AVM ISDN-Controller B1 USB

Manual

High-Performance ISDN by...

AVM ISDN-Controller B1 USB

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Symbols

This sign emphasizes very important notes which must always be followed to avoid errors.

The exlamation mark indicates paragraphs containing important information.

This sign draws your attention to useful additional information.

Highlighted text formats

Bold text marks keys on the computer keyboard, buttons or program symbols such as **RETURN**, **OK**, **Load B1**.

Menus, menu functions, options, etc. are set in quotations marks, e.g. "File", "AVM" and "Installation".

Commands entered at the DOS prompt are written in the following way:

```
a:\install
```

1 Introduction

1.1 What is ISDN?

ISDN is the internationally standardized digital telecommunications network. The abbreviation ISDN stands for **I**ntegrated **S**ervices **D**igital **N**etwork.

ISDN has three outstanding features that make it different from conventional communications media:

Integration of Services

The first is the integration of services. This means that all telecommunications services, such as telephony, telefax, data communications or videotex, are carried over a single data network. Voice, text, files and even images can be transmitted over ISDN. Users can connect several different terminals and use all available services with one ISDN line. Because the basic-rate ISDN subscriber access provides two user data channels (B channels), you may use two different telecommunications services at the same time—to receive a fax during a telephone conversation, for example.

High Throughput

The second substantial feature is the extraordinary speed of data transmission in ISDN. Voice and data are transmitted over the BRI's two B channels at the rate of 2 x 64,000 bits per second. Furthermore, the **AVM ISDN-Controller B1 USB** allows ISDN applications to bundle the two B channels so that throughput is doubled.

Outstanding Quality

The third important feature of ISDN is the end-to-end digital transmission of user data: this is the basis for high transmission quality. Poor connections, noise and interference, which cause transmission errors or interruptions in analog networks, are eliminated. Data communication over ISDN is thus not only faster, but also more reliable than in analog networks.

The one terminal device that that exploits the full potential of ISDN, however, is the personal computer. Before, separate terminal equipment was necessary for each service (a fax machine to send faxes, a Vtx terminal for Videotex, etc.). Today all that is needed is a PC, an ISDN PC adapter and the desired application software. **AVM** has played a major part in bringing about this development to combine the power and flexibility of the personal computer and the ISDN network. With the right ISDN software, your computer becomes a multimedia communications center!

1.2 USB: The Universal Serial Bus

The Universal Serial Bus (USB) transports data between computers and peripherals at a speed of 12 Mbit/s. The USB brings a new standard in convenience and user-friendliness to computer hardware: with USB devices, expanding a computer system is a simple matter of plugging in a bus cable and installing the driver software. USB devices all have a uniform connector.

These features make the USB an ideal platform for connecting input and communications devices to the computer. The new bus permits true plug-and-play and ”hot” installation, and makes it possible to connect up to 127 peripheral devices.

The USB’s architecture supports all kinds of components. Guidelines define how different devices are allowed to use bandwidth on the bus. The USB has a tree-shaped topology and is regulated by a host controller. Branches of the tree are connected by hubs; the leaf nodes are the hardware components to be connected to the computer. The bus cable can be up to five meters long between two hubs or between a hub and a terminal device. Hubs can also be incorporated in the host computer itself, or in other USB terminal devices, such as monitors or keyboards.

USB devices are grouped in speed classes. ”Fast devices” access the bus at 12 Mbit/s throughput, while ”slow

devices" use only 1.2 Mbit/s. (In this classification, the **AVM ISDN-Controller B1 USB** is a fast device on the USB.) Devices can access the bus in several ways, including bulk, interrupt, isochronous and control modes.

With these characteristics, the USB seems to be an outstanding solution to the tangle of cables and interfaces customary in today's PCs.

1.3 The AVM ISDN-Controller B1 USB

The **AVM ISDN-Controller B1 USB** is an external device connecting the computer to an ISDN line.

The **ISDN-Controller B1 USB** is simply connected to the USB socket on the computer or any USB hub. Its S_0 interface is then connected to the ISDN line using the cable supplied.

The **AVM ISDN-Controller B1 USB** is an active ISDN-Controller for the S_0 interface of a basic-rate ISDN line, and is equipped with a high-performance RISC CPU, one MB of memory and a USB interface. The **B1 USB** simultaneously operates both of the BRI's B channels (for user data) and the D channel (primarily for signaling functions).

