⁾

¹⁾ Only if the CAPI driver has not been loaded previously

²⁾ Please refer to the README file for your ISDN adapter card

◇ NOTE ◇ The driver software can be loaded automatically at start up by including the appropriate command line in your AUTOEXEC.BAT file.

Drivers for the USA

The following options are available with the US drivers:

Options	Meaning
none	Driver software will be installed, if possible
/d	De-install the driver software
/i	Inquiry about the current ISDN board installation
/q	Suppress the display of on-screen messages
/vxx	Set CAPI interrupt vector to xxh (instead of F1h) ¹⁾
/l	Display connection status in the upper right screen corner ²⁾
/cd=08	Load the AT&T 5ESS Custom protocol driver ³⁾
/cd=0A	Load the National ISDN-1 protocol driver
/cs1=<spid1>	Set the SPID for the first B channel ³⁾
/cs2=<spid2>	Set the SPID for the second B channel ^{3) 4)}
/cn1<dn1>	Set the DN for the first B channel ³⁾
/cn2<dn2>	Set the DN for the second B channel ^{3) 4)}

1) Only if the CAPI driver is not loaded already.

2) Please refer to the README file for the ISDN adapter card.

3) For AT&T 5ESS point-to-point operation, no SPID/DN should be used.

4) Only if both B channels are to be operated simultaneously.

F What is the ISDN?

ISDN stands for "Integrated **S**ervices **D**igital **N**etwork". The ISDN provides an integrated platform for all forms of electronic communications; voice, text, data and image transfer can all be performed with one digital connection. The advantage of digitalization is that the existing telephone infrastructure is used, and to far greater effect. ISDN offers new and improved services via a single connection, higher data transfer rates (64,000 bps) with improved quality and security, and all with the use of an internationally standardized interface, the S_0/S_{2M} .

The History of ISDN

1979	The German Post authorities decide to develop a digital telephone network
1982	The German Post authorities declare their intention to adopt the ISDN standard for the digital telephone network
1984	CCITT release a comprehensive set of recommendations for ISDN
1986	ISDN pilot project in Mannheim and Stuttgart (D), with more than 400 ISDN basic connections
1988	ISDN as standard in operation
1989	Foundation of Euro-ISDN: 26 network operators from 20 countries sign the "Memorandum of Understanding" (MoU)
Since mid-1993	ISDN connections to Australia, Austria, Belgium, Denmark, Finland, France, Great Britain, Hong Kong, Italy, Japan, Luxembourg, the Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, and the USA.
Late 1993	Euro-ISDN (DSS1) introduced to Germany
1994	Nationwide ISDN coverage in Germany
Until 2000	The German national ISDN (1TR6) will continue to be offered by the Deutsche Telekom.

The Services

The new and improved services include:

- Interference-free telephony with constant volume, quicker connection and a higher speech bandwidth (7.1 kHz)
- Fax transmission with the group 4 standard for improved transmission quality and higher resolution (400 dpi). The transmission time for an A4 side takes about 10 s. Unfortunately, fax transmission with group 4 is not compatible with group 3 receivers.
- The transmission of news via Teletex
- Access to T-Online/DateX-J/Btx (in Germany) at up to 64,000 bps instead of analog's best of 33,600 bps
- Video telephony with (slow) image data transfer
- The continued use of analog end devices via an a/b terminal adapter

Every ISDN service has a unique identifying signal for detection by the receiving device, which can then determine whether or not it is suitable to receiving the incoming call.

ISDN Service Features

ISDN offers many services not available to analog users, such as the caller-ID, call waiting, selection of the terminal device at the bus, "parking" of current calls, terminal portability (cable disconnection without call disconnection), online switching of service and/or device, call hold, three-party service, multiple services (channels can be used simultaneously for multiple services), call forwarding within PBXs, unconditional call forwarding (world-wide, even to mobile phones, either immediately or after a 15s wait, and when busy), connection blocking (for incoming telephone calls or all calls, for all outgoing calls, outgoing long-distance calls, outgoing overseas calls, outgoing intercontinental calls, however with permanent availability of emergency numbers), advice of charge, capture (determining from which number a call to the device under surveillance was made), the closed user group (max. 100 total users, max. 20 per service, multiple user groups per connection possible), semi-permanent and leased-line connections.

Basic Access

The basic access can also be described as a multiple device connection. This is a four-wire bus system to which can make up to 12 ISDN sockets available, from which a maximum of 8 devices (max. 4 telephones due to the current demanded) can be connected.

The multiple device connection uses a control channel (D channel) with a transfer rate of 16 kbps and two data channels (B channels) with transfer rates of 64,000 bps each. Both data channels can be operated simultaneously and from separate devices.