The **B1 USB** is a stable platform for professional users who want support for all ISDN features. The **B1 USB** can be connected directly to the ISDN BRI line, or to a PBX extension.

The **AVM ISDN-Controller B1 USB** owes its extraordinary performance to its active architecture, which makes this ISDN-Controller the ideal platform for software applications that demand high data throughput. One megabyte of on-board memory makes it possible to load protocol processing and other application software directly on the controller. This minimizes the burden on your computer's memory and processor.

The illustration below shows how the **ISDN-Controller B1 USB** installation connects the computer to the ISDN network terminator (NT).

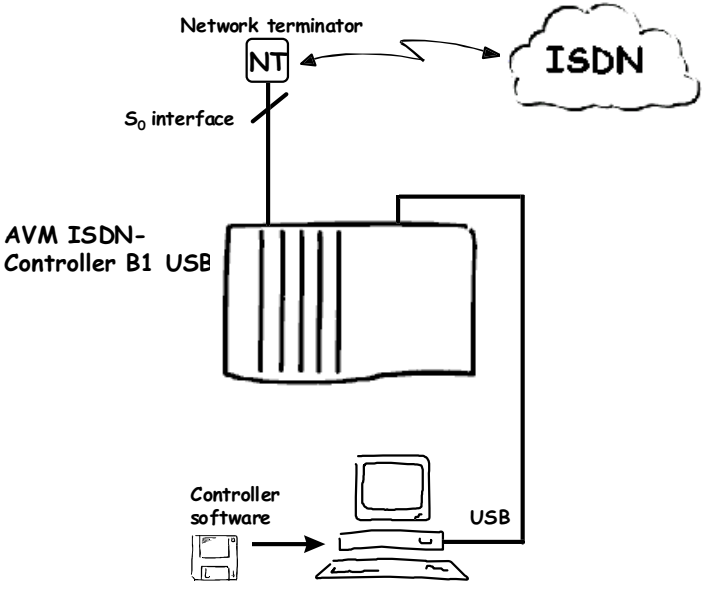

Fig. 1 Computer with ***AVM ISDN-Controller B1 USB***

The **AVM ISDN-Controller B1 USB** is completely software driven. It is equipped with a flash-ROM BIOS that permits a firmware update by means of a simple software download. The ISDN software is also downloaded to the Controller. This concept permits maximum flexibility and makes it simple to adapt the ISDN-Controller hardware to new technical developments.

Supported Protocols

The ISDN-Controller's driver software is loaded from the host computer's hard disk. This software handles the communications protocols and the data transmission. The Controller software supports the international D channel protocol DSS1 ("Euro-ISDN") and the national protocols 5ESS and NI-1 for the USA, Austel for Australia, and 1TR6 for Germany.

The driver files for the D channel protocols used in Germany, DSS1 and 1TR6, are included in the ISDN-Controller package. The drivers for the other protocols can be downloaded from the AVM Data Call Center by

direct ISDN connection (+49-30-399 84 300) or over the Internet (http://www.avm.de; ftp://ftp.avm.de). On the B channels, the software supports commonly used data communications protocols including X.75, HDLC transparent, X.31 and transparent connections. For further technical information, please see Chapter 3, ”Technical Data”.

CAPI

The driver software for the **AVM ISDN-Controller B1 USB** provides the industry standard application programming interface COMMON ISDN API (CAPI) Version 2.0 (see Chapter 4). This interface, adopted by the international standardization body ETSI, assures universal compatibility of ISDN applications and hardware for ISDN data, fax and voice services.

IDM

The controller software for the AVM ISDN-Controllers corresponds to the ISDN Driver Model (IDM). For further informationen about the IDM architecture, please see chapter 5.

Supported Operating Systems

The **AVM ISDN-Controller B1 USB** is available for the Plug & Play operating systems Windows 98, Windows NT 5.0 (in beta test versions at the time of this printing) and Windows 95 from release OSR 2.0 on with USB extensions (OSR 2.1). The driver architecture complies with the Microsoft Win32 Driver Model (WDM).

Several active AVM ISDN-Controllers can be easily combined in one computer. Up to four active AVM ISDN-Controllers can be operated at one time.

*Installation of the ISDN-Controller hardware and software completes the connection between the computer and the ISDN line. The ISDN-Controller package also contains the communications software suite **FRITZ!32** and the AVM ISDN Tools, a collection of CAPI-based utilities. Other CAPI applications are available separately: just ask your dealer.*

1.4 Package Contents

The **AVM ISDN-Controller B1 USB** package contains:

- the **AVM ISDN-Controller B1 USB** (the external ISDN-Controller for the USB)
- 6-meter ISDN cable to connect the ISDN-Controller to the ISDN line
- one 3.5” floppy disk with the Setup program for the operating systems Windows 98 and Windows NT 5.0
- one 3.5” floppy disk with the Setup program for the operating system Windows 95 OSR 2.0 with USB extension (OSR 2.1)
- one 3.5” floppy disk with the WDM-compatible AVM NDIS WAN Driver
- one **AVM ISDN-Controller B1 USB** manual
- one CD-ROM with the **FRITZ!32** Setup program
- one **FRITZ!32** manual

The driver software may also be shipped on a CD-ROM in place of the floppy disks listed above.

*In order to use the **AVM ISDN-Controller B1 USB** in Windows 95 OSR 2.0, you must install the USB extensions, available from Microsoft. This supplement upgrades the operating system to the version Windows 95 OSR 2.1.*

2 Installing the AVM ISDN-Controller B1 USB

This chapter describes how to connect the **ISDN-Controller B1 USB** to your computer or USB hub and to your ISDN line, and how to install the driver software. You may also read how to load and unload the controller software, how to handle the ISDN-Controller and how to change the **AVM ISDN-Controller B1 USB**'s configuration settings after installation. The chapter closes with instructions for removing the **ISDN-Controller B1 USB** from the system, and with a description of the NDIS WAN CAPI Driver.

The **AVM ISDN-Controller B1 USB** is available for the operating systems Windows 98, Windows NT 5.0 and Windows 95 (OSR 2.0) with USB extension.

The installation of the **AVM ISDN-Controller B1 USB** is performed in two main phases:

1. The **ISDN-Controller B1 USB** is connected to
   - the power supply,
   - the computer or USB hub, and
   - the ISDN line.
2. The new hardware component and its driver software are installed in the operating system.

While the first of these phases is the same for all the operating systems supported, the second is different, as the operating systems have different procedures for setting up a new hardware component and installing driver software. For details, see the corresponding sections 2.2.1, "Installation in Windows 98 and Windows NT 5.0" and 2.2.2, "Installation in Windows 95 OSR 2.1".

After the driver software has been installed and loaded, the applications interface COMMON ISDN API (CAP(I) 2.0 is available to all programs. This CAPI version also supports the use of CAPI 1.1-based applications. For more information on the CAPI driver supplied, please see Chapter 4.

Specially developed driver software is supplied for use with the ISDN-Controller B11 USB. This 32 bit device driver provides full support for all features of Microsoft Windows. AVM is continually revising and improving its driver software and provides updates free of charge. The latest drivers for the **AVM ISDN-Controller B1 USB** can be downloaded from the AVM Data Call Center using the file transfer program FRITZ!data (included). The drivers are also available from AVM's FTP server on the Internet.

AVM Data Call Center
+49-30-399 84 300 (IDtrans protocol)

AVM in the Internet
http://www.avm.de
ftp://ftp.avm.de

Before proceeding with the installation, find out which D channel protocol is used on your ISDN line. In Germany this may be DSS1 (Euro-ISDN) or the 1TR6 protocol. ISDN lines installed after December 1993 are generally DSS1 lines. The 1TR6 protocol is rarely used today.

2.1 Connecting the ISDN-Controller B1 USB to the Power Supply, the Computer or Hub and the ISDN Line

To connect the **AVM ISDN-Controller B1 USB,** proceed as follows:

- Switch on your computer and any peripheral devices already connected.

  Turn the **ISDN-Controller B1 USB** so that the connectors on the back are toward you.

- Take the power cord from the **B1 USB** package and plug the power adapter into an AC socket. Connect the adapter cord to the socket labeled "Power" on the **ISDN-Controller B1 USB.**

- Switch the **ISDN-Controller B1 USB**'s "On/Off" switch to "On". The left LED on the front panel of the ISDN-Controller now lights up.