The Network Terminator (NT) is the connection between the public ISDN network and the user's installation. The transition point from the public line (to the exchange) and the NT is called the U_{K0}/U_{K2} interface. The physical transmission from the NT to the exchange uses a copper wire pair, which means that the existing analog telephone infrastructure does not need to be replaced when upgrading to ISDN. The connection point between the NT and the bus to the terminal devices is the S_0/S_{2M} user interface. The NT is connected to the 230V power supply and offers increased protection against current spikes (e.g. lightning strikes).

The Protocols

The D channel controls the communications to an ISDN connection. In Europe the D channel protocols available are DSS1 (Euro-ISDN) and 1TR6 (German national ISDN).

With the DSS1 (Digital Subscriber System number 1) D channel protocol a connection can be allocated several (phone) numbers or MSNs (Multiple Subscriber Numbers). As a rule, 3 numbers (with up to 12 digits) are allocated, though a maximum of 8 is possible. The numbers can be freely allocated to any terminal device, meaning specific services (such as fax) can be given a specific (phone) number.

With the 1TR6 D channel protocol, the various devices attached to the S_0 bus are accessed via an EAZ number (German for Terminal Device Selection Digit). This one-digit number is attached to the phone number of the connection. The digit 0 has the function of a global call.

The D channel protocol controls only the establishment of communications between the user and his local exchange, and thus the communications between users is completely independent of the ISDN protocol. DSS1 devices and 1TR6 devices are fully able to communicate with one another.

Data transfer takes place over the B channel, which are controlled by the B channel protocols. These will be covered here in brief only: X.75 (bit rate 64,000 bps, data security controlled by the HDLC (High Level Data Link Control), V.110 (bit rate asynchronous 300...38,400 bps, synchronous 600...64,000 bps, permanent data structure, no data security), V.120 (used mainly in the USA, similar to X.75 but with just 56,000 bps).

Software Interface to ISDN Adapter Boards

The software interface between ISDN adapter boards and communications applications is called the CAPI (Common ISDN Applications Interface). This software makes all of the ISDN services available. CAPI was developed in a cooperation between the manufacturers of ISDN adapters and software, and the German FTZ (Telecommunications Technology Central Office), and is available in two versions: CAPI 1.1 and CAPI 2.0. The two versions are not compatible with one another.

EuroFileTransfer

This is an internationally standardized transfer protocol (ETS 300075) which enables a platform-independent data transfer via ISDN. The EuroFileTransfer protocol must be supported by the application software and the ISDN adapter board must fulfill the international standard ISO 8208.

G Answers to Frequently Asked Questions

General

How can I send AT commands to the ISDN adapter board?

To communicate with an ISDN adapter board via AT commands, you need a suitable communications or terminal program supporting the INT14 mode (communications via the BIOS interrupt 14h), for example *Telix 3.50*. After loading the CAPI and FOSSIL drivers and starting the communications program in INT14 mode, you can enter AT commands which are then sent to the ISDN adapter board via the drivers. See your *Telix* documentation for detailed information about the INT14 mode of Telix.

What is the best initialization string for calling a BBS with my ISDN adapter board?

All ELSA MicroLink® ISDN adapter boards come preconfigured especially for BBS operation. If you have changed the configuration, you can restore the default settings with the **AT&F** command.

My ISDN adapter board does not accept any AT commands. Is the configuration wrong, or is the board defective?

If entered AT commands are not displayed on the screen and/or not executed by the ISDN adapter board, this can have several possible reasons. Please check the following settings:

- Is your communications program set to INT14 mode? Many programs (e.g. Telix 3.50 and Telix for Windows) must be expressly set to INT14/FOSSIL mode for the operation with ISDN adapter boards.
- Is your communications software set to the COM port used by the FOSSIL driver (cFos)?
- If you have changed the configuration of your ISDN adapter board, try to restore the default settings with the **AT&F** command (even if this command does not appear on the screen). With this setting you should be able to enter an **AT** which is answered by the ISDN adapter board with OK.

■

After I have loaded the CAPI and FOSSIL driver and started a terminal program, incoming modem calls are not accepted, though I have set **ATS0=1**. No RING message appears, nor does the board go online in modem mode. Outgoing modem calls with **ATDN<number>** and call acceptance in ISDN mode work perfectly. What can be wrong?

The **ATBn** command selects the operating mode of the FOSSIL driver cFos. The standard setting **ATB0** is for ISDN mode only, and thus modem calls are not accepted. Use the command **ATB7** for analog operation. The default setting is **ATB0** so that the FOSSIL driver cFos can be used for ISDN adapter boards without a modem chip.

Can the CAPI or FOSSIL driver be loaded into the high memory area of my PC?

There are two ways to load the CAPI and FOSSIL driver into the high memory area. Under DOS the drivers can be loaded into the high memory by means of the DOS command **LOADHIGH**. Under

Windows the drivers can be swapped to the extended memory via command line entries in the WINSTART.BAT file.

Under DOS the memory managers HIMEM.SYS and EMM386.EXE (which are a part of DOS) provide the possibility to load drivers into the upper memory area between 640 KB and 1 MB. HIMEM.SYS and EMM386.EXE are included in the CONFIG.SYS and therefore loaded when the system is booted. See your DOS documentation for more information about these memory managers. The DOS command **LOADHIGH** (short form **LH**) can be called from the DOS prompt or included in the AUTOEXEC.BAT file. For example, the Euro-ISDN CAPI can be loaded into the high memory above 640 KB with the command **LH DSS1CAPI**, making more conventional memory available for application programs.

The DOS command **MEM** can be used to display the occupied and free memory and, with the **/c** option, to show the memory area the driver has been loaded into. If the available upper memory is not sufficient to load a driver, DOS will try to load the driver into the conventional (lower) memory.

Under Windows 3.1 and 3.11 (Windows for Workgroups) the WINSTART.BAT file can be used to swap drivers out of the conventional memory. If this file exists in the Windows directory, it is executed automatically when Windows is started. With this file drivers can be started by including driver calls like C:\ISDN\DSS1CAPX and C:\CFOS\CFOS, which are then swapped to the extended memory by Windows. The CAPI or FOSSIL driver is then available for Windows applications. After exiting Windows, the drivers are automatically de-installed and are therefore not available under DOS.

If the CAPI and FOSSIL drivers are loaded via the WINSTART.BAT under Windows, they cannot be accessed by DOS programs in DOS boxes. If the drivers are loaded under DOS before Windows is started, they can also be used by DOS programs in a DOS box under Windows.

Telix

What is the purpose of the FOSSIL driver when I work with Telix and the ISDN adapter board?

The FOSSIL driver (*Fido/Opus/Seadog Standard Interface Layer*) allows the control of the CAPI interface (*Common ISDN Application Programming Interface*) of ISDN adapter boards via conventional AT modem commands. The FOSSIL driver shipped with all ELSA ISDN adapter boards (cFos), must be loaded after the CAPI driver. The communications software or terminal program used must support Interrupt 14 (INT14) or direct FOSSIL output, as for example Telix INT14, Telix 3.50 and Telix for Windows. Whenever an AT command is entered, the BIOS interrupt 14h is triggered, and the FOSSIL driver converts the desired function into the appropriate command for the CAPI interface.

How must Telix for Windows be configured for the ISDN adapter board?

The CAPI driver DSS1CAPX or ISDNCAPX and the FOSSIL driver cFos must be loaded under DOS before Windows is started. The FOSSIL driver cFos must be configured to COM port 2 by calling it with the command line **cFos i -c1**. Now Windows and Telix for Windows can be started.

Select "Connect Devices" in the "Configure" menu of Telix for Windows, and create a new connect device, named for example "ISDN/PCFpro". Configure the new device with the following settings:

- Connect Port: FOSSIL Port 2
- Baud rate: 115,200 bps
- Flow Control: none
- Modem Initialization: **ATB0^M** for ISDN operation or **ATB7^M** for modem operation

ELSA-RVS-COM

There follows an explanation for installing *ELSA-RVS-COM* for Windows 3.x or *ELSA-RVS-COM* for Windows 95.

A Euro-ISDN connection has, in general, three access (telephone) numbers available, and the program *ELSA-RVS-COM* uses five EAZs (German for Terminal Device Selection Digit). This means that when running the CAPI driver, a precise allocation of the Multiple Subscriber Numbers (MSN) and the EAZs is required. For configuration, enter the following commands or enter them into the AUTOEXEC.BAT:

For ISDN adapter cards without modem/fax support

```
DSS1CAPI /N1=(tel.number 1) /N2=(tel.number 2) /N3=(tel.number 3)
```

For ISDN adapter cards with modem/fax support

```
DSS1CAPX /N1=(tel.number 1) /N2=(tel.number 2) /N3=(tel.number 3)
```

For example - for the access numbers 1234506, 1234507 and 1234508 the driver command will be:

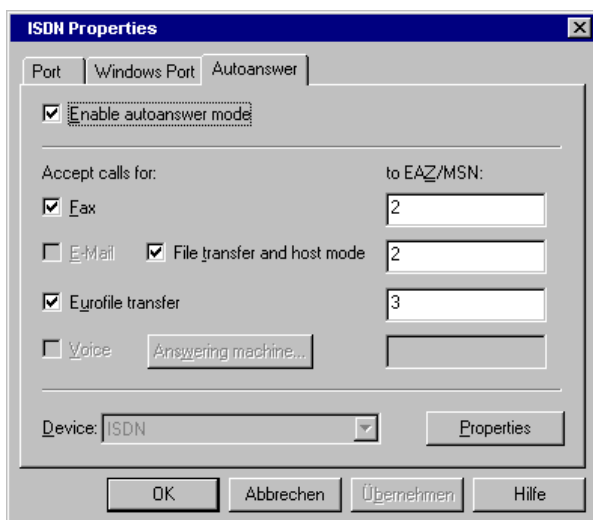
```
DSS1CAPI /N1=(1234506) /N2=(1234507) /N3=(1234508)
```