- Examine the USB cable. It has a different connector at each end, one plug with a flat, rectangular cross-section (called the Series A plug) and one with a square cross-section (the Series B plug).
- Connect the Series A plug to the USB socket of your computer or USB hub.
- Then connect the Series B plug to the socket labeled ”USB” on the **ISDN-Controller B1 USB.**
- After you have connected the **ISDN-Controller B1 USB** to your computer or hub, the second LED from left also lights up.
- Now you need to connect the ISDN-Controller to your ISDN line. The ISDN cable supplied has an RJ45 plug at each end. Insert one in the jack for your ISDN line, and the other in the socket labeled ”ISDN” on the **ISDN-Controller B1 USB.** The six-meter cable can be routed as desired.

The **AVM ISDN-Controller B1 USB** is now connected to the power supply, the computer and the ISDN line.

2.2 Setting up a New Hardware Component and Installing the Driver Software for the ISDN-Controller B1 USB

In the next part of the installation procedure, the **ISDN-Controller B1 USB** is integrated in Windows by the Add New Hardware Wizard, and its driver software is installed.

2.2.1 Installation in Windows 98 and Windows NT 5.0

After you have connected the **ISDN-Controller B1 USB** to your computer or hub, the operating system’s Plug & Play mechanism detects the ISDN-Controller. The Windows driver database is updated, and the Add New Hardware Wizard appears with the message, ”This Wizard searches for new drivers for: AVM ISDN-Controller B1 USB”. Click on **Next.**

- Insert the floppy disk labeled ”**AVM ISDN-Controller B1 USB,** Installation Windows 98/NT 5.0” in your 3.5" floppy disk drive.

  If the driver software was supplied on a CD-ROM, insert the **B1 USB** CD in your CD-ROM drive.

- In the next dialog you are asked, ”What do you want to do?” Select the option ”Search for the best driver for your device.” Then click on **Next.**

- In the next dialog the Wizard asks where to search for the driver software. Select the option corresponding to the medium supplied, ”Floppy disk drives” or ”CD-ROM drive”. Click on **Next.**

- The next dialog notifies you that the driver was located as follows (these paths are only examples; the actual paths may vary):

  Floppy disk: i.e.: A:\B1USBset.inf
  or
  CD-ROM: i.e.: D:\Cardware\B1USB\Windows.98\B1USBset.inf

  Click on **Next.** Windows now copies the Setup files for the **ISDN-Controller B1 USB** to a temporary directory on your hard disk.

- The next dialog announces, ”Windows has finished installing the software that your new hardware device requires.” Click on the **Finish** button.

- To complete the hardware component installation, the computer must be restarted. Answer **Yes** at the corresponding prompt.

  If you installed the driver from a floppy disk, remove it from the floppy drive now.

- After Windows has started again, the sign-on window of the **AVM ISDN-Controller B1 USB** appears automatically. Click on **Continue.**

- In the next dialog, select the option ”Installation” and then click on **Continue.**

- Next, enter the folder in which you want the driver software for the **ISDN-Controller B1 USB** installed on your computer. The default is C:\IDRIVER. You may confirm this or enter any other path.

  When you have entered the path to the desired folder, click on **Continue.**

- In the next dialog, select the D channel protocol used on your ISDN line (DSS1 or 1TR6). Click on **Continue** to confirm your choice.

- The Setup program now copies all the necessary files to the specified folder.

  Afterward, a message box shows the current configuration of the **ISDN-Controller B1 USB.** Click on **OK.**

To complete the driver software installation, you must restart Windows. Answer **Yes** at the corresponding prompt. After this restart, the installation of the **AVM ISDN-Controller B1 USB** in Windows 98 or Windows NT 5.0 is complete. You may now begin working with the ISDN-Controller: see section 2.3.

Under ”Programs” in the Windows Start menu you will now find a program group named ”AVM”. This group contains the programs **B1 Readme, B1 Setup, B1 Test, B1 Load, B1 Unload** and **AVM Internet Home Page.** The last of these is a link to AVM’s World Wide Web server, and requires a browser and an Internet connection.