In *ELSA-RVS-COM* the appropriate EAZ digits are to be allocated with the **ISDN Properties** (Win 95) or **Edit Services: ISDN** (Win 3.x):

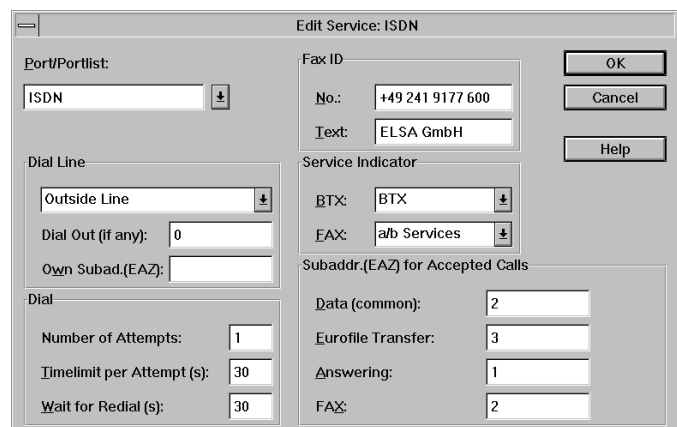
Answering machine on the first access number: EAZ 1

Fax receive and ISDN mailbox on the second access number: EAZ 2

EuroFileTransfer on the third access number: EAZ3



Windows 95

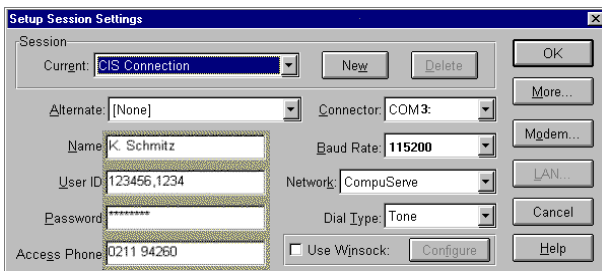


Windows 3.x

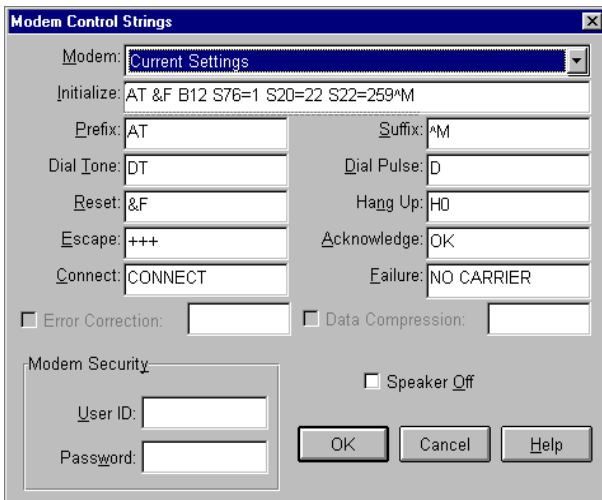
CompuServe Information Manager for Windows – WinCIM

ISDN access to CompuServe is still under development. Where ISDN accessibility is available, the V.120 protocol is in use. The WinCIM configuration described here is for CompuServe access via ISDN. Contact CompuServe directly for more details on accessibility and protocols supported.

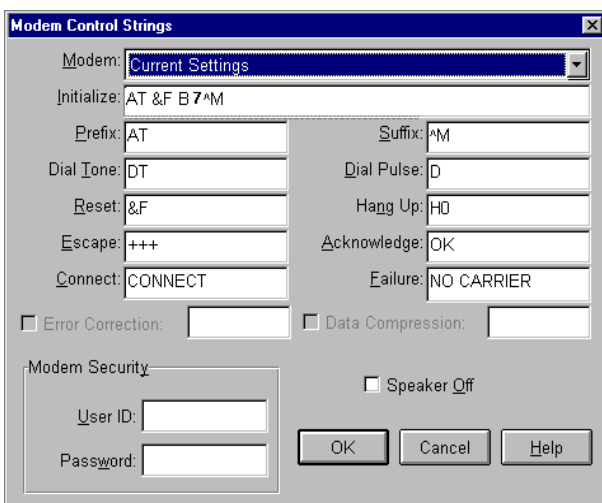
To use WinCIM 2.0 under Windows 3.x or Windows 95 it is essential that the cFos/Win Lite is installed, which is a driver making a virtual COM port available. In WinCIM, set up this COM port under **Special, Session Settings** and enter an ISDN CompuServe access number.