*The **B1 Setup** program allows you to adjust the settings for the D channel protocol, automatic loading of the **ISDN-Controller B1 USB** and data compression, without reinstalling the driver software. The document **B1 Readme** contains the latest information on the **ISDN-Controller B1 USB.** Use the program **B1 Test** to test your **ISDN-Controller B1 USB** for correct installation and working order.*

2.2.2 Installation in Windows 95 OSR 2.1

After you have connected the **ISDN-Controller B1 USB** to your computer or USB hub, Windows 95's Plug & Play mechanism detects the ISDN-Controller. The Windows driver database is updated, and the Add New Hardware Wizard displays a message box with the title "New Hardware Found" and the message "The Hardware Wizard is installing the following device: Unknown". Click on **OK.**

- Insert the floppy disk labeled "**AVM ISDN-Controller B1 USB,** Installation Windows 95 OSR 2.1" in your 3.5" floppy disk drive.

  If the driver software was supplied on a CD-ROM, insert the **B1 USB** CD in your CD-ROM drive.

- In a message box the Wizard notifies you that it is searching for an updated driver. By default, the floppy disk drive is searched.

  If your driver software was supplied on a CD-ROM, then click on the **Other Location** button in the next dialog and enter the following path:

  `D:\Cardware\B1USB\Windows.98\B1USBset.inf`

  (or browse to find the correct path, if different). Then click on **Continue.**

- The next dialog notifies you that the Hardware Wizard located the driver for the **AVM ISDN-Controller B1 USB.** Click on **Continue.**

- An error message box now appears and instructs you to insert the required disk. Simply click on **OK.**

  The "Copying files" dialog appears. In this dialog you may select the drive and path to the driver files:

  Floppy disk: i.e.: A:\B1USBset.inf
  or
  CD-ROM: i.e.: D:\Cardware\B1USB\ Windows.95\B1USBset.inf

  Click on **Continue.** Windows now copies the Setup files for the **ISDN-Controller B1 USB** to a temporary directory on your hard disk.

- To finish the hardware component installation, the computer must be restarted. Answer **Yes** at the corresponding prompt.

  If you installed the driver from a floppy disk, remove it from the floppy drive now.

- After Windows has started again, the sign-on window of the **AVM ISDN-Controller B1 USB** Setup program appears automatically. Click on **Continue.**

- In the next dialog, select the option ”Installation” and then click on **Continue.**

- Next, enter the folder in which you want the driver software for the **ISDN-Controller B1 USB** installed on your computer. The default is C:\IDRIVER. You may confirm this or enter any other path.

  When you have entered the path to the desired folder, click on **Continue.**

- In the next dialog, select the D channel protocol used on your ISDN line (DSS1 or 1TR6). Click on **Continue** to confirm your choice.

- The Setup program now copies all the necessary files to the specified folder.

  Afterward, a message box shows the current configuration of the **ISDN-Controller B1 USB.** Click on **OK.**

To complete the driver software installation, you must restart Windows. Answer the corresponding prompt. After this restart, the installation of the **AVM ISDN-Controller B1 USB** in Windows 95 is complete. You may now begin working with the ISDN-Contoller.

Under ”Programs” in the Windows Start menu you will now find a program group named ”AVM”. This group contains the programs **B1 Readme, B1 Setup, B1 Test, B1 Load, B1 Unload** and **AVM Internet Home Page.** The last of these is a link to AVM’s World Wide Web server, and requires a browser and an Internet connection.

*The **B1 Setup** program allows you to adjust the settings for the D channel protocol, automatic loading of the **ISDN-Controller B1 USB** and data compression, without reinstalling the driver software. The document **B1 Readme** contains the latest information on the **ISDN-Controller B1 USB.** Use the program **B1 Test** to test your **ISDN-Controller B1 USB** for correct installation and working order.*

2.3 Starting the ISDN-Controller; Automatic Loading

If you did not restart Windows at the end of the driver installation procedure, you may run the program **B1 Load** in the "AVM" program group to begin using the **ISDN-Controller B1 USB.**

By default, the **AVM ISDN-Controller B1 USB** is loaded automatically each time Windows starts up. The ISDN-Controller is loaded before the Startup program group is processed, so that you may include CAPI-based ISDN applications in this group.

The automatic loading mechanism can be deactivated using the program **B1 Setup** in the "AVM" program group. First unload the ISDN-Controller by running **B1 Unload.** Then start **B1 Setup** and change the options in the dialogs as desired.