Enter the following parameters under Modem (Initialize: AT &F B12 S76=1 S20=22 S22=259^M):



With the *MicroLink ISDN/PCFpro* you can also dial the analog CompuServe access numbers. You will require an initialization string as follows "AT&FB7^M" and the various other settings as shown below:



When using the program *ELSA-RVS-COMfpr Windows 95* you have the option to make use of the virtual COM port offered by this program. The settings required are: Initialize = "L256^M" (for ISDN) or "L^M" (for analog); Dial Tone "DU" (for ISDN/V.120) or "DN." The AT prefix must be deleted.

Modem Control Strings

Modem: Current Settings

Initialize: L256 ^M

Prefix: Suffix: ^M

Dial Tone: DU Dial Pulse:

Reset: L Hang Up: H

Escape: +++ Acknowledge: OK

Connect: CONNECT Failure: CLR

☐ Error Correction: ☐ Data Compression:

Modem Security

User ID: Password:

☐ Speaker Off

OK Cancel Help

Confirm your entries with **OK** and then click on the traffic lights button to dial CompuServe (for example the ELSA Forum (Service: ELSA):

H Product Support

You need help?

If you encounter problems during the installation or operation of your ISDN adapter board, please refer to this manual first.

◇ TIP ◇

In the appendix "Answers to Frequently Asked Questions" (page 43) you will find solutions for the most common problems.

If your problem persists, you can use the support services at one of the following locations. When contacting the Support team, please be sure to have the following information at hand:

◇ IMPORTANT ◇

- Precise model name and firmware version of the ISDN adapter board (the firmware version is displayed when the driver software is loaded).
- File name of the driver loaded
- Your operating system and hardware environment
- Name and version of your communications program
- A detailed error description. To be certain, try to reproduce the error at least three times and precisely describe the steps you took to trigger the error deliberately.

Who to contact?

First you should contact the dealer or company where you bought your ISDN adapter board for support. If there are still questions remaining, contact one of the following:

- The **ELSA ONLINE** Support BBS in Germany:

ISDN

+49-241-606-9820

8 data bits, no parity, 1 stop bit

V.110: 38,400..1200 bps

X.75, X.75 with V.42bis: 56,000 bps, 64,000 bps

V.120, V.120 with V.42bis: 56,000 bps, 64,000 bps

Modem

+49-241-606-9800

33,600..300 bps

8 data bits, no parity, 1 stop bit

MNP4, MNP5, V.42 and V.42bis

- The **ELSA forum in CompuServe**:
GO ELSA

- Or write to:
ELSA GmbH
Data Communications Support
Sonnenweg 11
52070 Aachen
Germany
Fax +49-241-606-6499
- In very urgent cases, call the **ELSA Hotline** in Germany:
Phone +49-241-606-6141
Monday to Thursday from 9 am to 4:30 pm (CET)
Friday from 9 am to 12 pm (CET)
- In the USA, you may also contact the ELSA subsidiary:
ELSA Inc.
2150 Trade Zone Blvd., Suite 101
San Jose, CA 95131
USA
Phone +1-408-935-0350
 +1-800-272-ELSA
Fax +1-408-935-0370
BBS +1-408-935-0380
Internet <http://www.elsa.com>

Configuration problems?

In the *ELSA ONLINE* Support BBS (ISDN forum, CONFIG file area) and in ELSA's CompuServe forum you will find information about the configuration of many applications to be used with ELSA *MicroLink*® ISDN adapter boards.

First of all, make sure that you are using the latest software and driver versions. The most up-to-date versions can be downloaded from the *ELSA ONLINE* Support BBS and from ELSA's CompuServe forum. You will also find plenty of information and answers to frequently asked questions (FAQs) here.

Support BBS

The *ELSA ONLINE* Support BBS has been established as a service for customers and others interested in ELSA products (ISDN products, modems and graphics boards).

The Support BBS is divided into product-specific forums, which are structured like file directories. In these forums, you can exchange experiences with other users and put questions to the ELSA Support team. Furthermore, the Support BBS offers the latest product information and example configurations as well current firmware and application software.

◇ ATTENTION ◇

Please pay attention to the structure of the *ELSA ONLINE* forum. Always choose the forum appropriate to your questions, e.g. the ISDN forum for questions about an ISDN product. This is very important in aiding our support work and helps to guarantee that your question is answered as soon as possible.