*Remember to reset your **AVM ISDN-Controller B1 USB** by selecting the **B1 Load** command so that your new settings take effect.*

When you exit Windows, the **AVM ISDN-Controller B1 USB** is automatically deactivated.

2.4 Plug & Play with the Computer Running

Windows' Plug & Play capabilities allow you to shut off the **ISDN-Controller B1 USB,** or to disconnect it from its power supply, from the ISDN line or from the USB bus, without shutting down the computer.

Even with this ”hot Plug & Play” capability, however, you must first terminate any CAPI applications that are active and unload the **ISDN-Controller B1 USB.** Then you may shut off the **ISDN-Controller B1 USB** or disconnect it from its power supply, the ISDN line or from the USB bus.

If you switch on or reconnect the **ISDN-Controller B1 USB** while the computer is running, you must then reload it by running the program **B1 Load** in the ”AVM” program group.

2.5 Automatic Data Compression in Accordance with V.42bis

The **ISDN-Controller B1 USB**’s driver software is able to perform data compression in accordance with the V.42bis standard. Data compression reduces connection costs by increasing the effective throughput rate, shortening the necessary connection time.

After installation, the feature **CAPI SoftCompression X75/V42bis** is deactivated by default. Applications that support the V.42bis standard may still negotiate the use of compression for the duration of a connection with the remote system, however.

After you have completed the installation of the driver software, you may activate V.42bis data compression using the program **B1 Setup.** When this option is activated, the driver software attempts to negotiate the use of data compression in accordance with V.42bis on every X.75 connection. You should not use this option, however, if your application already supports V.42bis data compression. If you have problems establishing connections, run the program **B1 Setup** again and deactivate the data compression option again.

To activate **CAPI SoftCompression X75/V42bis,** proceed as follows:

- Start the program B1 Setup in the ”AVM” program group.

- In the D channel protocol selection dialog, click on the checkbox labeled ”Enable CAPI SoftCompression X75/42bis”.
- Confirm your option by clicking on **Continue,** and in the following dialog click on **OK.**
- Then restart your computer.

2.6 Removing the ISDN-Controller

To remove the **AVM ISDN-Controller B1 USB** from your system, open the Control Panel (under Settings in the Windows Start menu) and double-click on the **Add/Remove Programs** icon. In the list of installed programs, select the entry **AVM ISDN-Controller B1 USB,** then click on the **Add/Remove** button. The ”Uninstall” program starts. All files and entries are then deleted from your computer. Restart your computer as prompted.

2.7 The AVM NDIS WAN CAPI Driver

To support the use of your **ISDN-Controller B1 USB** in conjunction with Windows 95/98’s Dial-up Networking or with Windows NT 5.0’s RAS, AVM provides the NDIS WAN CAPI Driver, found on the floppy disk labeled ”AVM NDIS WAN Driver” or on the CD-ROM in the folders \Tools\NDISWAN.95,\Tools\NDISWAN.98 and \Tools\NDISWAN.NT. The AVM CAPI Port Driver is also available from the AVM Data Call Center or from AVM’s FTP server on the Internet.

For detailed instructions on installing and using the NDIS WAN CAPI Driver, please see the accompanying .doc and .hlp files.

3 Technical Data and Features

This chapter provides exact technical data about the **AVM ISDN-Controller B1 USB,** a summary of its features, information about the status LEDs and pin assignments of all its connectors.

3.1 Technical Data

- ISDN-Controller for the USB interface; dimensions: approx. 220 x 160 x 30 mm.
- S_0 interface for BRI lines or PBX extensions
- High-performance CPU (20-MIPS multitasking RISC transputer)
- 1 MB of RAM on board; 2 KB high-speed cache memory
- Plug & Play installation; no jumpers to set
- Throughput: 2 x 64,000 + 1 x 16,000 bit/s (2 B channels + 1 D channel)
- Loadable D channel protocols: DSS1, 1TR6, 5ESS, NI1, Austel