After connecting to the ELSA Support BBS, you will see the following opening screen:

The login screen for
ELSA ONLINE

```

Connected to ELSA ONLINE (Port 18)
via MicroLink ISDN-Adapter from 1234 at 64000 bps, protocol: X.75
////////////////////////////////////

      ELSA ONLINE Support-Mailbox

      ELSA GmbH, Aachen

Modem: +49/0-241-6069800      (33600.. 300 bps)
ISDN : +49/0-241-6069820      (64000..1200 bps)

      Durchgehend geoeffnet

////////////////////////////////////

Vor- and Nachname:
    
```

At the prompt "Vor- und Nachname", enter your first and last name. If you are a first-time user, you can select the language you wish to use in the BBS.

◇ NOTE ◇

If you feel lost the first time you visit our BBS, don't be discouraged! Erroneous entries present no risk of damage either to your or our computer systems. The BBS software is designed to give you comprehensive help in finding your way. Most problems will be solved by carefully reading the login bulletin and the other texts provided for help and information.

Registration

To make sure you have access to the BBS when you need it, you should register as soon as possible. You can call the ELSA Support BBS at any time, 24 hours a day.

When logging in for the first time, you will assign yourself a password (4 to 10 characters). You are then an **unregistered user** with limited rights. You cannot access the product forums before registering.

The registration is performed via the menu option "REGISTER" and is free of charge (except for the costs of the call). To register, you have to enter your address, phone number and fax number as applicable. Your registration will be processed within one working day. After that, you are a registered user entitled to put questions to our Support team.

CompuServe

You can reach our ELSA Support forum in CompuServe via *GO ELSA*. In this forum, we offer you the same support and service as in the *ELSA ONLINE* Support BBS.

◇ ATTENTION ◇

Please pay attention to the structure of the mail and file areas in the ELSA forum. Always choose the appropriate mail area for your questions, for example "ELSA ISDN Adapters" or "ISDN Software" for questions about your ISDN product. This aids us with our support work and helps guarantee that your questions are answered as soon as possible.

If you have questions about CompuServe, CIM (CompuServe Information Manager) or the CompuServe registration, please contact the toll-free CompuServe Support directly.

Repair?

If you are not sure whether your problem is a defective ISDN adapter board or simply a configuration error, please call the ELSA Hotline before sending us the ISDN adapter board for repair.

If you want to send in the ISDN adapter board for repair, please use suitable packing material and the original box to prevent damage to the ISDN adapter board during transport. Always include a copy of the original purchase receipt as well!

You can help us to minimize the repair time by including a detailed description of the problem with the device, which will help us to track down the error source. Please send your ELSA product directly to our Service department.

I Warranty Conditions

This warranty is given to purchasers of ELSA products in addition to the warranty conditions provided by law and in accordance with the following conditions:

1. Warranty coverage

- a) The warranty covers the equipment delivered and all its parts. Parts will be replaced free of charge if, despite proven proper handling and adherence to the operating instructions, these parts became defective due to fabrication and material defects. Operating manuals and possibly supplied software are excluded from the warranty.
- b) Material and service charges shall be covered by us, but not shipping and handling costs involved in transport to the service station.
- c) Replaced parts become property of ELSA.
- d) ELSA are authorized to carry out technical changes (e.g. firmware updates) beyond repair and replacement of defective parts in order to bring the equipment up to the current technical state. This does not result in any additional charge for the customer. A legal claim to this service does not exist.

2. Warranty period

The warranty period is 36 months for color monitors, data communications and computer graphics products. It begins at the day of delivery from the authorized ELSA dealer. Warranty services do not result in an extension of the warranty period nor do they initiate a new warranty period. The warranty period for installed replacement parts ends with the warranty period of the device as a whole.

3. Warranty procedure

- a) If defects appear during the warranty period, the warranty claims must be made immediately, at the latest within a period of 7 days.
- b) In the case of any externally visible damage arising from transport (e.g. damage to the housing), the transport company representative and ELSA should be informed immediately. On discovery of damage which is not externally visible, the transport company and ELSA are to be immediately informed in writing, at the latest within 7 days of delivery.
- c) Only authorized ELSA dealers may accept warranty claims. ELSA will supply the purchaser with a list of names and addresses of authorized dealers on request.
- d) Transport to and from the location where the warranty claim is accepted and/or the repaired device is exchanged, is at the purchaser's own risk and cost.
- e) Warranty claims are only valid if a copy of the original purchase receipt is returned with the device.

4. Suspension of the warranty

All warranty claims will be deemed invalid

- a) if the device is damaged or destroyed as a result of acts of nature or by environmental influences (moisture, electric shock, dust etc.);
- b) if the device was stored or operated under conditions not in compliance with the technical specifications;
- c) if the damage occurred due to incorrect handling, especially to non-observance of the system description and the operating instructions;
- d) if the device was opened, repaired or modified by persons not authorized by ELSA;
- e) if the device shows any kind of mechanical damage;

- f) if, in the case of an ELSA Monitor, damage to the cathode ray tube (CRT) has been caused by mechanical load (e.g. from shock to the pitch mask assembly or damage to the glass tube), by strong magnetic fields near the CRT (colored dots on the screen), or through the permanent display of an unchanging image (phosphor burnt).
- g) if the warranty claim has not been reported in accordance with 3a).

5. Operating mistakes

If it becomes apparent that the reported malfunction of the device has been caused by unsuitable software, hardware, installation or operation, ELSA reserves the right to charge the purchaser for the resulting testing costs.

6. Additional regulations

- a) The above conditions define the complete scope of ELSA's legal liability. The warranty gives no entitlement to additional claims, such as any refund in full or in part. Compensation claims, regardless of the legal basis, are excluded. This does not apply if e.g. injury to persons or damage to private property are specifically covered by the product liability law, or in cases of intentional act or culpable negligence. Claims for compensation of lost profits, indirect or consequential detriments, are excluded. ELSA is not liable for retrieval of lost data unless ELSA employees intentionally or by culpable negligence caused its loss and the purchaser has guaranteed that the data can be retrieved with justifiable effort from data material kept in machine legible form.
- b) The warranty is valid only for the first purchaser and is not transferable.
- c) The court of jurisdiction is located in Aachen, Germany in the case that the purchaser is a merchant. If the purchaser does not have a court of jurisdiction in the Federal Republic of Germany or if he moves his domicile out of Germany after conclusion of the contract, ELSA's court of jurisdiction applies. This is also applicable if the purchaser's domicile is not known at the time of institution of proceedings.
- d) The law of the Federal Republic of Germany is applicable. The UN commercial law does not apply to dealings between ELSA and the purchaser.

J Glossary

- 1TR6** *1TR6* is a specification by the German Telekom for ISDN terminal devices with a S_0 interface. This specification defines the $\rightarrow D$ channel protocol and is used mainly in Germany. Most other European countries use the $\rightarrow DSS1$ protocol.
- ASCII** The **American Standard Code for Information Interchange** is the most commonly used international code to represent a 128-character alphabet. It is also called *standard ASCII*, unlike *extended ASCII*, which is an extension of the code by international special characters and graphic symbols to a set of 256 characters (also called *IBM character set*). Standard ASCII can be coded with a word length of 7 bits ($2^7 = 128$), whereas extended ASCII requires a word length of 8 bits ($2^8 = 256$).
- B channel** \rightarrow Data channel
- Basic Rate Interface** ISDN terminal connector providing two \rightarrow data channels (64,000 bps each) and one \rightarrow control channel (16,000 bps). The link between the Basic Rate Interface and the terminal device is the $\rightarrow S_0$ bus.
- Baud** *Baud* (abbreviation: Bd) is the unit for the step rate (1 Bd = 1 step per second), i.e. the frequency of status changes on a transmission channel per second. Erroneously, the unit Baud is often confused with the transmission rate measured in \rightarrow bps. In the case of signals having only two states, as in the ISDN, the step rate is identical with the transmission rate.
- BBS** Abbreviation of **Bulletin Board System** (also called Electronic Mail System). A *BBS* is an automatic information system with one or more connections to a communications network. The users of a BBS usually have the opportunity to send messages to each other and to use the BBS as a communication forum. In addition, many BBS's are offering libraries containing software and information on various themes. The *ELSA ONLINE* Support BBS, which can be accessed with the ISDN number +49-241-606-9820 (Germany, modem access +49-241-606-9800), was set up as a forum for ELSA customers to exchange experiences and to ask questions for the ELSA support team. Furthermore, *ELSA ONLINE* constantly offers latest product information, application examples and user software. The latest versions of the ISDN driver software, for example, are always available in the Support BBS for download.
- BIBA** A **Bilingual Basic Rate Interface** provides two D channel protocols (the European DSS1 and the German 1TR6) on the same ISDN line. This allows older German devices supporting only 1TR6 to be operated at the same interface as newer devices ($\rightarrow DSS1$).
- bps** Abbreviation of **bits per second**. This is the unit to measure the speed of a data transmission. Unlike the step rate measured in \rightarrow Baud, the transmission rate indicates the actual amount of information transferred per second.