  Loadable B channel Layer 2 protocols: X.75, HDLC transparent, V.110, V.120, V.29

  Loadable B channel Layer 3 protocols: transparent, X.25, ISO 8208, T.70, T.90, T.30 (G3 fax)
- G3 telefax implemented in the ISDN-Controller
- Standardized programming interface COMMON ISDN API Version 2.0 (incl. support for CAPI 1.1 applications, Windows NT 5.0, Windows 95 OSR 2.1 and Windows 98)
- Runs in the operating systems Windows NT 5.0, Windows 95 OSR 2.1 and Windows 98
- Power consumption: approx. 2.5 watts
- Safety tested in accordance with IEC 950, EN 41003, EN 60950, VDE 0804, VDE 0805

- EMC tested in accordance with EN 41003, VDE 0878
- CE approval 0170X

3.2 Features of the AVM ISDN-Controller B1 USB

- The **AVM ISDN-Controller B1 USB** supports simultaneous use of both the ISDN BRI's B channels (for user data) and the D channel (for signaling). It can be connected directly to an ISDN subscriber access or to a PBX extension.
- The **B1 USB** provides the following B channel protocols: X.75, HDLC transparent, X.25 (ISO 8208), X.31 case a/b, T.70, V.110, V.120, transparent, T.90 (G4 fax), T.30 (G3 fax), ISO 3309 (for GSM) and V.42bis over X.75.
- The **B1 USB** supports all ISDN services, including Internet access, Euro-file transfer, Group 3 and 4 telefax, voice and videoconferencing.
- AVM supplies controller software for international use in such operating systems as Windows 95 OSR 2.0 with USB extension, Windows 98 or Windows NT 5.0. The driver architecture conforms to the Microsoft Windows Driver Model (WDM).
- The **AVM ISDN-Controller B1 USB** is completely software driven. It is equipped with a flash-ROM BIOS that permits a firmware update by means of a simple software download. The ISDN software is also downloaded to the Controller. This concept permits maximum flexibility and makes it simple to adapt the ISDN-Controller hardware to new technical developments.
- The **B1 USB** draws a maximum of 2.5 watts of power, supplied by an external power adapter.

3.3 LEDs on the ISDN-Controller B1 USB

The operating status of the **ISDN-Controller B1 USB** is indicated by five LEDs (light-emitting diodes). Their significance is explained in the following table:

LED	Color	Significance
Power	Green	Ready
USB	Green	Connection to computer or USB hub active
D	Green	Connection active on D channel
B1	Green	Connection active on 1st B channel
B2	Green	Connection active on 1st B channel

Table 1 Significance of LEDs

3.4 Connector and Cable Pin Assignments

The ISDN-Controller is connected to the ISDN line by an RJ45 plug with the following pin assignments:

3.4.1 Pin assignments, S_0 Interface (RJ45 to IAE)

RJ45	IAE plug	Signal
1		
2		
3	3	Rx (a2)
4	4	Tx (a1)
5	5	Tx (b1)
6	6	Rx (b2)
7		
8		

Table 2 Pin assignments, RJ45 to IAE

3.4.2 Pin assignments, S_0 Interface (RJ45 to TAE 8)

RJ45	IAE plug	Signal
1		
2		
3	6	Rx (a2)
4	3	Tx (a1)
5	4	Tx (b1)
6	5	Rx (b2)
7		
8		

Table 3 Pin assignments, RJ45 to TAE 8

4 The Application Programming Interface COMMON ISDN API 2.0

4.1 General Information

What is CAPI?

Common ISDN API (CAPI) is a standardized software interface that allows ISDN applications to operate ISDN adapters connected to BRIs and PRIs. Applications that build on this interface use uniform methods and do not have to be adapted to the particular characteristics of various manufacturers' hardware. Thus such applications are independent of future extensions or modifications in the hardware. CAPI makes such changes transparent to the application. ISDN hardware manufacturers also benefit from this standard, since it makes all kinds of applications compatible with their products.

Common ISDN API contains an abstract definition of the ISDN services which is independent of any given ISDN provider's network or any given manufacturer's ISDN adapter. It provides an interface that is easy for applications to use, and unified access to the various communications services in ISDN, such as data and fax transmission, telephony or video conferencing.

Advantages of CAPI

Common ISDN API has come to be an internationally recognized standard. This development is due to the numerous advantages offered by the uniform interface: manufacturer independence and the resulting investment security; a wide variety of compatible applications for all kinds of operating systems and ISDN protocols, etc. ISDN (the Integrated Services Digital Network) is attractive for more and more companies because it facilitates fast and reliable transmission of data in any form.