CAPI	<i>Common ISDN Application Programming Interface</i> . This software interface was originally developed by German ISDN adapter manufacturers in cooperation with the German FTZ, and is used for communication between ISDN adapters and ISDN application software. ELSA drivers support CAPI version 1.1 or 2.0, allowing the use of standard ISDN software for fax group 3 and 4, data communications and file transfer. CAPI 2.0 is an internationally accepted standard for ISDN software interfaces.
CCITT	→ITU-T
Control channel	ISDN signaling channel (also called <i>D channel</i> , →DSS1) for the transmission of control data (e.g. message about incoming call etc.) between the ISDN interface and the public exchange at a transfer rate of 16,000 bps for →Basic Rate Interfaces, or 64,000 bps for →Primary Rate Interfaces.
D channel	→Control channel
Data channel	ISDN transmission channel (also called <i>B channel</i>) for the transmission of data with a transmission rate of 64,000 bps.
DSS1	A European standard developed by the →ETSI for the →D channel protocol (also called <i>Euro-ISDN</i>). In Germany, this standard was introduced in 1993 and is likely to replace the older national 1TR6 protocol. For an intermediate period, ISDN interfaces in Germany will support both protocols.
EAZ	The <i>Endgeräteauswahlziffer</i> (German for <i>Terminal Device Selection Digit</i>) is used by the →1TR6 protocol to distinguish between several terminal devices connected to the same ISDN Basic Rate Interface. Unlike the →MSN in the →DSS1 protocol, this digit is appended to the ISDN number as the last digit.
Effective transfer rate	The <i>effective transfer rate</i> must be distinguished from the transmission rate. The transmission rate indicates the number of bits per second physically transmitted over a data line as a theoretical maximum value, whereas the transfer rate is a measure of the average amount of usable data transmitted per unit of time. Control data and protocol headers, which are to be sent in addition, can reduce the effective speed of transmission. On the other hand, using data compression methods can result in an increase of the effective transfer rate to a multiple of the physical transmission bit rate.
ETSI	<i>European Telecommunications Standards Institute</i> . This standardization committee has developed a European standard for the →D channel protocol (→DSS1).
Euro-ISDN	→DSS1
Firmware	<i>Firmware</i> refers to the control software integrated into the device hardware, and which cannot be modified by the user.
FOSSIL	<i>Fido/Opus/SEAdog Standard Interface Layer</i> was developed for the use of hardware-independent interfaces in data communications and is supported by

	many standard communications programs (e.g. Telix, Telemate, Frontdoor or Binkly).
Host	<i>Host</i> designates a central computer that carries out certain functions for other units (e.g. terminals), such as file handling etc.
ISDN	Abbreviation of <i>Integrated Services Digital Network</i> .
ISDN a/b adapter	ISDN a/b adapters are used to connect non-ISDN devices to the ISDN. An ISDN a/b adapter, for example, connects devices designed for analog telephone networks, such as analog telephones, class 2 and 3 fax devices, modems etc. to the ISDN.
ITU-T	The <i>Telecommunications Standardization Sector</i> of the <i>International Telecommunications Union</i> (ITU) is working on the standardization of data and telephone services. The ITU-T standards of the V. series mainly deal with data transmission across telephone networks, while the I. and Q. series are standards for the ISDN. The ITU-T is the successor organization of the CCITT (<i>Comité Consultatif International Télégraphique et Téléphonique</i>).
MSN	<i>Multiple Subscriber Number</i> . The →DSS1 protocol allows several access numbers to be assigned by the exchange operator to a single ISDN line. Normally these are three numbers, but may be up to eight. Similar to the →EAZ digits of the →1TR6 protocol, these numbers can be used to select one of several terminal devices connected to the same →S ₀ bus. Unlike the EAZ digit, which is appended to the access number, an MSN is a unique and proper access number up to eight digits long.
Multiple Subscriber Number	→MSN
NT	<i>Network Terminator</i> . This is a device installed on the terminal side of an ISDN →Basic Rate Interface which converts the signals coming from the exchange into the form needed by the →S ₀ interface, and vice versa.
Primary Rate Interface	ISDN interface providing 30 →data channels (64,000 bps each) and one →control channel (64,000 bps). At the time of press, this ISDN connector is only used for large private branch exchanges.
S₀ interface	Also called <i>S/T interface</i> . Serial bus interface between the Network Terminator (→NT) of a →Basic Rate Interface and the ISDN terminal devices. Up to eight terminal devices can be operated simultaneously on one S ₀ bus, and up to 12 connection sockets can be connected to the bus.
Semi-permanent connection	A leased-line connection on demand. This service is provided for the German →1TR6 protocol only and can be ordered for any pair of ISDN stations and separately for each B channel. Semi-permanent connections are leased for a monthly flat rate independent of the length of the actual calls and can give significant cost savings in the case of frequent or long calls.
S/T interface	Another name for the →S ₀ interface, used for example in the USA.

SysOp	Abbreviation of System Operator , the administrator or operator of a →BBS or other online system.
TEI	<i>TEI (Terminal Endpoint Identifier)</i> is an identification code negotiated with the exchange in the →D channel protocol, in order to distinguish several terminal devices connected to the same →S ₀ interface. The <i>MicroLink ISDN/PCFpro</i> and the <i>MicroLink ISDN/PCF</i> have a green LED that indicates whether a TEI has been assigned to the board.
Terminal Endpoint Identifier	→TEI

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