CAPI 1.1

As early as 1989, ISDN manufacturers began developing a standard interface for the rapidly growing ISDN market. The first version of CAPI was oriented toward the German national ISDN protocol 1TR6, since there was not yet an international standard for ISDN protocols. The development work was completed in 1990, and a CAPI working group was formed among ISDN application and hardware manufacturers, large-scale customers, user groups and Deutsche Telekom. Common ISDN API Version 1.1 was a major milestone in the development of the national ISDN market in Germany. Today all German and a great number of international ISDN solutions are based on Common ISDN API.

CAPI 2.0

The international specification of ISDN protocols is now complete, and nearly all telecommunications providers offer BRI and PRI subscriber access based on the international standard Q.931 / ETS 300 102. The currently available Common ISDN API 2.0 is also based on this standard. The development of this new applications interface for international ISDN systems benefited enormously from the experience accumulated over the past several years in the development of the ISDN applications interface in Germany and at the international level, and from the great number of CAPI installations.

CAPI 2.0 thus represents over nine years' experience in the expanding ISDN market. It offers all the advantages of an open interface and covers the vast majority of ISDN services (including data communications, telephony, Group 3 telefax and video-conferencing). Because CAPI handles most of the ISDN subscriber interface control functions, these no longer have to be specially programmed. This vastly simplifies ISDN application development. Furthermore, software no longer has to be tailored to country-specific or manufacturer-specific systems, so that a great variety of applications is now possible.

Common ISDN API Version 2.0 presents the international market with a comprehensive technology and the potential for high benefits.

Further information about COMMON ISDN API 2.0 you will find in the Internet under the following address:

`http://www.capi.org`

4.2 Features

Common ISDN API offers a number of important features:

- Support for Basic Call Features such as call set-up and clear-down
- Support for multiple B channels for data and/or voice connections
- Support for multiple logical connections over a single physical connection for data communications
- Service and protocol selection on call initiation and on accepting incoming calls
- Transparent interface for protocols above Layer 3
- Support for one or more BRIs and PRIs with one or more ISDN adapters
- Support for multiple applications
- Messages independent of operating systems
- Message exchange implementations optimized for specific operating systems
- Asynchronous, event-driven mechanism (high throughput)

5 The ISDN Driver Model Architecture

The ISDN Driver Model (IDM) shown below illustrates the integration of ISDN into the operating system familiy of Microsoft.

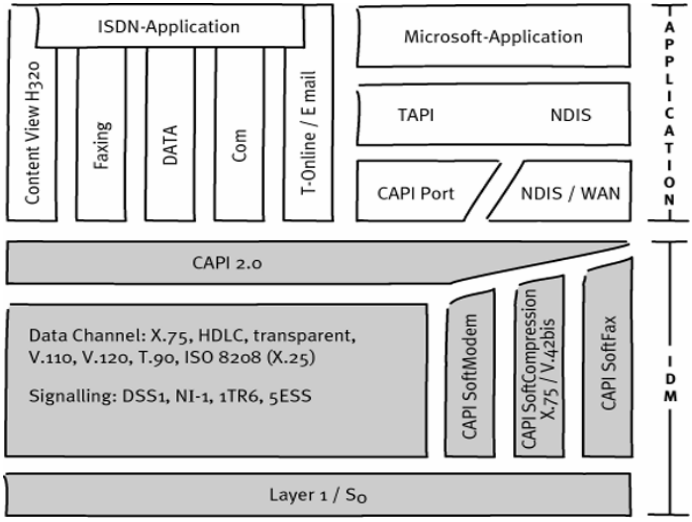

Fig. 2 IDM architecture

The ISDN Driver Model forms the framework for all driver components of the AVM ISDN products. The IDM describes the integration of ISDN into the operating system environment and the application interface, in order to use all performance features.

As shown in figure 2, the COMMON ISDN API is the basis of all communication applications. CAPI is used by all applications, wether directly or indirectly, even by Internet browsers or Remote Access Services. The connection of non CAPI applications is realised via middleware products such as the AVM ISDN CAPI Port Driver or the AVM NDIS WAN CAPI Driver. The architecture of the ISDN Driver Model allows the simultaneous operation of native CAPI applications and middleware.